Designing Smart Tech Solutions for Enhanced Aging in Place: A Caregiver Evaluation

by

Sukritt Suksawang

BS in Biomedical Engineering, Srinakharinwirot University, 2019

Submitted to the Graduate Faculty of the

Swanson School of Engineering in partial fulfillment

of the requirements for the degree of

Master of Science in Bioengineering

University of Pittsburgh

2023
This thesis was presented

by

Sukritta Suksawang

It was defended on

December 15, 2023

and approved by

Yong Choi, PhD, MPH, Assistant Professor, Department of Health Information Management

Mark Redfern, PhD, Professor, Department of Bioengineering

Pamela Toto, PhD, OTR/L, BCG, FAOTA, FGSA, Professor, Department of Occupational Therapy

Thesis Advisor: Dan Ding, PhD, Associate Professor, Department of Rehabilitation Science and Technology with a secondary appointment in Bioengineering
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Sukrita Suksawang, MS
University of Pittsburgh, 2023

Purpose: The emerging challenges in caregiving, due to the aging global population and the increasing trend of older adults preferring to age in their home environments, emphasize the need for effective technological solutions. Particularly, smart home technologies and remote monitoring systems are essential to support caregivers and care recipients. The research aims to develop and evaluate a prototype remote monitoring system, CARE360, to enhance the caregiving process and facilitate aging in place.

Methods: The study was conducted in four phases: Conceptualization, System Development, Small-Group Interviews, and Data Analysis. The CARE360 system, a low-fidelity prototype, focused on seven care areas: Overall Activity, General Health, Medication Compliance, Climate Control, Bathroom Use, Bedroom Use, and Wandering Behavior. It integrated various smart devices for comprehensive monitoring. Small-group interviews were conducted with seven informal caregivers to understand their needs in providing care for older adults, highlighting the importance of caregiver and care recipient perspectives, evaluating the CARE360 system, and gathering feedback for improvements. The study employed both quantitative and qualitative methods, including demographic questionnaires, Likert scale ratings, and thematic analysis.

Results: The participants provided insights into the usability and effectiveness of the CARE360 system. The findings demonstrated an acknowledgment of the system's potential to enhance caregiving capabilities and effectively manage the needs of care recipients. Caregivers evaluated various aspects of the system, including its importance, usefulness, and ease of use. The results revealed diverse levels of perceived usefulness and ease of use across the seven monitoring areas. Overall, the feedback was positive, highlighting the system's ability to offer peace of mind and improve the quality of care provided to older adults.

Conclusions: This study lays the foundation for the development of remote monitoring systems, focusing on the CARE360 system and its coverage of seven key care areas. The user-centric design of the CARE360 system, combined with its capability to integrate a variety of smart devices, presents a promising solution for addressing the practical challenges faced by caregivers. However, further research and development are necessary to refine and tailor the CARE360 system to effectively meet the diverse and specific needs of both caregivers and care recipients.
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1.0 Introduction

The COVID-19 pandemic dramatically altered the lives of older adults, forcing many to rely on their abilities to age in place.[1] This circumstance not only demonstrated their resilience and self-efficacy but also highlighted an ongoing trend of aging in familiar home and community environments.[2-3] Extensive surveys reveal that a vast majority, often exceeding 80%, of older adults prefer to age at home[3-5], emphasizing the importance of understanding and addressing their unique needs.

However, this trend towards home-based aging brings with it substantial challenges, especially in the caregiving sector. As the global population ages, estimates suggest that by 2050, nearly 22% of the population will be over 60.[6] The demand for caregivers in the U.S. is expected to increase in parallel with the rising population of older adults. Currently, the ratio is seven potential family caregivers for each older adult.[7] However, this is projected to decline to only four potential family caregivers per older adult by 2030.[7] This surge in the older adult population is exacerbating the existing shortage of caregivers, resulting in a lower caregiver-to-older adult ratio, increased workloads for caregivers, and heightened stress among them. [7-9]

The impact of this caregiver shortage is profound as many caregivers, who are often unpaid family members, have consistently provided both emotional and physical assistance to family members and others that they feel close to.[10] They face challenges in managing their personal lives alongside the demanding needs of older adult care, resulting in physical and emotional exhaustion.[11-12] Research has consistently show that a substantial number of caregivers suffer from stress, anxiety, and depression, which have significant long-term health effects.[10,13] Economically, the burden is also heavy, as caregivers often face financial strain due to reduced
working hours or the need to quit their jobs.[14-15] In addition to psychological and financial stress, caregivers confront difficulties and challenges in providing care itself, especially for the growing number of older adults with chronic conditions or disabilities, requiring diverse skills and knowledge often without adequate training or support[10,15]. This gap in professional caregiving assistance and the increasing reliance on informal, family-based care underline the urgent need for supportive programs and policies.

Technological advancements, such as smart home technologies and remote monitoring systems are at the forefront of innovative caregiving solutions. These technologies have the potential to significantly improve caregiving effectiveness and scope.[16-19] However, the path to fully integrated smart home solutions faces hurdles, including privacy concerns with camera usage[20-21], discomfort with wearable technologies[22], challenges in integrating a variety of smart devices for personalized monitoring[23-24], and limitations in current alert systems.[25] These issues emphasize the importance of a design approach that is attuned to the real-life experiences of caregivers and care recipients.

In response to these identified challenges, this thesis focuses on developing and using a preliminary prototype remote monitoring system based on off-the-shelf smart home technologies. The primary aim is not the full-scale development of a new system, but rather to use the prototype as a catalyst to garner more specific and meaningful feedback from caregivers. By presenting a tangible and practical example, the discussions and evaluations become more relevant and grounded in the practical experiences of older adults receiving care. This prototype serves as a bridge, enabling caregivers to better express their needs, concerns, and expectations in caring for older adults. This interactive process enables us to acquire a deeper understanding of the effectiveness of technological solutions and the nuanced requirements of both caregivers and care
recipients. The findings gained from this study are crucial for both older adults and caregivers, providing deeper insights in developing a more informed and efficient strategy for designing support systems for aging in place. These systems should not only be technologically advanced but also empathetic and aligned with the real-world contexts of older adult care, ensuring they address both caregiver needs and older adults’ unique needs.

1.1 Remote Monitoring Needs

Although older adults have various needs and supports depending on their condition, there are some general areas that could be addressed as we summarized here.

_Daily Mobility and Activity Patterns_

Monitoring the general activity patterns of older adults, especially those living alone, is essential for identifying and managing health concerns. Older adults who are living alone have a risk of frailty.[26] Frailty in older adults often manifests through various signs, including a decrease in walking speed, more sedentary behavior, and a reduction in daily step count. These indicators can be assessed through measures like leg muscle power (for walking speed), accelerometry (for sedentary behavior), and muscle strength related to sarcopenia (for step count).[27-28] By tracking these activity patterns, it has a potential to detect signs of frailty early and allow caregivers to take steps to manage it effectively.

The extent of an older adult’s movement within their home and in the wider community, often referred to as ‘life space,’ is a crucial health indicator.[29] Research has demonstrated that limited mobility, characterized by reduced frequency of outings or neighborhood walks, correlates
with a higher risk of frailty and associated mortality. This holds true even when accounting for other health conditions.[29] Another research study suggests that gait speed can also be seen as a general indicator of completing ADLs.[30] A decrease in the frequency of indoor mobility might signify issues like weakness, fatigue, depression, apathy, or impaired balance, which affects the ability to move around rooms for ADLs.[31]

Furthermore, the ability to move through different environments is intricately linked to cognitive health. Declines in mobility often precede cognitive issues like Mild Cognitive Impairment (MCI).[31] It also noted that individuals with cognitive decline showed reduced indoor movement, in contrast to those with normal cognitive function who maintained consistent indoor activity levels.[32] Therefore, monitoring movements within the home can be key to the early identification of cognitive decline.

Encouraging an active lifestyle is crucial to counter the effects of sedentary behavior. Engaging in regular physical activity is beneficial in preventing health problems associated with inactivity.[33-34] Older adults who live alone or lack constant care are more likely to exhibit sedentary behavior.[35] Monitoring their activity patterns serves as an essential early warning system, signaling potential health changes. This proactive approach allows caregivers and health professionals to intervene timely, helping to maintain the overall health and independence of older adults.
Health Monitoring

Health monitoring is a crucial aspect of caring for older adults, aiding in the early detection of a range of health issues. Monitoring sudden changes in body weight, for example, is important, as weight loss can be an indicator of not only frailty[36], but also health conditions such as nutritional deficiencies[37], chronic diseases, or underlying medical problems.[38]

For those with chronic respiratory conditions, monitoring oxygen saturation levels is vital. Observing for signs of respiratory distress or a decrease in oxygen levels can alert caregivers to potential respiratory complications[39], which might require immediate medical attention. Sleep quality and stress levels, which can be assessed through heart rate monitoring are other important aspects to consider. Poor sleep and elevated stress levels can have a significant impact on an individual’s overall health, affecting both physical and mental well-being.[40] Regularly monitoring blood pressure also helps maintain the health of blood vessels that nourish the brain, thereby reducing the risk of brain damage and cognitive impairment in older adults.[41] Additionally, sharing blood pressure data with caregivers can offer insights into the brain health of older adults, enabling the early detection and prevention of health issues.

Medication Compliance

Ensuring medication adherence among older adults is crucial for managing chronic conditions and maintaining their health.[42] Older adults often face challenges with medication adherence, particularly due to factors like the use of multiple medications[43], memory impairments[44-45], complex dosing schedules[46-47], inconsistent daily routines[48]. Caregivers can play a crucial role in supporting older adults to follow their medication regimens. As the oldest-old individuals become more dependent, the significance of caregivers' roles in
acquiring, administering, and monitoring medication typically increases.[49] Caregivers frequently employ various tools and strategies, including pill boxes, checklists, calendars, verbal reminders, and additional aids, to assist in medication management. Nonetheless, these methods often require customization or personalization to suit the unique demands of their caregiving circumstances.[50] Therefore, there is a need to develop more adaptable and personalized medication management systems that can be tailored to the diverse and specific needs of different caregivers and older adults.

**Managing Extreme Climate Conditions**

Monitoring climate conditions, specifically temperature and humidity, is critical for the well-being of older adults. These individuals have a diminished capacity to regulate body temperature[51], and they may face challenges in communicating discomfort.[52-53] Older adults are also at an increased risk of both hyperthermia and hypothermia due to physiological changes associated with aging, chronic diseases, and the use of multiple medications.[54] For instance, during heatwaves, older adults are at a heightened risk of dehydration and heatstroke, which is fatal if body temperature is not quickly lowered.[55-56]

The significance of maintaining appropriate humidity levels in the living environments of older adults is also paramount. High humidity can increase the risk of heat stress [57] and exacerbate existing respiratory problems[58], while low humidity can lead to dry symptoms of the eye, nose, and throat.[59] and aggravate chronic respiratory issues.[60]
**Bathroom Safety and Usage Patterns**

Monitoring bathroom activities in older adults is vital for their health and safety. The bathroom is a common site for falls and accidents among the older adults, which can result in serious injuries.[61-62] Therefore, safety monitoring in this area is essential. Additionally, changes in bathroom visit patterns, such as increased frequency or urgency, can indicate health issues like urinary tract infections or diabetes.[63] Promptly identifying these changes is crucial for early intervention and effective management.

Nocturia, which is frequent nighttime urination, affects about half of those over 65, with around 24% experiencing two or more episodes nightly.[64] This condition can disrupt sleep patterns[65], negatively impacting overall health and quality of life. Furthermore, maintaining regular personal hygiene routines is important, as deviations can signal older adults’ health, cognitive decline or physical impairments.[66-67] By monitoring bathroom activities, caregivers can proactively identify and address health issues, ensure safety, and support the overall well-being of older adults. Additionally, this monitoring helps in tailoring care routines to meet the specific needs and conditions of each individual, ensuring a more personalized and effective approach to older adult care.

**Understanding Bedroom Activity Patterns**

Monitoring bedroom activities, particularly sleep patterns, in older adults is critical for several health-related reasons. Sleep disturbances are prevalent among older adults, affecting up to 50% of the older population.[68] These disturbances are associated with various health issues such as cognitive decline, cardiovascular and respiratory conditions, and overall reduction in life
Sleep serves as a vital indicator of health and can be disrupted by numerous factors. Therefore, it is important for caregivers to monitor aspects like the regularity of nighttime awakenings, sleep duration, frequency of bed exits, and consistency of bedtime and wake-up times. Irregularities in these patterns could signify sleep disorders like insomnia or pain-related disturbances, as well as other serious health conditions that require prompt attention.

Sleep deficiencies, such as those seen in insomnia, increase the risk of falls, making the early identification of sleep disorders crucial for fall prevention. Reduced sleep efficiency is linked to slower walking speeds and greater gait variability, especially during multitasking, which escalates fall risks in older adults. Additionally, a gradual reduction in sleep duration can negatively affect an individual's mental state. The time spent in bed often reflects a person's mental well-being. Early detection of changes in this pattern can aid in preventing a decline in their well-being. On the other hand, frequently getting out of bed at night may be a sign of restlessness or disturbed sleep. Thus, monitoring bedroom activities is an integral part of comprehensive older adult care, helping to maintain their safety, health, and overall well-being.

Wandering Behavior

Wandering behavior frequently seen in older adults with dementia, involves navigating or orienting themselves while attempting to fulfill a specific need or achieve a goal. Night-time wandering heightens risks of falls, injuries, and elopement – instances where individuals wander away from home, potentially into hazardous situations. This behavior not only poses serious safety concerns but also exerts substantial pressure on caregivers. Caring for individuals with dementia often leads to deteriorating health among family caregiver, which is intimately associated...
with high stress levels, places a substantial burden on caregivers, potentially compromising their ability to sustain home-based care.[79] Additionally, caregivers of individuals with dementia are at a higher risk of numerous health issues than caregivers of people with other conditions.[80] Addressing wandering is crucial, as it impacts the well-being of individuals with dementia and the mental and emotional health of caregivers.

1.2 A Review of Literature and Product

1.2.1 Literature review

Recent studies have attempted to review and summarize the challenges associated with using remote monitoring systems and recent smart home technologies to monitor older adults. Read et al. [81] conducted a scoping review on passive remote monitoring (PRM) and aging in place. They searched the literature from 2008 to February 2019 and found 14 articles that met the eligibility criteria. Their criteria focused on PRM technology for older adults and excluded review articles, studies about wearable technology, telephone-based care, studies that describe a technology or algorithm such as validation of an artificial intelligence (AI) method or sensor technology), and studies of in-home simulation (e.g., apartments used as labs). The review revealed a predominant focus on door and motion sensors in the studies analyzed, with comparatively less emphasis on other types of PRM technologies. Furthermore, it was concluded that there is a notable scarcity of research exploring the effectiveness of PRM technology in aiding older adults to age in place within their homes. Specifically, there is a significant gap in studies assessing the impact of PRM systems on family/friend caregivers. Kim et al. [82] conducted a
similar scoping review on in-home monitoring technology for aging in place. They found 30 studies published between June 2016 and 2021. Their criteria focused on studies monitoring human physical, emotional, and social behavior involving human subjects, excluding wearable system studies, theoretical, conceptual, or review papers lacking empirical data or demonstrations, and qualitative research. The review addresses six main characteristics of in-home monitoring system: daily activities, abnormal behaviors, cognitive impairment, falls, indoor person positioning, and sleep quality. The study revealed that health assessments in in-home monitoring systems largely rely on self-reports from older adults or reports from their caregivers. This approach has limitations. Consequently, understanding an older adult’s daily activities at home is crucial, as changes in health status are often identified through alterations in their ADL. Additionally, it emphasized the need for thoughtfully tailored design and implementation strategies that cater to the unique needs and preferences of older adults, ensuring that these systems are less intrusive and respect the privacy of the individuals, for instance, some sensors, like contact sensors on doors, are more noticeable and can cause discomfort or annoyance.

Both studies acknowledge the benefits and challenges of technology in supporting older adults and their caregivers, with a focus on maintaining independence and improving safety. However, a notable limitation of both studies is that they specifically excluded wearable sensing. This exclusion might overlook the potential benefits and advancements in wearable technology relevant to monitoring the health and activities of older adults.

In addition to the scoping reviews, many studies have explored different facets of developing and evaluating remote monitoring systems. Some of these articles have focused on assessing the needs and understanding the user perceptions of older adults and caregivers regarding home-based monitoring technologies.
Tiersen et al. [83] employed an iterative user-centered design approach, involving a mix of methods. Participants included 9 people with dementia, 9 caregivers, and 10 academic and clinical staff. People with dementia and their caregivers engaged in activities such as semi-structured interviews, which gathered insights into their daily life challenges and interactions with technology. They also participated in a workshop aimed at defining needs, where they scored their perceived necessities in various aspects of daily life affected by dementia. Additionally, a workshop for academic and clinical staff was conducted to discuss design opportunities for representing these needs through personas based on findings from the prior interviews and workshops. The study identified critical aspects of daily life of people with dementia such as preventing illness and injury, addressing sleep, hydration, continence, hygiene, and psychological states, and ensuring medication compliance.

Bian et al. [84] explored the attitudes of older adults towards technologies for frailty assessment in home settings, using a qualitative approach and gathering data through focus group meetings. Fifteen older adults aged 65 and older, including both participants who have experienced physical decline while aging and those who have not, were involved in the study. Ten different types of technologies were presented and explained how to use them based on the frailty criteria. The questions asked during these discussions were designed to elicit feedback from various perspectives. These included concerns or barriers related to installing and using the technology in daily life at home. The study revealed that participants generally had positive attitudes towards the use of technology for frailty assessment. However, they found some technologies more acceptable only under specific conditions, such as cameras being turned on only at specific times or upon a doctor's request, and sensors that were less obtrusive and could blend into their home environment.
Additionally, participants questioned the data accuracy of motion and fridge door sensors in shared living environments.

Wrede et al. [85] conducted a qualitative research study, combining semi-structured interviews and focus groups with 35 caregivers of individuals with dementia. This study aimed to explore the benefits and barriers of unobtrusive in-home monitoring by presenting hypothetical scenarios. Participants perceived unobtrusive in-home monitoring as a beneficial tool for tracking various aspects such as falls, sleep patterns, personal hygiene, nocturnal restlessness, and eating and drinking behaviors, while expressing concerns about privacy related to data misuse and loss of control over data sharing.

Camp et al. [86] engaged two groups of older adults in photo-elicitation interviews (PEIs) and open-ended questions: Seventeen participants were aged 55-69 years and 16 participants were aged 70 years and older. Fourteen photographs depicting wearable and environmental-based systems were presented, prompting participants to share their views on ADL and monitoring technologies. The findings showed diverse needs and preferences across different age groups. The older participants, with less prior knowledge of monitoring technology, demonstrated greater openness to wearable sensors. In contrast, the younger group favored environmental sensors and preferred using such technologies only when they noticed a decline in their daily living capabilities.

While the existing literature provides important insights into user perceptions of remote monitoring technology, it exhibits limitations in scope and methodology. Most studies concentrate on the perspectives of older adults, while the views of caregivers, who play a crucial role in the caregiving process, are less frequently examined. Understanding the perceptions of caregivers alongside older adults towards remote monitoring systems could offer more nuanced and practical
insights into system design and functionality. Furthermore, these studies generally do not use prototype systems to gather feedback, which may lead to more generalized rather than specific responses to real-world applications. Gathering feedback from participants using tangible prototypes could lead to more detailed insights, significantly enhancing the relevance and applicability of the research to actual caregiving contexts.

Another body of published research focuses on developing and deploying remote monitoring systems in the homes of older adults. These research studies aim to evaluate the feasibility of these systems in a real-life setting and gauge the acceptance and usability among older adults and caregivers. A primary limitation in home monitoring systems for older adult care in these studies is their focus on narrow user groups and specific behaviors. Many projects target specific conditions, such as dementia or other cognitive impairments, potentially limiting their broader applicability. Additionally, there is a notable reliance on limited sensor types, often constrained by regional product availability or the use of single-brand technologies. Furthermore, the scope of monitored behaviors is often restricted, focusing on a few ADL or specific aspects like physical activity and sleep changes, which may not comprehensively address the diverse needs of the older adult population. These limitations highlight the need for more inclusive and varied approaches in both user demographics and behavioral monitoring in the development of remote monitoring systems.

Lentelink et al. [87] developed and evaluated a Home Monitoring System (HMS) to assist informal caregivers of people with dementia. The HMS, which integrated motion and door sensors, aimed to provide caregivers with essential information about the health and living conditions of persons with dementia. The selection of the system's controller and sensors faced limitations due to the restricted availability of controller products in the Netherlands and the necessity for an open
API. These constraints led to the choice of the Vera Plus controller, with sensor selection further influenced by the need for compatibility with this controller. The study involved six informal caregivers and a dementia case manager, conducting a 5-day trial in a home setting. The study suggested five functional requirements 1) support multiple users 2) display information about events and behavioral changes, 3) differentiate between normal, abnormal, and alarming situations, 4) a shared calendar feature, and 5) the integration of a chat function. Overall, the final HMS prototype scored high in terms of usability and the quality of the Smartphone Application.

Caroux et al. [88] introduced an "activity verification" approach to monitor daily activities in aging individuals. The study was conducted over 8 weeks with seven participants, averaging 82 years in age. These participants were selected based on specific criteria, including cognitive integrity. The methodology involved the use of motion sensors, contact sensors, and smart switches installed in the participants' homes. The study was limited in scope, applying the approach to just three Activities of Daily Living (ADLs) – breakfast preparation, getting dressed, and taking a shower. The study suggested the importance of personalizing the application to align with the needs and expectations of the monitored individuals to enhance its effectiveness. This personalization includes allowing the older adult to choose which activities they want to be monitored for and which notifications they wish to receive.

Grguric et al. [89] conducted a pilot study for evaluating in-home monitoring SmartHabits system in a real environment. The study involved 13 different users, including home users (older people living alone), caregivers (each with access only to their designated home user), and administrators (responsible for the system and pilot setup). The SmartHabits system was tested in a real environment for a duration of six months. The system utilized commercially available off-the-shelf sensors integrated with a home gateway, transferring data to cloud-backend services. The
study found that the SmartHabits system was generally easy to use. However, older adults vary greatly in their tech skills and willingness to use new systems. Some find these systems too intrusive, while others are more accepting. It is crucial for the system to address specific needs and offer clear advantages over any drawbacks, like privacy concerns. Systems that are too complex or have unclear benefits are less likely to be used.

Lazarou et al. [90] conducted a study to explore the long-term effects of remote monitoring system for individuals with cognitive impairment. The study involved 18 participants with cognitive impairment. The system was installed at home for 4 to 12 months. The study utilized various Internet-of-Things (IoT) devices, including ambient depth cameras, plug sensors, tags, presence sensors, a sleep sensor, and a wearable wristwatch. These sensors collected data on activities, sleep patterns, physical activity. Long-term use of the multi-sensor system was found to be feasible and beneficial for people with cognitive impairment. The older adult participants’ unfamiliarity with technology could have influenced the effectiveness and acceptance of the system.

Lach et al. [91] assessed the feasibility, acceptability, and usefulness of a commercially available home monitoring system, BeClose (Alarm.com, Tysons, VA) designed to track total daily activity and sleep changes over time. The system was tested for 3 months in 10 older adults’ house. The setup included a wearable device, motion detectors, a bed sensor, a door sensor, and a chair sensor. Overall, participants had a positive view of the monitoring system, however, some participants found the bed and chair pads irritating and required repositioning. Awareness that a monitoring system was being installed in the house also led to behavioral changes in some participants.
Ault et al. [92] developed a night-time wandering detection and diversion system named the Night-time Wandering Detection and Diversion (NWDD), which included smart home technologies such as sensors, smart bulbs, pressure mats, and speakers. The participants were 20 dyads of community-living older adults with moderate to severe dementia who experienced instances of night-time wandering and their main caregivers. The system was tested in the participants' homes for a duration of 12 weeks. The system is designed to detect when a person with dementia leaves their bed, activating cue lighting to safely guide them to the bathroom. Additionally, it employs prerecorded audio prompts if they wander away from the bedroom. The caregiver is only alerted when the person with dementia opens an exit door. Overall, caregivers provided positive feedback and felt that the system helped them feel more at ease during the night. It indicated that the system functioned as anticipated without any failures, and the caregivers and the older adults with dementia scarcely noticed the technology installed in their homes. However, the study stated the limitation of using devices and sensors from a limited range of brands and did not explore the potential effectiveness or challenges of using a wider variety of technologies.

VandeWeerd et al. [93] evaluated the HomeSense ambient home sensing tool developed by researchers at the University of South Florida (USF). The system was installed in the homes of older adults for 6 months. The study involved 21 older adults living in single-resident homes. The HomeSense system included various wireless sensing devices like magnetic contact sensors, passive infrared motion sensors, energy sensors, pressure sensors, water sensors, and environmental sensors. The study highlighted maintenance challenges with the ambient sensors installed in private homes, mainly due to difficulties in accessing these sensors for routine upkeep or repairs.
1.2.2 Product Review

Our investigation also included a market search for remote monitoring system products. The table providing a list of commercially available products along with their features can be found in Appendix A.1. Additionally, the table listing devices and sensors used in these commercial products can be referred to in Appendix A.2. [94-99]

The review of these products and services highlights several limitations in terms of functionality, features, and the nature of services provided. One notable issue is the limited online information for each product, making it challenging for potential users to make informed decisions.

This lack of detailed product information could affect user understanding of features, installation processes, and overall capabilities. A common issue across many systems like Livindi[94], Micare[95], and CarePredict[97] is the limited customization options for alerts and notifications. This restriction can hinder tailoring these systems to individual user needs.

These systems also rely on only a single type of sensor for monitoring activities, which can limit the scope and accuracy of the data collected and raise concerns about their reliability. Furthermore, a notable shortfall in almost all reviewed systems is the lack of temperature and humidity detection, which limits their comprehensiveness in ensuring safety.

Regarding installation and setup, while these systems generally boast easy setup processes, they vary in terms of the complexity of installation and the need for additional hardware. Some of them may require more involved installation processes or are limited by compatibility with certain devices or platforms, as seen with GrandCare's reliance on specific touchscreens.[96]

The current landscape of remote monitoring systems for older adults reveals significant gaps both in the market and in academic research. On the market front, the effectiveness of existing commercial products is not supported by research, with minimal or even non-existent data to
validate their efficacy in practical settings. There is some doubt about their function and reliability. To date, academic research has focused on research prototypes, particularly focusing on algorithm development and system validation with less emphasis on the practical aspects of real-world adoption. This frequently overlooks the practical aspects of real-world adoption, effectiveness, and impact. This underscores a critical need for more comprehensive and inclusive research that bridges this gap, focusing on the development of systems that are not only technologically sound but also genuinely beneficial and user-friendly for older adults residing in their homes and communities, who wish to age in place. This approach should encompass a thorough evaluation of system impact, integration of diverse technologies, and a deep understanding of the essential features that truly meet the needs of caregivers while addressing older adults’ challenges.
2.0 Methods

To achieve the objectives, the study was organized into four phases: Phase I - Conceptualization, Phase II - System Development, Phase III – Small-group Interviews, and Phase IV – Data Analysis (see Figure 1)

![Figure 1 The Four-Phase Study Framework](image)

2.1 Phase I: Conceptualization

The study involved a comprehensive analysis of existing products in the remote monitoring system market and a thorough review of scientific literature from databases including PubMed, IEEE, and ScienceDirect, which can be found in the tables in Appendix A. The focus was on remote home monitoring systems, in-home monitoring technologies, and their monitoring capabilities. The investigation led to the identification and quantification of seven key care aspects:

- Overall Activity: Examining patterns of daily activities both inside and outside the home.
- General Health: Tracking health metrics for a comprehensive health overview.
- Medication Compliance: Ensuring and tracking adherence to medication schedules.
- Climate Control: Alerting about extreme climate conditions.
• Bathroom Use: Monitoring unusual bathroom activity.
• Bedroom Use: Observing unusual bedroom activity.
• Wandering Behavior: Safeguarding by monitoring and managing nocturnal wandering.

2.2 Phase II: System Development

We developed a low-fidelity prototype of the CARE360 remote monitoring system to address the seven care areas. This initial version was crafted for preliminary concept exploration. Central to the architecture of the CARE360 remote monitoring system is the Home Assistant platform, which serves as the primary software hub. The system operates locally on a Raspberry Pi equipped with both USB Zigbee and Z-Wave dongles for enhanced connectivity. The system’s capability to support various communication protocols like Zigbee, Z-Wave, Wi-Fi, and Bluetooth, enables the integration of a wide range of devices from many manufacturers, thereby providing a unified management and monitoring infrastructure.

For comprehensive monitoring and data collection across seven care areas, the system integrates a variety of smart devices. Table 1 displays the smart devices utilized in various areas along with the functions and features they support.
Table 1 Overview of Smart Devices by Area with Supported Functions and Features

<table>
<thead>
<tr>
<th>Areas</th>
<th>Functions and Features [Smart Devices That Support Them]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Activity</td>
<td>• Home/Away status [Smartphone]</td>
</tr>
<tr>
<td></td>
<td>• Total steps [Fitness tracker]</td>
</tr>
<tr>
<td></td>
<td>• Walking speed [Fitness tracker]</td>
</tr>
<tr>
<td></td>
<td>• Sedentary time [Fitness tracker]</td>
</tr>
<tr>
<td></td>
<td>• Out-of-home frequency and duration [Smartphone]</td>
</tr>
<tr>
<td></td>
<td>• Frequency and duration of room access [Motion and Presence sensors]</td>
</tr>
<tr>
<td></td>
<td>• When and where motion was last detected [Motion sensor]</td>
</tr>
<tr>
<td>General Health</td>
<td>• High Stress Duration [Fitness Tracker]</td>
</tr>
<tr>
<td></td>
<td>• SpO2 [Fitness Tracker]</td>
</tr>
<tr>
<td></td>
<td>• Sleep Duration [Fitness tracker]</td>
</tr>
<tr>
<td></td>
<td>• Weight [Smart scale]</td>
</tr>
<tr>
<td></td>
<td>• Blood Pressure [Smart blood pressure monitor]</td>
</tr>
<tr>
<td>Medication Compliance</td>
<td>• Missed Medication [Presence sensor]</td>
</tr>
<tr>
<td></td>
<td>• No Confirmation [Smart button, Presence sensor]</td>
</tr>
<tr>
<td></td>
<td>• Taken Successfully [Smart button]</td>
</tr>
<tr>
<td>Climate Control</td>
<td>• Room temperature [Smart indoor air quality]</td>
</tr>
<tr>
<td></td>
<td>• Room humidity [Smart indoor air quality]</td>
</tr>
<tr>
<td></td>
<td>• HVAS mode [Smart thermostat, Smart AC controller]</td>
</tr>
<tr>
<td>Bathroom Use</td>
<td>• Overall Toilet Use Frequency [Water leak sensor]</td>
</tr>
<tr>
<td></td>
<td>• Overall Toilet Use Duration [Presence sensor]</td>
</tr>
<tr>
<td></td>
<td>• Post-Bedtime Toilet Use Frequency [Water leak sensor]</td>
</tr>
<tr>
<td></td>
<td>• Post-Bedtime Toilet Use Duration [Presence sensor]</td>
</tr>
<tr>
<td></td>
<td>• Shower Use Frequency [Water leak sensor]</td>
</tr>
<tr>
<td></td>
<td>• Shower Use Duration [Water leak sensor]</td>
</tr>
<tr>
<td></td>
<td>• Potential Fall Alert [Motion sensor, Presence sensor, Smart speaker, Smart button]</td>
</tr>
<tr>
<td>Bedroom Use</td>
<td>• In bed/Off Bed status [Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Wake-up Time [Motion sensor, Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Time-to-Bed [Motion sensor, Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Sleeping Time [Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Post-Bedtime Bed Exits [Pressure mat]</td>
</tr>
<tr>
<td>Wandering Behavior</td>
<td>• Wandering Frequency [Motion sensor, Contact sensor, Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Wandering Duration [Motion sensor, Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Return to Bed Frequency [Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Out-of-Bed Duration [Motion sensor, Contact sensor, Pressure mat]</td>
</tr>
<tr>
<td></td>
<td>• Wandering Behavior Alert [Motion sensor, Contact sensor, Smart light bulb, Smart speaker, Pressure mat]</td>
</tr>
</tbody>
</table>
2.2.1 Key System Features

The dashboard contains the task selection page, configuration page, home page and individual pages for seven care aspects: Overall Activity, General Health, Medication Compliance, Climate Control, Bathroom Use, Bedroom Use, and Wandering Behavior.

2.2.1.1 User-Centric Customization

On the task selection page, users are allowed to choose their preferred areas for monitoring according to their needs. The areas marked in green indicate the selected options, while those in grey represent the unselected options as in Figure 2.

![Figure 2 Task Selection Interface for Monitoring Preferences](image-url)
Once the monitoring areas are selected, users can tailor settings to manage the timing and method of notifications and prompts sent to caregivers and care recipients. This includes selecting devices to be used and customizing alert messages according to their preferences and the specific conditions in each monitoring area.

For example, in the Medical Compliance area, the system allows customization of the timing and method for sending prompts and notifications to both caregivers and care recipients, as shown in Figure 3. Figure 4 details settings for scheduling reminders, alert light, and alert light color. Additionally, as demonstrated in Figure 5, users have the option to personalize messages for phone reminders and speaker announcements.

![Notification Preferences](image)

**Figure 3** Notification Preferences in Medication Compliance Area
Figure 4 Configuration for Medication Compliance Area

Figure 5 Custom Messages and Announcements in Medication Compliance Area
2.2.1.2 Overview and Historic Data Trend

The home page presents an overview of daily activities in selected care areas and the critical alerts in each card, allowing caregivers to provide timely assistance to a care recipient. (see Figure 6) Furthermore, individual pages for the seven care areas offer more detailed information, such as summaries on a daily, weekly, monthly, and yearly basis, allowing caregivers to observe trends over time. (see Figure 7 and 8)

![Home Page Interface for Monitoring Preferences](image)

Figure 6 Home Page Interface for Monitoring Preferences
Figure 7 Daily Summary of Bathroom Use Interface

Figure 8 Weekly Summary of Bathroom Use Interface
2.2.1.3 Support for Care Recipients

In addition to assisting caregivers with remote monitoring, the system also directly supports care recipients. For instance, in the Medication Compliance area, it includes smart buttons that function as confirmation devices, allowing care recipients to press them to confirm successful medication intake. Moreover, in the Wandering Behavior area, the system employs voice prompts to guide care recipients back to bed if they begin to wander, enhancing their safety. The system also features automatic lights that activate during night-time bed exits, ensuring a secure environment. These features are specifically designed to boost the independence and comfort of care recipients while simultaneously offering caregivers reassurance and peace of mind.

Our prototype system employs YAML (YAML Ain't Markup Language) as a critical tool for programming essential features within the Home Assistant platform. YAML is central to establishing a framework that integrates sensors, utilizes their data for automations, and manages alerts based on sensor statuses. It configures how the smart home system behaves and responds to data from various sensors. This setup is crucial in monitoring and adapting to changes in sensor statuses, making the home automation system smarter and more responsive. Additionally, YAML was also primarily used along with HTML and CSS for structuring and configuring the layout of the CARE360 dashboard user interface in Home Assistant. This involved various UI components, such as cards for displaying data or controls for interacting with smart devices. Refer to Appendix B.1 for the YAML code used in our automations, and see Appendix B.2 for configuration specifics. Detailed information on the YAML code used for automations can be found in Appendix B.1, while configuration specifics are available in Appendix B.2.
2.3 Phase III: Small-Group Interviews

The study involved conducting four small-group interviews via video conferencing. This initial step focused on gathering insights from caregiver, aiming to (1) gain a better understanding of caregivers’ needs and the support they seek in situations where they cannot be physically with their care recipients, and (2) collect feedback on CARE360, assess the perceived usefulness, and identify areas for improvements. Subsequent steps of the study will involve the inclusion of older adults in future work.

2.3.1 Study Participants

The study received approval from the University of Pittsburgh’s Institutional Review Board (IRB) and recruited potential participants through the Pitt UCSUR Regional Research Registry (PuRRR). A brief screening process was conducted to confirm eligibility. To participate, individuals had to meet the following criteria: 1) be a caregiver who is aged 18 years or older, 2) provide assistance to older adults aged 65 years or older who live in a private residence (rent or own), 3) been a caregiver for at least one year (paid or unpaid), 4) be capable of communicating effectively in English, and 5) willing to be audio and video recorded during small-group interviews.

Eligible participants who expressed interest in participating were required to complete a consent form online through the University of Pittsburgh's REDCap survey system. Participants were also asked to complete a demographic questionnaire that includes age, race, ethnicity, household annual income, employment status, education, difficulty with functional skills, age range of care recipient, relationship with care recipient, length of providing care, hours per week
for providing care, type of care, technology use (smartphone, tablet, laptop/computer, smart home technology, wearable devices) technology attitude, overall comfort with technology, tech passion. Subsequently, they were scheduled for either individual or small-group interviews based on convenience.

2.3.2 Interview Session

The interview, lasting no more than 2 hours, was structured into three parts: 1) exploring general perspectives on caregiving, 2) assessing the perceived importance of seven care aspects, and 3) discussing CARE360 and its focused areas. At the start of the session, participants received an overview of the study's objectives and an introduction to smart home technology. All sessions were audio and video-recorded for transcription and qualitative analysis.

Part I: The goal is to understand the caregiver’s general needs, concerns, and expectations independently of our system. The guiding questions are as follows.

- Can you please share details about your caregiving experience? This includes who you are caring for, whether you live in the same household as them, the type of care you provide, the amount of time you spend caregiving, and any other aspects of your role that you consider important.

- Can you list a few things you are worried about when you are not with the person you are caring for?
  - How do you currently stay informed about their well-being when you are away?
  - Have you used any kind of technology to keep you informed of the person's situation while you are not around? If so, what was your experience?
• Can you list a few things that you would like to know to make you feel comfortable when leaving the person you care for?

Part II: We first introduced the seven care areas of CARE360 including overall activity, general health, medication compliance, climate control, bathroom use, bedroom use, and wandering behavior, without revealing the system. We then asked the participants to rate the importance of each area on a five-point Likert scale ('Not important', ‘Slightly important’, ‘Moderately important’, ‘Important’, 'Very Important') through a Zoom poll.

Part III: Participants first viewed a video showcasing the overall CARE360 system, after which they shared their first impressions, including likes and dislikes. They then watched videos of each individual area, sequenced from highest to lowest in perceived importance as determined in Part II. Following each video, participants responded to the following questions.

• What are your initial thoughts on [Area]?
  o Perceived usefulness: How well do you think [Area] addressed your needs or concerns as a caregiver?
  o Perceived ease of use: How easy do you think [Area] would be to use it?

• What improvements or additional features would you suggest for [Area]?

• Can you think of any potential challenges or issues or do you have any concerns about using [Area] in your daily life?

Additionally, participants rated the perceived usefulness and ease of use for each area on a five-point Likert scale in a Zoom poll, ranging from 'Not Useful' to 'Very Useful' and 'Very Easy' to 'Very Difficult', respectively. Due to time constraints, some small-group interviews could not cover all seven care areas.
Following the discussions of the specific focus areas, participants rated the perceived usefulness and ease of use of the overall system on a five-point Likert scale in a Zoom poll, ranging from ‘Strongly disagree’ to ‘Strongly agree'. The statements used were adapted from the System Usability Scale.[100]

Perceived Usefulness Questions:

1) The system would enhance my caregiving capabilities.

2) I find the system to be beneficial in managing the care recipient’s needs.

3) The system could improve the quality of care I can provide.

4) The system would give me peace of mind when I am away from the person I care for.

5) I think I would like to use this system frequently.

6) I would recommend the system to other caregivers.

Ease-of-use Questions:

1) I think the system is easy to use.

2) I find the system unnecessarily complex.

3) I think I would need the support of a technical person to be able to use this system.

4) I find the various functions in this system are well integrated.

5) I would imagine that most people would learn to use this system very quickly.

6) I think I would need to learn a lot of things before I could get going with this system.

At the conclusion of the interview, participants were asked to share their thought on the following question:

• Based on what you've seen and discussions about our system, do you feel there are any areas or features that are missing or could be added to better meet your needs as a
caregiver? If you could add or suggest a new feature or area to our system, what would it be and why?

2.4 Phase IV: Data Analysis

2.4.1 Quantitative Analysis

Quantitative data comprised of the ratings of the perceived importance for each focus area, as well as the perceived usefulness and ease of use for each focus area and the overall system. Descriptive statistics were employed to detail the frequency distribution of these responses.

2.4.2 Qualitative Analysis

All small-group interviews were transcribed verbatim. Data management and analysis were conducted using NVivo (version 14; released March 2023). An inductive approach to thematic analysis was applied to all transcripts, starting with open coding. Independently, two members of the research team (DD and SS) read each transcript and created an initial set of codes. Subsequently, they met to compare, discuss, and reconcile codes, reaching a consensus on the final list. They also conducted focused coding to eliminate, combine, and divide categories, thereby allowing for the development of patterns within the data. Patterns were then synthesized and refined into themes and sub-themes.
3.0 Results

3.1 Participant Demographics

Table 2 summarizes the detailed characteristics of the seven participants from the demographic questionnaire. The participants, who are all female unpaid caregivers, range in age between 38 to 55 years.

Table 2 Participant Demographics

<table>
<thead>
<tr>
<th>Participant Characteristics</th>
<th>Mean (standard deviation) or Number of Participants (% of participants) (ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>46 (7.87)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic or Latino</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Household annual income</td>
<td></td>
</tr>
<tr>
<td>$10,000 - $39,999</td>
<td>2 (28.6%) (ID: #2 and #3)</td>
</tr>
<tr>
<td>$70,000 - $99,999</td>
<td>3 (42.8%) (ID: #1, #4 and #5)</td>
</tr>
<tr>
<td>$100,000 or more</td>
<td>2 (28.6%) (ID: #6 and #7)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>2 (14.3%) (ID: #1 and #5)</td>
</tr>
<tr>
<td>Master's degree</td>
<td>4 (57.1%) (ID: #2-#4 and #7)</td>
</tr>
<tr>
<td>Vocational training or certificate</td>
<td>1 (28.6%) (ID: #6)</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
</tr>
<tr>
<td>Part-time employed</td>
<td>2 (28.6%) (ID: #2 and #3)</td>
</tr>
<tr>
<td>Full-time employed</td>
<td>5 (71.4%) (ID: #1 and #4-#7)</td>
</tr>
<tr>
<td>Difficulty with functional skills</td>
<td></td>
</tr>
<tr>
<td>Difficulty using my legs and feet</td>
<td>1 (14.3%) (ID: #2)</td>
</tr>
<tr>
<td>Difficulty with mental health or</td>
<td></td>
</tr>
<tr>
<td>emotional skills</td>
<td>1 (14.3%) (ID: #2)</td>
</tr>
<tr>
<td>Length of providing care</td>
<td></td>
</tr>
<tr>
<td>1-2 years</td>
<td>2 (28.6%) (ID: #2 and #5)</td>
</tr>
<tr>
<td>3-5 years</td>
<td>2 (28.6%) (ID: #6 and #7)</td>
</tr>
<tr>
<td>6-10 years</td>
<td>3 (42.8%) (ID: #1, #3 and #4)</td>
</tr>
<tr>
<td>Hours per week for providing care</td>
<td></td>
</tr>
<tr>
<td>Less than 10 hours per week</td>
<td>3 (42.8%) (ID: #1, #2 and #6)</td>
</tr>
<tr>
<td>10-20 hours per week</td>
<td>2 (28.6%) (ID: #5 and #7)</td>
</tr>
<tr>
<td>Type of care</td>
<td>Frequency</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>21-40 hours per week</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>More than 40 hours per week</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>Physical care (e.g., bathing, dressing, feeding)</strong></td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>Emotional support (e.g., companionship, listening)</strong></td>
<td>7 (100%)</td>
</tr>
<tr>
<td><strong>Medical care (e.g., administering medication, wound care)</strong></td>
<td>5 (71.4%)</td>
</tr>
<tr>
<td><strong>Household tasks (e.g., cleaning, cooking)</strong></td>
<td>5 (71.4%)</td>
</tr>
<tr>
<td><strong>Financial management (e.g., paying bills)</strong></td>
<td>4 (57.2%)</td>
</tr>
<tr>
<td><strong>Other, please specify</strong></td>
<td>2 (28.6%)</td>
</tr>
</tbody>
</table>

**Technology use**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Frequency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smartphone</strong></td>
<td>7 (100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Tablet</strong></td>
<td>4 (57.2%)</td>
<td>(ID: #1, #3, #4, and #7)</td>
</tr>
<tr>
<td><strong>Laptop/Computer</strong></td>
<td>7 (100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Smart Speaker</strong></td>
<td>2 (28.6%)</td>
<td>(ID: #5 and #7)</td>
</tr>
<tr>
<td><strong>Smart Light Bulb</strong></td>
<td>1 (14.3%)</td>
<td>(ID: #5)</td>
</tr>
<tr>
<td><strong>Home Security Technology</strong></td>
<td>1 (14.3%)</td>
<td>(ID: #5)</td>
</tr>
<tr>
<td><strong>Smart TV</strong></td>
<td>1 (14.3%)</td>
<td>(ID: #3)</td>
</tr>
<tr>
<td><strong>Streaming Device</strong></td>
<td>3 (42.8%)</td>
<td>(ID: #3, #5 and #7)</td>
</tr>
<tr>
<td><strong>E-Reader</strong></td>
<td>1 (14.3%)</td>
<td>(ID: #5)</td>
</tr>
<tr>
<td><strong>Smart Health Technology (smart scale, thermometer, blood pressure cuff, etc.)</strong></td>
<td>1 (14.3%)</td>
<td>(ID: #5)</td>
</tr>
<tr>
<td><strong>Wearable</strong></td>
<td>3 (42.8%)</td>
<td>(ID: #2, #5 and #7: Fitness tracker)</td>
</tr>
</tbody>
</table>

**Technology attitude**

| #1: Satisfied; #2: Satisfied, Frustration, Confident, Uncertain; #3: Satisfied, Enjoyment, Frustration, Confident, Simple; #4: Satisfied, Confident; #5: Satisfied, Confident; #6: Satisfied; #7: Satisfied, Enjoyment, Confident |

**Overall comfort with tech**

| **Very comfortable**              | 4 (57.2%) | (ID: #3-#6) |
| **Comfortable**                   | 3 (42.8%) | (ID: #1, #2 and #7) |

**Statement: “I am passionate about exploring new technologies and finding ways to improve existing products or processes”**

| **Disagree**                      | 1 (14.3%) | (ID: #2) |
| **Neutral**                       | 2 (28.6%) | (ID: #3 and #7) |
| **Agree**                         | 2 (28.6%) | (ID: #1 and #6) |
| **Strongly Agree**                | 2 (28.6%) | (ID: #4 and #5) |
In addition, we have compiled information about their care recipients and the caregivers’ concerns during times they are not physically present with their care recipients. This data was collected from both the demographic questionnaire and the small-group interviews. The details are shown in Table 3.

Table 3 Care Recipient Characteristics

<table>
<thead>
<tr>
<th>ID</th>
<th>Care Recipient Profile</th>
<th>Care Recipient Level of Independence</th>
<th>Care Recipient Tech Use</th>
<th>Caregiver Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>86y, Mother Live alone</td>
<td>Overall independent</td>
<td>Smartphone</td>
<td>• Medication</td>
</tr>
<tr>
<td></td>
<td>Health conditions</td>
<td>• Confusion about various things</td>
<td>- Does not understand it</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fair/Good</td>
<td>• Risk of getting lost</td>
<td>• PERS unit</td>
<td>• Safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• when going outside alone</td>
<td>- Does not like it</td>
<td>- fall or injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Forgetting to take medication</td>
<td></td>
<td>risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Risk of falling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>78y, Mother Live in the same household Health conditions</td>
<td>Mobility Issues</td>
<td>Smartphone</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Uses bedside commode</td>
<td>- Does not always</td>
<td>- fall or injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Uses rollator at home and wheelchair when goes out.</td>
<td>understand it</td>
<td>risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Unable to cook</td>
<td>- Texting communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Risk of falling</td>
<td>• Smart light bulbs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cognitively intact</td>
<td>• Continuous glucose</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• PERS unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Feel uncomfortable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- fall or injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>risk</td>
</tr>
<tr>
<td>#3</td>
<td>72y, Mother Live alone</td>
<td>Fluctuating Abilities</td>
<td>Smartphone</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Health conditions</td>
<td>• Sometimes overestimates her</td>
<td>- Texting</td>
<td>- fall or injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capabilities, leading to self-harm.</td>
<td>communication</td>
<td>risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• History of Multiple</td>
<td>- Phone communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Falls</td>
<td>- Barely use phone</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• One fall resulted in</td>
<td>• Chromebook</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>spinal cord surgery, increasing levels of care.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

35
| #4  | 87y, Grandma | Live alone | Health conditions:
|• Obesity
|• Joint cartilage degeneration
|• Mini strokes
|• Migraine with aura
| | ● Trouble coordinating care.  
| ● Able to perform ADLs.  
| ● Recently admitted to hospice.  
| ● Memory issues: Forgets having eaten food.  
| | ● Smartphone: Phone communication.
| ● Alexa: Often forgets to say "Alexa" first.
| ● Fitbit: Forgets to charge it.
| ● PERS unit: Does not wear it – leave it in the bedroom.  
| | ● Safety: Potential for fall or injury.  
|● Meal intake:  
|● Medication Compliance: |
| #5  | 87y, Father | Live in the same household | Health conditions:
|• Stroke
|• Heart condition
|• Urology
| | ● Able to perform ADLs.  
| ● Health issues:  
| | ● Smartphone: Do not use smartphone, and any technology.  
|● Medication Compliance:  
|● Safety: Potential fall or injury.  
|● Meal intake: Issues with the pacemaker.  
| #6  | 81y, Uncle | Live alone | Health conditions:
|• Arthritis
|• Cancer recovery
|• Old age
| | ● Pretty much self-sufficient.  
| ● Tendency to hurt himself.  
| ● Uses walking sticks.  
| | ● Smartphone: Only used for calling.  
| ● Texting is not used because typing is difficult for him.  
| ● Voice input is not known or utilized.  
| | ● Medication Compliance:  
|● Does not answer phone calls.  
| #7  | 73y, Father and 74y, Mother | Live in the same household.  
| Health conditions:
|• Diabetes
|• Heart disease
|• COPD
|• Kidney failure
| | ● Mother: mobility issue  
| - Uses a cane or walker.  
| | ● Father: Knee issue  
| - A little cognitive issue.  
| | ● Smartphone: Texting communication.  
| - Phone communication.  
| | ● Medication Compliance:  
|● Well-being:  
|● Meal intake:  
|● Does not want them to drive: |
3.2 Results of Quantitative Caregiver Feedback for CARE360 System

3.2.1 Importance of Seven Remote Monitoring Areas

Before examining the CARE360 system, caregivers assessed the importance of seven remote monitoring areas. They expressed their views using a five-point Likert scale, ranging from 'Not Important' to 'Very Important'. The distribution of their ratings is presented in Table 4. All seven participants provided their ratings.

Table 4 Perceived Importance of Seven Remote Monitoring Areas

<table>
<thead>
<tr>
<th>Areas</th>
<th>Not important</th>
<th>Slightly important</th>
<th>Moderately important</th>
<th>Important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Activity</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>General Health</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>4 (57%)</td>
</tr>
<tr>
<td>Medication Compliance</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>0 (0%)</td>
<td>3 (43%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>Climate Control</td>
<td>3 (43%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>Bathroom Use</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>Bedroom Use</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>Wandering Behavior</td>
<td>5 (71%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
</tr>
</tbody>
</table>

3.2.2 Perceived Usefulness and Ease of Use for CARE360’s Monitoring Areas

Before initiating the open discussions and following the presentation of the video showcasing each monitoring area of CARE360, participants were prompted to rate their perceived usefulness and ease of use of each monitoring area. The assessment of perceived usefulness employed a five-point Likert scale from ‘Not useful’ to ‘Very useful’, in response to the question, ‘How well do you think it addressed your needs or concerns as a caregiver?’. The assessment of perceived ease of use utilized a five-point Likert scale from ‘Very easy’ to ‘Very difficult, in
response to the question, “How easy do you think it would be to use it?”. Due to time constraints, we were unable to cover each area during some small-group meetings. Table 5 provides a summary of responses regarding perceived usefulness, whereas Table 6 displays the responses for perceived ease of use.

Table 5 Perceived Usefulness of CARE360's Monitoring Areas

<table>
<thead>
<tr>
<th>Areas</th>
<th># of participants</th>
<th>Not useful</th>
<th>Slightly useful</th>
<th>Moderately useful</th>
<th>Useful</th>
<th>Very useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Activity</td>
<td>7</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>3 (43%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>General Health</td>
<td>7</td>
<td>1 (14%)</td>
<td>1 (14%)</td>
<td>1 (14%)</td>
<td>0 (0%)</td>
<td>4 (57%)</td>
</tr>
<tr>
<td>Medication Compliance</td>
<td>7</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>3 (43%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>Climate Control</td>
<td>3</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Bathroom Use</td>
<td>3</td>
<td>0 (0%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td>1 (33%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Bedroom Use</td>
<td>5</td>
<td>0 (0%)</td>
<td>1 (20%)</td>
<td>1 (20%)</td>
<td>1 (20%)</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>Wandering Behavior</td>
<td>3</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (67%)</td>
</tr>
</tbody>
</table>

Table 6 Perceived Ease of Use of CARE360's Monitoring Areas

<table>
<thead>
<tr>
<th>Areas</th>
<th># of participants</th>
<th>Very easy</th>
<th>Moderately easy</th>
<th>Neither easy nor difficult</th>
<th>Moderately difficult</th>
<th>Very difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Activity</td>
<td>7</td>
<td>0 (0%)</td>
<td>4 (57%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>General Health</td>
<td>7</td>
<td>2 (29%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>Medication Compliance</td>
<td>7</td>
<td>0 (0%)</td>
<td>3 (43%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>Climate Control</td>
<td>3</td>
<td>2 (67%)</td>
<td>0 (0%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Bathroom Use</td>
<td>3</td>
<td>0 (0%)</td>
<td>3 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Bedroom Use</td>
<td>5</td>
<td>1 (20%)</td>
<td>0 (0%)</td>
<td>1 (20%)</td>
<td>0 (0%)</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Wandering Behavior</td>
<td>3</td>
<td>1 (33%)</td>
<td>2 (67%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
3.2.3 Overall Perceived Usefulness and Ease of Use for CARE360 System

After the conclusion of each small-group meeting, participants were requested to evaluate the overall perceived usefulness and ease of use for CARE360 in its entirety. The perceived usefulness and ease of use were both evaluated using a five-point Likert scale from ‘Strongly disagree’ to ‘Strongly agree’ across six statements. Table 7 summarizes the responses related to perceived usefulness, while Table 8 presents the responses concerning perceived ease of use of CARE360 system overall.

Table 7 Perceived Usefulness of CARE360 System

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree no disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system would enhance my caregiving capabilities.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>3 (43%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>I find the system to be beneficial in managing the care recipient’s needs.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4 (57%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>The system could improve the quality of care I can provide.</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>The system would give me peace of mind when I am away from the person I care for.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td>I think I would like to use this system frequently.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>4 (57%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>I would recommend the system to other caregivers.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>3 (43%)</td>
<td>3 (43%)</td>
</tr>
</tbody>
</table>
### Table 8 Perceived Ease of Use of CARE360 System

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree no disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think the system is easy to use.</td>
<td>0 (0%)</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
<td>0 (0%)</td>
<td>4 (57%)</td>
</tr>
<tr>
<td>I find the system unnecessarily complex.</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>I think I would need the support of a technical person to be able to use</td>
<td>2 (29%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>this system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I find the various functions in this system is well integrated.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>3 (43%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>I would imagine that most people would learn to use this system very</td>
<td>1 (14%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>0 (0%)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>quickly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think I would need to learn a lot of things before I could get going</td>
<td>3 (43%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>with this system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 Results of Qualitative Caregiver Feedback for CARE360 System

The thematic analysis identified five key themes including 1) Factors affecting technology engagement of care recipients, 2) Inadequacy of technology in meeting varied and specific real-world needs, 3) Challenges in adopting and utilizing the CARE360 system, 4) Perceived usefulness of the CARE360 system, and 5) Desired monitoring areas, features, and functions. There are also multiple sub-themes under each theme. Each of these main themes is further divided into several sub-themes. These findings are comprehensively outlined in Table 9.
<table>
<thead>
<tr>
<th>Theme 1</th>
<th>Factors affecting technology engagement of care recipients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sub-Theme 1.1: Care recipients' beliefs, privacy concerns, and habits</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 1.2: Care recipients' functional impairments</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 1.3: Care recipients' tech familiarity and competence</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 1.4: Caregivers' tech ability and attitude</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 1.5: Technology simplicity, comfort, and unobtrusiveness</td>
</tr>
<tr>
<td>Theme 2</td>
<td>Inadequacy of technology in meeting varied and specific real-world needs</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 2.1: Care recipients have diverse medication routines</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 2.2: Care recipients have unique daily routines or living conditions</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 2.3: There are other individuals or pets in the same household</td>
</tr>
<tr>
<td>Theme 3</td>
<td>Challenges in adopting and utilizing the CARE360 system</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.1: Setup Complexity</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.2: Affordability</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.3: Caregiver challenges in tech adoption and utilization</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.4: Challenges in introducing tech to care recipients</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.5: Practical implementation and maintenance considerations</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.6: Usability concerns on the medication module</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.7: Concerns on security and hackability</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.8: Device selection for usability and accuracy</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 3.9: Information overload</td>
</tr>
<tr>
<td>Theme 4</td>
<td>Perceived usefulness of the CARE360 system</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 4.1: Ease of access to information</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 4.2: Objective record that does not rely on memory</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 4.3: Supporting customization</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 4.4: Data and trend tracking</td>
</tr>
<tr>
<td>Theme 5</td>
<td>Desired monitoring areas, functions, and features</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.1: Fall detection</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.2: Detailed sleep monitoring</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.3: Kitchen Activity</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.4: Intelligent data analytics and alerts</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.5: Integrated and comprehensive reminder system</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.6: Track sleep in more locations</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.7: Action tips for climate change</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.8: Support access by multiple caregivers</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.9: Ease of use for caregivers</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.10: Customizability and modularity</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.11: Tech integration</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.12: Devices for continuous health monitoring</td>
</tr>
<tr>
<td></td>
<td>Sub-Theme 5.13: System integration</td>
</tr>
</tbody>
</table>
3.3.1 Theme 1: Factors affecting technology engagement of care recipients

This theme covers various elements that could impact how care recipients interact with and respond to remote monitoring technology. These factors play a crucial role in determining the effectiveness and acceptance of technological solutions in a caregiving context.

Code: Care recipients' beliefs, privacy concerns, and habits

Participants expressed varied opinions about their care recipients' attitudes towards technology. Some participants noted their care recipients were comfortable using technology, while others observed resistance due to skepticism about its value and security.

- “And she is also one of those conspiracy people. Like Smart speaker. Like I'm not going to let the NSA listen to what I'm doing.”
- “As far as the camera goes, I don't think she would care if it was just us who had access to it. So, you would have to make sure, I guess, that the system was as unhackable as possible.”
- “He says he's too old for that [smartphone] and he doesn't need to.”
- “So, you know, like she does a lot of her own self-monitoring. So, I could see this smart tracker being something that she'd be willing to an extent to use.”

Code: Care recipients' functional impairments

Functional impairments, whether cognitive, physical or sensory, play a critical role in how care recipients engage with technology. These impairments could affect their ability to use or understand technological devices.

- “About last one, potential challenges or issues. My mom forgets a lot of things, so she might see that on the wall or whatever and unplug it because she doesn't know what it is.”
- “I've met some people who are pretty badly off in terms of the extent of their dementia and a floating voice that they're totally unfamiliar with coming out of nowhere. I could see that being suddenly perceived as threatening or even as if maybe someone were in this space that they didn't anticipate, like a home intruder or something that might cause fear or erratic behavior.”
• “But again, I think going to that age, can an older person put on a Fitbit? Most of them have arthritis or are they able to do it themselves?”
• “Because she's a little bit hard of hearing in one ear. And it would have to be clear and concise from the speaker or wherever it's coming from.”

Code: Care recipients' tech familiarity and competence

The level of familiarity and competence that care recipients have with technology impacts their ability to engage with it. Participants mentioned past experiences of their care recipients with technology and their current skill level in using existing technologies.

• “Because my mom being 86. She had a flip phone until a couple of years ago, and we tried to get her an iPhone. She did not understand it, no matter how many times we told her so. I guess. Obviously keeping in mind, a lot of old people don't understand the technology.”
• “He has zero technology. He does have a smartphone now, but all he does is phone calls on it. He doesn't text, doesn't do anything else.”
• “And also, you know, almost all of the older folks in my life personally and I do come from a working-class background, people who are technology resistant or not technology competent. So, they just don't have things in their house because they don't want them or they don't feel competent to use them.”
• “We did get the smart light bulbs for her room, which is a huge help because she's able to turn her lights on and off with her phone now as opposed to trying to reach a light. So that, I think, that has definitely helped.”
• “We're somewhat lucky that she is sort of tech savvy as far as people her age go. She likes her iPhone.”

Code: Caregivers' tech ability and attitude

Caregivers' own technical skills and attitudes towards technology can influence the adoption and usage of tech solutions in caregiving as well. While most participants reported utilizing technology in some form to aid their caregiving, there were varying levels of familiarity and comfort with these technologies.

• “I'm not sure if any of this is out here already because I don't keep up with the technology.”
• “I use an Alexa, actually, to give reminders when I'm not there like the medication reminders.”
• “You know, having any type of camera. I wouldn't want that. I wouldn't do that for my dad.”
• “I used his phone and I set alarms in his phone for the times he needed to take his medicine and then just showed him how to turn the alarm off. So, that was helpful.”
• “Only had [Life360] his phone. So, he doesn't know how to use it to track me. But we can at least track him and know where he's at.”

**Code: Technology simplicity, comfort, and unobtrusiveness**

The design and functionality of technology, including its ease of use, comfort in daily use, and how unobtrusive it is, are significant factors. Participants feel that technologies that are simple to use, comfortable, and minimally invasive are more likely to be accepted and used regularly by care recipients.

• “My mom is very stubborn. She would be resistant. Resistant for the technologies stuff unless it was very simple.”
• “I think convincing her to wear something would probably be easier as long as it was comfortable, because when she had that PERS unit, the one of the things that she hated was she didn't like having it around her neck because she didn't like sleeping, because she felt like it was going to choke her.”
• “I think it will be easy to use also because with that pad being under the mattress sheet, I could put it there and she'd never even know it was there.”
• “And then I also go back to the motion sensors that are, as you had said about picking something off the door. They're going to be very curious and probably be picking those things up, wanting to move them.”

### 3.3.2 Theme 2: Inadequacy of technology in meeting varied and specific real-world needs

This theme explores the limitations of current technology in addressing the diverse and specific requirements of care recipients in real-world scenarios.

**Code: Care recipients have diverse medication routines**

A common concern among participants was the inability of current technologies to adequately support the varied medication routines of care recipients which could affect medication adherence in real-world settings.
• “Because even if you would just send one [reminder] at 9:00 and she's sitting in the living room and she's not ready for breakfast yet. She's going to forget. I mean some people will forget.”
• “Sometimes mom takes her medicine in the kitchen and sometimes she takes it in her recliner.”
• “There are a couple of things like the medication one. You know, if they are out, how does that work? Does it like, does it then turn an alarm on their phone to remind them or send an alert to their home?”

Code: Care recipients have unique daily routines or living conditions

Some participants expressed that their care recipient's daily routine and living conditions are unique and could be a challenge for technology to adapt accordingly.

• “I guess I would have to know more about what the devices and such were just because like, I mean this doesn't really apply to my mother-in-law cause she has a bedside commode.”
• “And she sleeps off and on all day, so something along the lines of like if she didn't get up on time, it's sending me an alert. I think I would hate that as well. It tends to sleep off and on all day.”
• “But frankly, my mom's an awful sleeper. She sleeps all over the place. She sleeps for two hours, sometimes 14 hours, sometimes. Sometimes she goes to bed at 7 a.m. Sometimes she is in bed at nine. She is everywhere. And so I'm like, well, aside from recording fascinating data. I'm not sure how much useful that would be to me.”

Code: There are other individuals or pets in the same household

Some participants noted that the presence of other individuals or pets in the same household can complicate the use of monitoring technologies.

• “But it made me curious about, like cats and dogs and other creatures that might like what it takes to trigger a motion sensor.”
• “So, my first thoughts were, what if somebody else use the bathroom? How does that get monitored and or does it not? You know, how do you bypass a different person in that bathroom?”
3.3.3 Theme 3: Challenges in adopting and utilizing CARE360 System

This theme focuses on the diverse challenges caregivers face in adopting and effectively using the CARE360 system. Setup complexity emerged as the most cited challenge, mentioned in three out of four meetings. Other significant challenges discussed in two out of four meetings included affordability, caregiver challenges in tech adoption and utilization, challenges in introducing tech to care recipients, practical implementation and maintenance considerations, and usability concerns on the medication module. Lastly, challenges such as concerns on security and hackability, device selection for usability and accuracy, and Information overload were brought up in one out of four meetings. Figure 9 provides a summary of challenges faced by participants.

![Figure 9: Challenges faced by participants in adopting and utilizing CARE360](image-url)
Code: Setup Complexity

This code captures the shared concerns about the challenges in setting up the technology, the considerations regarding its physical placement, and the relative ease of its use once installation is complete. It highlights a common perception among caregivers about the need for support during the setup phase and a preference for professional assistance.

- “I think once it's set up, it looks like running it on a daily basis didn't seem too difficult. But I would probably want someone to walk me through the setup.”
- “Like as a caregiver, I'd be like, here, let me pay you. And you set this up for me.”
- “But they also mostly all seem like things that once you have them set up and integrated, you don't need to continue to worry about that. So, I think use in the long run would be easy, even if installation might be challenging.’

Code: Affordability

Participants felt that the affordability of the technology used in the system could be a challenge.

- “And then, obviously the main challenge is just that. I'm like, Well, our family's poor. We can't afford a lot of the things that you would use.”
- “I was like the initial thought was like, how am I going to afford this?”

Code: Caregiver challenges in tech adoption and utilization

This statement broadly captures the essence of both the difficulties caregivers face in learning to use and manage care technology and the decision-making process involved in choosing which technology to implement in the caregiving setting. It reflects the overall challenges caregivers encounter at different stages of technology engagement.

- “And now I got to go in and track stuff and now I got to go in and adjust my setting like so it also seems very overwhelming to me.”
- “So, I think that that would be a learning curve for myself as well.”
- “But unless I would assume that unless it was, you know, somebody was there to, okay, jump on the scale, okay, let's do your blood pressure to some degree. And I think that I think conceptually, I think it's fantastic. And but my personally, I think like, okay, well, how do we ensure that.”
“I think that this would be helpful is like if you have like, if I would hire somebody who would be like, taking care of my grandma, I could see that this would be beneficial because, like number two is saying if someone, then it's there to kind of walk them through to them.”

Code: Challenges in introducing tech to care recipients

Participants mentioned that there would be challenges in introducing new technology to care recipients, especially those who are unfamiliar with tech.

• “Yeah, I think it would be harder sell to get it in the house. I think once it was in the house, she would probably forget that. I mean, as long as you’d probably forget that it's there.”
• “I don't see that happening for my dad's range of ages and often, like even his neighbor. She's in her 80s and they get they'll get very flustered.”
• “I think that's a great point that number one had to about trying to introduce technology to a certain age group that has not been did not grow up with.”

Code: Practical implementation and maintenance considerations

This code captures concerns about the day-to-day practicalities, safety, and reliability of using tech, which were also considered as challenges to utilizing the system.

• “I would say the charging of the item. So, like I know with a Fitbit, like I go over there all the time and it's like dead, you know, because she doesn't put it on the charger, things like that.”
• “Yeah. And then those cords are hanging out like elderly people are like babies, go back to you know, obviously having accidents. What if something falls in the water. What if something falls in the toilet? Is there enough plugs in the bathroom to utilize something like that. The little device that was in the bathtub, I thought how do you clean the bathtub with a little device in there?”
• “Do they have battery backup in case of like a blackout cause? Well, my house is prone to those.”

Code: Usability concerns on the medication module

Participants noted concerns about the usability of monitoring medication compliance for care recipients who may be less technologically adept.

• “All of a sudden I was just picturing my mom like, this light is on and it's the wrong color and can't make the light go the right color and hit the button. But did I get the message?”
And then, you know, I can just there's a lot going on there that I could see a place for frustration for especially for a less technologically competent older adults.”

“I think that flashing light like that could, you know, maybe for her, she might think that there's something wrong with the light or she might be like, not really picking up like you or I might go, oh, that's a reminder. But you have to know in your mind that that light going off is the reminder for the medication. If you can't retain that, right? you're just seeing a flashing light and now you're thinking something's wrong with your light. So now you're going to fix it.”

Codes: Security and hackability, Device selection for usability and accuracy, and Information overload

One participant brought up concerns about the security of the system, particularly the risk of hacking and unauthorized access to information: “But to me when I think open source just as a buzzword, I think like everyone can see the source code, and you know, if you're trying to market this like people might hear open source and think everyone is going to be able to see it. You might just have to do a little bit of education to reassure people that its security is.”

The challenge of selecting devices for usability and accuracy was also noted, particularly for care recipients with specific needs: “I can see my mom being potentially frustrated with mechanical ones.[blood pressure monitor] And the primary reason for that is that all of the people in our life experience, we're all people who are obese and manage obesity. And most digital cuffs pop off or don't record accurately. And so, it would be a challenge for people for who might in like in a doctor's office need an extra large cuff or something along those lines.”

Additionally, some comments indicated the challenge of information overloaded: “That's a lot of information that I would have to read through and understand and everything.”
3.3.4 Theme 4: Perceived usefulness of CARE360 System

This theme centered on how participants perceive the usefulness of the CARE360 system across seven aspects of caregiving, as well as their overall impressions and attitudes towards the system. The most frequently mentioned area was Bathroom Use, highlighted in four meetings, followed by Overall Activity which was cited in three meetings. Climate Control, Medication Compliance, and Wandering Behavior were also noted for their utility in two meetings each. Bedroom Use and General Health areas were each mentioned in one meeting. Figure 10 provides a summary.

Figure 10 Perceived usefulness of CARE360 system as experienced by participants
3.3.4.1 Overall impressions of the system

In general, all participants had a positive attitude towards CARE360 as a whole. Key points of usefulness included ease of access to information, reliable records, system customization, and data tracking capabilities.

Code: Ease of access to information

Participants highlighted the simple and straightforward of accessing information within the system.

- “Things I like that you were able to sort of have an overall dashboard of everything that was going on that you had set up, but you were also able to click on it and get more detail on everything.”
- “Like the dashboard seemed really nice, but when you clicked on to get into the individual aspects of it, I liked the graphs that charted the data at the top.”

Code: Objective record that does not rely on memory

The ability of the system to provide objective records that did not rely on memory was especially valued. Participants shared that they would feel less concerned by knowing the actual records which do not depend on their care recipients' memory.

- “As I think about what how we do it now, it's entirely based on my mother's memory of how things have been. It's literally self-report day-to-day which is normal for her, [...] So that would for me, that would alleviate some of the concern that her self-reports aren't accurate to what's really happening.”
- “That would be fantastic. And then he can't lie. You can't say all my blood pressure is good.”

Code: Supporting Customization

The support for customization of the system was also a feature that the participants found useful.

- “I do like that option that I can type in what I want to say.”
- “If I have no interest in seeing temperature, are you able to remove those things from view? Things like that.”
• “Yeah, some of those things, I wouldn't even bother using for her. Like you say, everybody's different. Everyone has different issues with their, you know, with who they're caring for.”

Code: Data and trend tracking

Lastly, participants found that the system's capability to track data and trends over time is beneficial as they could see the unusual trends over time.

• “I think my initial thoughts are that the data would be useful for identifying baselines and then any shifts in the trends that might be worrying.”
• “Just, I also really like the idea of just being able to like it provides the capacity to have a record that you can view over time.”
• “Again, my thought is, is that it's all, you know, great things and it's great to monitor those things over time and then to see the summary, to see in real-time what's going on.”
• “I can see where, I like the patterns, like over time so that you could. I wouldn't mind having it for myself.”

3.3.4.2 Bathroom Use

Participants highlighted the value of monitoring bathroom activity for indicating potential health issues. Additionally, they appreciated the system's ease of use with minimal technological interaction.

• “I do think that, you know, how long have you been in the bathroom? Like on the toilet, you know, monitoring that is a good idea.”
• “So, at first with the bathroom thing, I was like, I don't really need that. But after listening to that, I think it would be helpful to monitor frequent bathroom use or not frequent. I think that could be a warning signal that there may be health problems.”
• “I like that one. [Bathroom Use Area] I think that that's not as intense as finding, that one's okay. Like with pushing a button and, you know, just kind of like the sensor there. So yeah, I think that out of the ones that have been presented, this one might be the easiest for her to, you know, I could see her using this.”
• “About being able to say to Alexa to say like call 911 or to say, you know, that they're having issue or pressing the button. You know, I thought I read somewhere along the lines that most issues could or could not happen in the bathroom. You know, accidents can happen in the bathroom. So, I think that's a good thing.”
3.3.4.3 Overall Activity

Participants showed a favorable attitude towards fitness trackers, motion sensors, and presence sensors in terms of activity monitoring. Furthermore, these technologies were seen as providing significant relief, especially when caregivers were not physically present with the care recipient.

- “They feel for me like tremendous relief. Even if she's going somewhere or doing something that makes that I'm concerned about, I have the information, right.”
- “And I think it would be beneficial for to have it for him to continue to live on his own instead of having to live with somebody else if I can monitor those things.”

3.3.4.4 Climate Control

The climate control feature was seen by some participants as a potentially lifesaving tool, particularly in extreme weather conditions and for care recipients with specific needs.

- “My initial thought is that like, it could be lifesaving, right? Like especially in summer elders dying in their homes because their home environment got too hot and nobody knew. And especially because sometimes that, like, the temperature itself can create like a decreased awareness of what is happening or can create just decreased capacity for the body to change something like it seems like it could really be lifesaving and could mean that someone who isn't physically inside the house could be monitoring and could potentially make changes. So, that just seems like it would be very useful if you already had or if you purchased as part of the Care 360 package, the devices that you need.”
- “But there are situations where my mother's house gets really warm in the summer where it would be nice if, you know, if I at least had the ability to track the temperature, even if I didn't necessarily have the ability to control the system.”
- “So, I will say that this is an area that I didn't even think about as like something that you would provide an option for. But it makes me extremely happy because one of the issues that we're having with my grandma is the thermostat. So, as I shared, she's having like, you know, she has mild cognitive impairment. And she is constantly cold. She always like freezing. [...] what is happening is she goes over to the thermostat, and she will like it's set to heat and she thinks that like she needs to keep increasing it, [...] And what happens is it's causing her to become very dehydrated at times because she's sitting in that warm environment. So, for me, this is like, yes, this would be wonderful. I could see a lot of benefits in this.”
3.3.4.5 Wandering Behavior

Participants conveyed the capabilities of the system in managing wandering behavior. They highlighted its diverse applications in enhancing the safety of care recipient safety with automated lighting and providing real-time alerts to caregivers.

- “It seems like it would be incredibly useful. And again, my mother in particular at this moment doesn't experience dementia, so her wandering is elective and purposeful and in a way that I think for some adults using the system, it wouldn't be. But I still picture having some utility.”
- “I especially liked, I liked the interacting with the lighting so that in the event that the person being taken care of were to be unable, like because of urgency or whatever, to get to lights because my mom specifically an issue that she has is urination urgency and she struggles with incontinence. Sometimes she's scrambling up out of bed really fast. She doesn't have time to mess with lights. But if a motion sensor kicks off lights, that's helpful, which I realized we could do without this particular system. But I like that is part of the triggering.”
- “I think that this will be very helpful because it's a lot of people are worried about this, people getting up at night kind of wandering around the house, leaving the house.”
- “I think just the whole, you know, the alarm getting a notice that somebody is leaving, you know, here the door is open in the middle of the night or really at any time is would have been very helpful.”

3.3.4.6 Medication Compliance

Participants discussed the potential benefits of using both visual and verbal prompts in aiding their care recipients to adhere to their medication schedules effectively.

- “Even though I also want to flag I love the idea of the light system, and I like the idea of using multiple sensory inputs. Obviously, there are older adults who are partially or completely deaf, and so like, oral messages are useless for them and so other ways to provide indicators are helpful.”
- “I like the colored lights option. Not currently, but I took care of my mom for many years. I know she towards the end she was sleeping a lot like during the day, and if I would call, and I'd say it's time to take your medicine, and she would say, is it my morning medicine or my afternoon medicine like, what medicine am I taking? And a light would have been nice, you know, like whatever red, blue, green, whatever order it had. She had the light she wouldn't needed me. And she can know by the light what color or you could even match the color to maybe, like, a pillbox of a certain color.”
- “[Speaker announcement]That would be good too. Just like a verbal. Take your blue pills.”
3.3.4.7 Bedroom Use and General Health

One participant expressed the usefulness of a system that could alert her if her care recipient does not wake up at their usual time. Also, one participant emphasized that it is interesting to have a detailed overview of key health indicators to ensure the well-being of the care recipient.

- "I'd hate to be like this, but I'm afraid that if she falls asleep and doesn't wake up ever. Like if she passes away while she's sleeping. That's what I would need to know. So, I would have to set it. You know, if she doesn't wake up by 11:00, you know, to send me something."
- "I think this was probably one of the ones that I would be most like if I had to pick one. This would be the one most interested in just to be able to monitor like heart rate and blood pressure and eventually oxygen, because those would be definitely red flags if they're all that something's not right."

3.3.5 Theme 5: Desired monitoring areas, functions, and features

3.3.5.1 Areas for remote monitoring

Code: Fall Detection

Most participants expressed a strong preference for a fall detection feature that is both sensitive and accurate, and which provides immediate and direct communication to caregivers. They emphasized the importance of being able to respond promptly to falls in critical areas such as stairways. Additionally, they valued the assurance of receiving notifications about falls regardless of the care recipient's proximity to a communication device. These features were identified as critical in enhancing the caregiving experience and providing peace of mind to caregivers.

- "You know, something on the stairway that you would know if she fell, since nobody else is there cause I worry about that. That's all I had to add."
- "I have a question if I just want to monitor if my mom has fallen, is there will there be an option for that? Because I don't necessarily need to know her sitting in her chair or walking back and forth to the kitchen just as she falls. Like, will there be something for that?"
- "I would feel better. If there were some kind of system in place for her to notify me if something is really... If she were to have a fall or something like something unexpected that is urgent needs, urgent attention."
• “Like she has her life alert, but the life alert stuff goes to the life alert system. It does not come to me. And the best we've got is really kind of, at the moment, like a text from her that comes from her phone. And if she isn't near her phone when she falls, there's no way for me to kind of know what's going on. So, I would like to know that she had a way to get a hold of me regardless of where she was physically in her space.”
• “But as far as like if he fell but was just couldn't maybe get to help or something like that, I don't necessarily know if I would know that. So, I just think from my personal experience, I fear of a fall of some sort.”
• “I would really be more comfortable with like, fall sensors or maybe something that, you know, if I didn't talk to them in like two days, like if I called and it just went to voicemail and, you know, I gave it a little time and I gave it till the next morning and still didn't hear from them. Like there was some way of like checking in without having to send one of the neighbors over.”

Code: Detailed sleep monitoring

Participants stated an interest in advanced sleep monitoring features, such as tracking sleep stages, time taken to fall asleep, frequency of waking up during the night, and physical movements in bed. Such detailed monitoring could provide valuable information for both caregivers and healthcare professionals, leading to a better understanding and management of sleep health. Participants also expressed interest in the ability to track sleep patterns in multiple locations, not just in the bed but other potential resting areas.

• “I don't know but how well she's sleeping might be something that cause I know, like a lot of times, like her doctors ask her, how well are you sleeping? And she doesn't answer because in her mind, she's not sleeping well, but she sleeps a lot. And so, like, I don't know if the fact that she naps throughout the day is why she's not sleeping well at night. Something like that. I know there are like wearables that like track like stages of sleep. So, maybe that might be helpful as well.”
• “Just being able to track because especially because I know like as you get older, like your sleep, you don't get into the deeper levels of sleep and cause some problems. But like if you know, how long does it take her to fall asleep once she's in bed, how many times during the night is she waking up but not necessarily getting out of bed. Something like that might be helpful.”
• “I wish it tracked more like I wish it tracked breathing or motion, you know, that sort of thing. Not just did they get out of bed, but like, motion in the bed. Something to detect that they're still breathing.”
• “I'm wondering if there's a capacity for like tracking two locations, how much time do you spend in the recliner versus how much time would we spend in the bed.”
• “Does that one [pressure mat] also work in like a recliner, or does it have to lie flat?”
Participants expressed a need for monitoring tools specifically designed for the kitchen, recognizing it as an area with potential safety risks, particularly related to the use of cooking appliances like stoves and ovens. Additionally, they also highlighted the desire to monitor eating habits more comprehensively than just detecting when the fridge is opened and closed.

- “I think something in the kitchen. I don't know If we really talked about that, but I don't know but it's the only room that probably wasn’t mentioned. I think a lot about a stove and a like an electric stove versus a gas stove. A gas stove can be problematic. What I'm looking for. I don't know. But I do think that that is a room that could potentially have harm.”
- “So, something that would know if the oven's on or you could automatically shut the oven off.”
- “I will say, like sometimes when I'm over at my grandma's. She'll go over to the fridge and open it and just stare at it and then walk away and she does that again and again. So, I just, wow. It would be great to know her intake right there. I just don't know how technology wise you could do that. That's like a human, you know, thing. Like besides having somebody there saying, yeah, she ate this or no she ate that. I don't know how you would monitor that.”

3.3.5.2 Functions

Code: Intelligent data analytics and alerts

Most participants expressed a desire for the system to analyze trends, provide contextually relevant alerts, and simplify data presentation for both caregivers and medical professionals. The capability to automatically set baselines, interpret trends, and offer actionable insights was identified as essential in enhancing the utility and effectiveness of the system.

- “I do have one question about the data that it collects. So, saying how it's able to. It's going to help to identify, like, changes. Is there a way to set it up so that, like, it just passively collects data for like, a week or so and then sets that as a baseline and then is able to, like, alert you when like something goes outside of that baseline or do you have to like physically go in and determine like, this is what I consider the baseline?”
- “And then I guess my other question is like when you're talking about like being able to combine, you know, how often she's sleeping in bed during the day and then comparing that to how well she's sleeping at night, is that something that the system is going to do or is that something that, like we as the caregivers like I would need to say, okay, she thought she didn’t sleep well on Tuesday. How many times did she nap on Monday?”
• “My major suggestion if you didn't already have it implemented, because if I'm not medically trained. So, like I may see a trend, but I have no idea what that trend necessarily might mean. So, if you have something that can track, that might fall under the general health thing, but like, you know, they track trends and then, you know, maybe we get a pop-up that says, hey, we've noticed this trend. You might want to have the person you're caring for see a doctor about, you know.”

• “Just thinking off the top of my head, in that case, could you set up a reminder so that like, if the presence sensor notices that she's gone into the kitchen and it's within the morning hours, it reminds her while she's in the kitchen to take her medication.”

• “But if I can get an alert that says like, listen, she went outside, and she's not supposed to because it's January and it's icy everywhere. That'd be good.”

• “I look at it and say like, I would use it even though I would have to do the work like I would kind of look at everything, but I also look at it and say like their medical providers are busy. May or may not have time to go through a bunch of stuff so if I just show up with all of this data, then they have to sort through it. Whereas, you know something that would give the big picture in a snapshot for them would be helpful.”

**Code: Integrated and comprehensive reminder system**

Participants indicated a demand for a reminder system that not only tracks medical appointments and medication schedules but also seamlessly integrates with existing digital tools and provides holistic management options. Additionally, they valued the ability to centralize and automate reminders while offering a comprehensive view of the care recipient's schedule and needs.

• “Because instead of the medication reminder, I would love like appointment reminder type of things that it announces, you know, hey, you have this appointment. Or it announces, Hey, reminder you need bloodwork before your appointment on whatever day. And then kind of the ability to look at things holistically. So, not just this one feature or that one feature, and not just everything that this system tracks, but then to look at this, plus everything else is a whole.”

• “Like I use Google Calendar to manage appointments and you know, that has the benefit of being able to share it with my sister. My mother uses the UPMC app. And that's great for her. But it doesn't let me know if somebody does, you know, like if her doctor's office schedule something for her. And like, I wish there was a way that if it had an appointment in there, I could just click it and it would automatically send it to the Google calendar. And maybe there is, and I'm missing it. But like, there's a lot of. Okay, there's this appointment now I have to go to Google calendar and type everything in or I do that one.”

• “I don't know specifically what you need to add, but if there were, you know, kind of a way for there to be reminders, you know, just setting reminders about like ordering medications because you can't take a medication that you forgot to order. Yeah, something like that.
That was part of making sure they had the medication in the first place. Or maybe a weekly reminder to refill their pill minder or something like that. That might help with the med plans.”

Code: Action tips for climate change

One participant showed interest in having actionable tips and advice integrated into the system, particularly in response to climate or temperature changes within the home environment.

- “Just also have some like, tips and tricks for like changing the temperature in the house that that were maybe part of you know, because AC obviously will make a difference, right. But if you mostly only have the capacity to track the temperature, but you can at least get an alert that the temperature was potentially dangerous, if you could then get either through an app or a smart speaker, some instructions on things and actions that you could take to change the temperature. You know, like open windows, close windows, turn on your fan, switch the direction of your fan, right. Like, if there were practical tips that could then be provided that, you know, along with an alert, that might be cool.”

Code: Support access by multiple caregivers

One participant expressed the need for the system to accommodate access for multiple caregivers, with varying levels of permissions.

- “And is it and is it possible to also set it up so that like, you could have like a main caregiver who can change the data or change the parameters and then have other people who just have like read access but not right access to the to the parameters?”

3.3.5.3 Features

Code: Ease of use for caregivers

Participants highlighted the necessity for the system to be user-friendly, stressing the importance of presenting data in a manageable way and ensuring simplicity in interface navigation for caregivers. They also emphasized the need for easy navigation through settings, efficient management of device maintenance, and the flexibility to adjust notifications according to varying circumstances.
“Having those [settings and graphs] separate might make it a little easier because otherwise it's just a lot of data being thrown at you all at once.”

“When it was scrolling down, and it was showing you like settings and things. I think having that all on one screen was a lot. Yeah. Maybe having something where like you click through to the settings or you click through to the graphs.”

“Right now the fitbit's kind of like a pretty like bracelet to her and it's not really use much and so I don't think to charge it but yeah reminders like about what percentage where the batteries that would be helpful especially if you don't live with the person.”

“On that note, it would be nice to have just like a click button that, you know, like turn notifications on, turn applications off without having to do each individual one.”

**Code: Customizability and modularity**

Participants state a need for a system that allows caregivers to tailor monitoring solutions to their unique needs, offering flexibility in device selection, notification settings, and alert types. The ability to adapt the system as the care recipient’s needs change over time was seen as crucial for effective and efficient caregiving.

- “I do think that maybe even if it were customizable, like here, the 2 or 3 things that are the most important priorities to me, and we don't need a whole one. We need these two pieces of technology to track that. Great. Yeah, you can obtain those. So maybe, yeah, based on your priorities, here are our recommended technologies that you might need to have or obtain, right? Or sort of like packages based on what you want to monitor. You can get a package that comes with various devices that you might need to install in order to make that possible.”

- “I would really like the option to kind of pick and choose the components. And part of that goes back to like.”

- “I think that's a good thing, though, because as situations change, or even if they have, you know, a procedure done, or some kind of a surgery, you know, for those few weeks, we might want to monitor different things than what we normally would do.”

- “Yeah, like I would like that even with traveling because I could reduce the amount of notifications when I'm home, but then get them regularly. You know, get them more regularly when I'm not.”

- “I'll be with him for Thanksgiving, you know, he'll be at my house for those couple of days so I could turn everything off because I'm in his presence, so I wouldn't really want any kind of notifications.”

- “If there's changes in red during the day or how long they're in the bathroom, maybe some kind of alert or just the like a different color pops up a different color if on some of the other alerts, like their oxygen or their heartbeat, their heart rate. If those things are out of the norm of what their daily life is, that they would maybe pop up on it as a different color, something that would draw my attention because I don't think I would have time every day to sit and analyze and study all the material.”
Code: Tech integration

Participants discussed the potential of integrating various medical devices, such as pacemakers and glucose monitors, into a single platform. Such integration would facilitate a more holistic view of the care recipient's health and potentially streamline caregiving responsibilities.

• “My mom actually has a unit in her house because she has a pacemaker. Is there any way I don’t know if this even would be allowed to somehow integrate that monitoring system. If it goes off into what you’re doing or is that just have to be through the. But that doctor, whoever set it up or whatever.”
• “I would have loved to be able to integrate her continuous glucose monitor into her overall health data.”
• “[Integrate different devices under one platform] I agree. It's a great idea.”

Code: Devices for continuous health monitoring

The participant stated the need for devices capable of continuous health monitoring, especially for vital signs like blood pressure, and the potential challenges and benefits associated with their use.

• “One of the challenges, I guess, would be I mean, my mother-in-law would probably do it because she loves that kind of data. But for the average person remembering to take their blood pressure and then if, for instance, my mother-in-law can sometimes fall if her blood pressure falls. So, at some point when it becomes something that's on a wearable, I think that's going to be super, super useful because if they can track your blood pressure and alert you that it's going lower, and she might fall like that would be amazing. But I've been searching for something like that, and I know the technology just isn't quite there yet.”

Code: System integration

One participant expressed a strong interest in integrating the system with other health-related platforms, particularly electronic health records (EHRs) and health provider apps.

• “I would really love integration between this and either electronic health records or health provider apps, that sort of thing. So, the one that they can see the data as well, so that a medical provider can see the data as well.”
4.0 Discussion

4.1 Interpretation of Remote Monitoring Area Importance

The quantitative feedback from caregivers on the CARE360 system offers insightful perspectives on the importance of various remote monitoring areas. Participants rated 'Overall Activity' and 'General Health' as the most important ones, underscoring the high value placed on comprehensive health monitoring and daily activity tracking in caregiving. This emphasis aligns with their need to ensure the well-being of care recipients, particularly in situations where they are not physically present. It reflects a keen interest in being alerted about critical events like potential falls or other health-related emergencies.

'Medication Compliance' was another area highlighted as important. This is understandable considering some participants reported that their care recipients often deal with memory issues and forget to take their medications. While some participants have tried using technology such as Alexa or phone alarms, the effectiveness varies due to the diverse and specific needs of each care recipient. This underscores the necessity for a tailored approach to medication management.

The variability in importance ratings for 'Bathroom Use' and 'Bedroom Use' among participants likely mirrors the diverse daily routines and specific care requirements of their care recipients. This variation in responses underscores the inherently personalized nature of caregiving. This finding highlights the need for adaptable and customizable solutions in caregiving technologies to effectively cater to the unique needs of each caregiving situation.

Conversely, 'Climate Control' and 'Wandering Behavior' aspects were received lower importance ratings in the caregiving context compared to other areas due to the specific situation
of care recipients, making these care aspects less relevant for caregivers. This disparity in prioritization underscores the necessity for a nuanced understanding of each care recipient's unique condition and environmental needs.

4.2 Evaluation of Usefulness and Ease of Use in Seven Care Areas

In assessing the CARE360 system, user ratings indicate its perceived strengths and highlight areas needing enhancement. The majority of participants find the Overall Activity and Medication Compliance areas to be useful, with 43% rating them as very useful. However, 43% of participants also suggest these areas range from moderately easy to use to very difficult to use, signaling a need for either simplification or improved user training. General Health is considered very useful by 57% of users, yet its ease of use is split, with 29% finding it difficult, indicating the usability of this valued area could be improved.

For Climate Control, a third of users attest to its high usefulness, and a majority (67%) report it as very easy to use or moderately easy to use, reflecting a favorable user experience. Bathroom Use was unanimously acknowledged for its ease of use, but its usefulness received mixed reviews, with a third considering it only slightly useful. Bedroom Use, though found to be useful or very useful by 40% of the caregivers, presents usability challenges, with 60% rating it as very difficult. Wandering Behavior, deemed very useful by 67% and easy to use by all respondents, stands out as both beneficial and user-friendly, indicating it aligns well with user needs and capabilities.
Understanding the perceived usefulness and ease of use of different care areas is crucial in gaining insights into caregivers' utilization preferences. Caregivers are more likely to use features they consider very useful, as these are deemed beneficial in their daily caregiving tasks, regardless of the ease of use. Conversely, areas rated as not useful might be underutilized, even if they are easy to use. This underscores the importance of exploring the reasons behind such preferences and identifying potential improvements, especially in areas that are highly valued but difficult to use. Gaining these insights through qualitative feedback is key to enhancing the system's design.

4.3 Evaluation of CARE360 System

The overall perceived usefulness of CARE360 was rated highly, with caregivers acknowledging that the system could enhance their caregiving capabilities and provide peace of mind. However, the perceived ease of use presented a more mixed response, with some caregivers anticipating the need for technical support. This highlights the necessity for the system to be intuitively understandable and easily navigable, ensuring that caregivers can utilize it effectively without extensive technical assistance.

The system's ability to provide easy access to information was particularly praised. Its dashboard offers a comprehensive yet concise overview, skillfully balancing broad oversight with the option to delve into more detailed data. This design approach is appreciated for its ability to present objective records, thereby reducing reliance on human memory and providing a more accurate account of events and health metrics. Users also highlighted the importance of customization in CARE360, valuing the ability to adjust configuration to meet specific caregiving needs. This customization is crucial, considering the diverse contexts and unique requirements of
each caregiver-care recipient circumstance. Furthermore, CARE360's functionality in tracking data trends over time emerged as a key feature. This capability allows for the early detection of deviations from normal patterns, acting as a proactive alert system for potential health concerns. CARE360 thus proves to be a promising, comprehensive, and effective solution in the realm of caregiving technology.

4.3.1 Factors affecting technology engagement of care recipients

The engagement of care recipients with technology is influenced by a complex interaction of factors. Attitudes toward technology vary significantly; some care recipients readily embrace it, while others resist, often due to privacy concerns or skepticism about its efficacy and security. This variation underscores the need for sensitivity to individual beliefs and habits in the design and implementation of technological solutions in caregiving. Otherwise, systems that are too complex or have unclear benefits are less likely to be used by care recipients, as they do not perceive any value in them.[88]

Furthermore, functional impairments (cognitive, sensory, and physical) critically shape a recipient's ability to interact with technology. For instance, visual prompts might be misunderstood by people with dementia, who may perceive issues with lighting. Similarly, verbal prompts could lead them to believe there are intruders in the house due to unfamiliar voices. Even familiar sounds can cause confusion. Additionally, persons with hearing impairments may encounter difficulty in understanding statements provided by voice prompts.

Equally important is the level of tech familiarity and competence among care recipients, which varies widely and impacts their interaction with new devices or systems. Older adults are diverse; some are adept at using technology, while others are not. This variability is a critical factor
that should be considered, as it can influence the system's effectiveness and acceptance [85,89]. Additionally, caregivers' technological abilities and attitudes play a pivotal role in the adoption and effective utilization of technology in caregiving contexts, as they are often the primary source of support for older adults [13].

Finally, the simplicity, comfort, and unobtrusiveness of technology also emerge as key factors. Technologies that are easy to use, non-intrusive, and comfortable are more likely to be accepted and used regularly [84]. For instance, people with dementia might become curious and feel intruded upon when they notice something new or unfamiliar, like contact sensors and motion sensors, and may try to remove them. Additionally, it also has been found that participants appreciated the ease of use of Bathroom Use monitoring area due to its minimal technological interaction required. The Overall Activity feature was also noted for its ease of use with older adults, as they do not need to actively engage with it.

In response to the previously mentioned factors, it is essential to consider the specific needs of care recipients with cognitive impairments when developing a remote monitoring system. This involves disabling potentially confusing features like voice and visual prompts. Furthermore, sensors should be placed unobtrusively to prevent recipients from noticing them, ensuring the system functions properly without errors or failures [91]. Moreover, the system must clearly demonstrate its benefits, particularly in addressing privacy concerns, with a strong emphasis on maintaining security and confidentiality in data sharing [84,88].
4.3.2 Inadequacy of technology in meeting varied and specific real-world needs

The study highlights the challenges in addressing the diverse and specific needs of care recipients with current technological solutions. One significant issue is the inadequacy of technology in supporting varied medication routines, which can impact medication adherence and management in real-life scenarios. Care recipients often have diverse medication routines, making it difficult for existing technologies to provide effective support. For instance, reminders sent at a fixed time may not align with the individual's readiness to take medication, leading to forgetfulness. Also, the variability in where and how individuals take their medications (e.g., in different rooms or at different times) poses additional challenges for technology. This finding is consistent with the previous study that inconsistent daily routines have an impact on adherence.[48] Additionally, the daily routines and living conditions of care recipients are often unique, and this uniqueness can be a challenge for technology. For example, a person who sleeps irregularly or has specific living arrangements like a bedside commode, so they felt that there is no need to monitor Bathroom Use aspect. The presence of other individuals or pets in the household can also complicate the use of monitoring technologies. For example, pets might trigger motion sensors, leading to false alarms or inaccurate data collection. Therefore, the presence of multiple users can lead to challenges in monitoring accurately and effectively differentiating between them. [83]

The insights from the study highlight the importance of developing adaptable and personalized caregiving technologies that clearly outline their capabilities and limitations to caregivers and recipients. For the Medication Compliance area, medication reminders could be more effective if designed to adapt to individual routines. This might include location-based reminders that use presence sensors to detect a person’s location at medication times or
customizable schedules or periods that align with daily activities like mealtimes and sleep routines, enhancing adherence. Additionally, to address the challenge of multiple individuals and pets in a household, wearable technology such as beacons on pet collars could help distinguish movements, especially since some older adults might forget to wear or charge their devices. Coupled with advanced sensor technologies, these approaches can improve monitoring accuracy, making them more attuned to the unique needs and living conditions of care recipients.

4.3.3 Challenges in Adopting and Utilizing the CARE360 System

Participants highlighted several challenges that affect the adoption and practical application of the technology. Setup complexity stands as a primary concern, with caregivers expressing the need for clearer guidance and possibly professional assistance to manage the initial implementation of the system. This suggests an opportunity for the CARE360 system to offer more intuitive setup processes or dedicated support services. Affordability is another critical barrier; many caregivers are deterred by the costs associated with advanced monitoring technologies. Addressing this issue could involve developing more cost-effective models or providing financial assistance programs to increase accessibility for families with budget constraints. The requirement for technical support points to a broader issue of technological literacy among caregivers. It is apparent that while some find the system reasonably straightforward, a significant portion would benefit from additional resources or training, indicating the potential value of creating more robust educational materials or a helpdesk service. Security concerns, particularly regarding data hackability, were also mentioned, reflecting the need for the CARE360 system to prioritize robust security measures and transparent communication about these measures to assure users of the safety of their data. Lastly, the practical implementation and daily maintenance of the system, such
as the need for battery backups during blackouts and the ease of cleaning and managing devices, are practical concerns that affect user experience. These details are crucial for user satisfaction and long-term adoption, as they address the daily realities of caregiving.

Overall, these insights point to a need for a more user-centered approach in the design and support of the CARE360 system, considering not just the technological capabilities but also the affordability and real-world applicability for caregivers.
5.0 Limitations

Our primary goal in the system development phase was to create a quick prototype using an open-source software platform. While this approach provided convenience and several useful features, it had limitations in UI design and data visualization capabilities. Furthermore, the system's development acknowledged the need for incorporating intelligent data analytics and alerts to deliver contextually relevant insights and streamline data interpretation for caregivers. Also, the system's capability to integrate electronic health records and health provider apps was identified as a vital function in enhancing caregiving as well. However, the platform used in this project presented limitations in supporting these integrative functions, thus restricting its full potential in these areas. Many usability issues and suggested improvements from participants could potentially be addressed if we are able to implement our own software platform to offer more flexibility and customization.

For the small-group interview phase, our recruitment strategies focused primarily on a limited number of caregivers, potentially limiting the generalizability of our findings to all caregivers assisting older adults. The study engaged only seven caregivers across four small group meetings, divided into three two-person interviews and one individual interview. While this format allowed for an in-depth exploration of their insights, a focus group consisting of 3-4 individuals could be more effective in stimulating thoughts and ideas, and in gathering a broader range of perspectives. Furthermore, the emergence of new codes in the final meeting indicated that thematic saturation was not achieved. All codes including those mentioned only once, were also reported in the thesis, therefore, further testing with more participants is needed to validate these codes and the thematic analysis.
Additionally, although CARE360 is primarily designed for caregivers, it incorporates features relevant to older adults. Therefore, it is important to include older adults in the study to gain insights into how these elements meet their needs and preferences, ensuring a more comprehensive understanding of the system's impact. Lastly, the data analysis could be made more rigorous by involving an additional coder and enhancing validity through participant verification. This would involve presenting the results back to the participants, allowing them to confirm the accuracy of the findings.
6.0 Future Work

The analysis of caregiver feedback on the CARE360 system has provided valuable insights into the realm of remote caregiving technology. Building upon these findings, we propose the following recommendations:

(1) Additional care areas: Several areas raised by the caregivers could be considered for future iterations of CARE360 including fall detection, detailed sleep monitoring, kitchen activity.

   a. Fall detection: In developing fall detection features, integrating a range of technologies is crucial to meet the varied preferences of caregivers. Utilizing a combination of wearable devices, motion sensors, and mmWave radar sensors can significantly enhance the accuracy of fall detection. Wearable devices, attached directly to the individual to detect sudden changes in movement or orientation, signaling a potential fall. Motion sensors, strategically placed in the home, monitor for unusual movement patterns or absences of movement. mmWave radar sensors can help add another layer of precision, capable of detecting subtle movements across various conditions. Additionally, incorporating pressure mats in high-risk fall areas like beside the bed or in the bathroom provides another level of detection. These mats can sense changes in pressure that indicate a fall, offering immediate alerts. By combining these technologies, the system can cross-verify alerts, reducing false positives and enhancing overall reliability, ensuring a comprehensive approach to fall detection.
b. Detailed sleep monitoring: For improving sleep monitoring, it is crucial to track a variety of metrics, focusing particularly on quality measures. These metrics include tracking sleep stages, the duration it takes to fall asleep, the frequency of waking up at night, and in-bed physical movements. Wearable devices can provide data on sleep stages based on heart rate monitors. mmWave radar sensors, offering non-contact monitoring, can detect subtle movements and fall during breathing, contributing to assessments of restlessness and overall sleep quality. Pressure mats also can track bed exits, providing additional insights into sleep patterns. Furthermore, the system should be versatile enough to monitor sleep in different locations, such as living rooms or chairs, reflecting the varied sleeping habits and environments of care recipients. This is particularly important for individuals who might sleep outside the bedroom or have irregular sleep schedules. Ensuring that technologies like pressure mats are adaptable and functional on various surfaces and in different sleeping environments is crucial. This multifaceted approach to monitoring enables a thorough understanding of sleep patterns, catering to the unique needs and habits of each care recipient. Additionally, the pressure mat should be tested to ensure that it works effectively on every potential resting area surface, not only on beds or flat surfaces.

c. The kitchen is identified as an area of potential safety risks, especially concerning the use of cooking appliances like stoves and ovens, which can pose fire hazards. Implementing a stove sensor could enhance safety in the kitchen, as it can detect sufficient heat levels that might indicate a fire. In addition to
monitoring appliance use, tracking eating habits is an important aspect of kitchen activity monitoring as well. A comprehensive approach would involve the integration of various sensors to monitor these activities effectively. For example, using contact sensors to detect when the refrigerator is opened and closed can be combined with smart plugs to monitor the usage of microwaves and other appliances. Incorporating stove sensors adds another layer of safety by ensuring cooking appliances are not left unattended or overheating. This integrated sensor approach, utilizing contact sensors, smart plugs, and stove sensors, provides a more complete and effective solution for kitchen safety and activity monitoring than relying on a single type of sensor, such as a contact sensor for the fridge alone. This holistic monitoring strategy not only enhances safety but also offers valuable insights into the dietary habits and routines of the care recipients.

(2) Actionable insights: The advanced analytics capability of CARE360 would not only provide real-time monitoring but also generate insights about long-term trends and potential health risks. For example, gradual changes in sleep patterns or mobility could indicate emerging health issues, detecting early signs of potential health issues, and changes in routine that may require attention.

(3) Multiple User Access and Privacy Controls: The capability for caregivers to grant system access to other family members or secondary caregivers. This feature will allow the primary caregiver to designate an administrator who can manage access levels and permissions. The system will offer flexible settings to control the visibility of sensitive care recipient information, ensuring that secondary users have limited access based on
the care recipient's privacy preferences and the necessity of the information for caregiving purposes. This multi-user functionality will facilitate collaborative caregiving while maintaining the privacy and dignity of the care recipient. It will also support a networked approach to caregiving, where responsibilities and information can be shared efficiently among a trusted group, enhancing the overall caregiving experience and support system.

(4) Incorporate Older Adult's Perspective: To ensure the CARE360 system's effectiveness, it is vital to include the perspective of older adults in its development and design. Their insights can provide valuable guidance on how the system can better cater to their needs and preferences, ultimately improving its usability and impact.

(5) Continuous Study of Target Audience: Identifying the most suitable target audience for remote monitoring systems remains a complex challenge. Care recipients' beliefs, privacy concerns, habits, functional impairments, and tech familiarity all significantly impact system effectiveness. Collaborative efforts involving caregivers and technology can play a pivotal role in addressing these challenges. Continued research is needed to gain a deeper understanding of these dynamics and to refine the system accordingly.

In conclusion, this study has laid the groundwork for vital advancements in the CARE360 system and the broader field of remote caregiving technology. These developments, combined with a commitment to ongoing research and involving the perspectives of older adults, will significantly enhance the caregiving experience, offering more targeted, efficient, and user-friendly solutions.
## Appendix A Commercial Remote Monitoring Systems Review

### Appendix A.1 Commercially Remote Monitoring Systems and Features

#### Appendix Table 1 List of Commercial Remote Monitoring Systems and Key Features

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Key features</th>
</tr>
</thead>
</table>
| Livindi [93]   | - Monitor ADLs.  
- Monitor health biometrics (i.e., blood pressure, pulse)  
- Call button.  
- Predict a potential fall, dehydration.  
- Track sleep  
- Concierge and medication reminders  
- Make a call and video call.  
- Alerts include changes in activity level, eating habits, bathroom pattern, temperature in home is too hot/too cold, call history.  
- Real-time location  
- Auto Cell Phone Alert, if there is a deviation from normal activity. |
| Mii care [94]  | - Monitor ADLs  
- Monitor health biometrics (i.e., blood pressure, pulse)  
- Call for help by using voice command or pressing the button on MiiCube. (up to 3 emergency contacts)  
- Track sleep  
- Medication reminder  
- Make a call.  
- Alerts include changes in activity level, location and presence, vital measurements.  
- Log visitors  
- Smart-mug use  
- Real-time location |
| GrandCare [95] | - Monitor ADLs.  
- Monitor health biometrics (i.e., blood pressure, blood glucose, oxygen, temperature, and weight.)  
- Medication and calendar appointment reminders  
- Track sleep  
- Real-time location  
- Make a video call via touchscreen and app. |
| CarePredict [96]                                                                 | • Monitor ADLs.  
|                                                                              | • Call Button on device: caregivers are alerted with patient’s name and location. They can also use a two-way audio feature to speak with each other immediately.  
|                                                                              | • Track sleep  
|                                                                              | • Fall detection.  
|                                                                              | • Visitor management  
|                                                                              | • Real-time location  
|                                                                              | • Predict health insights by their behavior patterns.  
|                                                                              | • Keyless door entry  
| Alarm.com Wellness Solution [97]                                               | • Monitor ADLs.  
|                                                                              | • Make a call.  
|                                                                              | • Fall detector pendant and button.  
|                                                                              | • Learn routines and send alerts of unusual activity.  
|                                                                              | • Medication reminder  
|                                                                              | • Track Sleep  
|                                                                              | • Home automation  
|                                                                              | • Remote control of doors. (lock/unlock)  
|                                                                              | • Light control  
|                                                                              | • Temperature control  
|                                                                              | • Access control  
|                                                                              | • Fall detection  
| Caregiver Smart Solutions [98]                                                 | • Monitor ADLs.  
|                                                                              | • Medication reminder  
|                                                                              | • Fall detection.  
|                                                                              | • Emergency button  
|                                                                              | • Door/Drawer status  
|                                                                              | • Current Temperature  
|                                                                              | • Current Humidity  
|                                                                              | • Emergency contact  
|                                                                              | • Real-time location tracking |
Appendix A.2 Devices and Sensors in Commercial Remote Monitoring Systems

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Smart hub</th>
<th>Motion sensor</th>
<th>Door/Window sensor</th>
<th>Bed sensor</th>
<th>Temperature and Humidity sensor</th>
<th>Wearable Device</th>
<th>Emergency button</th>
<th>Other sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livindi [93]</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Mii care [94]</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>GrandCare [95]</td>
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<td>Alarm.com Wellness Solution [97]</td>
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</table>

Appendix Table 2 Overview of Devices and Sensors Used in Commercial Remote Monitoring Systems

Note: “X” indicates types of technology used in each study.
Appendix B YAML Code for Home Assistance

Appendix B.1 YAML Code for Home Automation and Scripts

Appendix B.1.1 Out-of-Home Frequency Alert

alias: Out-of-Home Alert
description: ""
trigger:
  - platform: state
    entity_id:
      - device_tracker.iphone_tn
to: not_home
  - platform: state
    entity_id:
      - input_number.ooh_sim
condition: []
action:
  - variables:
    ooh_freq: "{{ states('sensor.out_of_home_times')[:2]|int }}"
ooh_sim: "{{ states('input_number.ooh_sim')|int }}"
desired_freq: "{{ states('input_number.ooh')|int }}"
  - choose:
    - conditions:
      - condition: template
        value_template: "{{ ooh_freq >= desired_freq }}"
    sequence:
      - parallel:
        - if:
          - condition: state
            entity_id: input_boolean.notify_phoneout
            state: "on"
          then:
            - service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
              title: Out-of-Home Frequency Alert!
              message: >-
                {{ states('sensor.name') }} has left the home {{ states('sensor.out_of_home_times') |int }} times today.
            - service: logbook.log
data:
  name: Out-of-Home Frequency Alert!
  message: >-
    {{ states('sensor.name') }} has left the home {{ states('sensor.out_of_home_times') |int }} times today.
  entity_id: input_boolean.activity_logbook
- conditions:
  - condition: and
    conditions:
    - condition: state
      entity_id: input_boolean.simulation
      state: "on"
    - condition: template
      value_template: "{{ ooh_sim >= desired_freq }}"
  sequence:
  - parallel:
    - if:
      - condition: state
        entity_id: input_boolean.notify_phoneout
        state: "on"
      then:
        - service: notify.mobile_app_{{states('sensor.noti_device2')}}
          data:
            title: Out-of-Home Frequency Alert!
            message: >-
              {{ states('sensor.name') }} has left the home {{ states('input_number.ooh_sim') |int }} times today.
        - service: logbook.log
          data:
            name: Out-of-Home Frequency Alert!
            message: >-
              {{ states('sensor.name') }} has left the home {{ states('input_number.ooh_sim') |int }} times today.
          entity_id: input_boolean.activity_logbook
      mode: restart

Appendix B.1.2 Medication Compliance

alias: Medication Compliance
description: ""
trigger:
  - platform: time
    at: input_datetime.medication_reminder_time1
condition:
  - condition: template
    value_template: "{{ states('sensor.home') == 'Home' }}"
action:
  - repeat:
    count: "{{ states.input_number.repeat_meds.state | int }}"
sequence:
  - if:
    - condition: or
      conditions:
        - condition: and
          conditions:
            - condition: state
              entity_id: input_boolean.medication_reminder
              state: "on"
            - condition: template
              value_template: "{{ states('input_number.value') | int == 0 }}"
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
      - condition: template
        value_template: "{{ states('input_number.value') | int == 4 }}"
then:
  - choose:
    - conditions:
      - condition: and
        conditions:
          - condition: state
            entity_id: input_boolean.medication_reminder
            state: "on"
          - condition: state
            entity_id: input_boolean.speaker
            state: "on"
          - condition: state
            entity_id: input_boolean.phone
            state: "off"
sequence:
  - parallel:
    - service: notify.alexa_media
      data:
        message: "{{ states('input_text.announce_meds1') }}"
        target: "{{ states('sensor.set_medspeaker1') }}"
    - service: media_player.play_media
      target:
entity_id: media_player.living_room
data:
  media_content_id: ->
    media-source://media_source/local/Mom Med Reminder
    - Num.mp3
    media_content_type: audio/mpeg
metadata:
title: Mom Med Reminder - Num.mp3
thumbnail: null
media_class: music
children_media_class: null
navigateIds:
  - {}
  - media_content_type: app
    media_content_id: media-source://media_source
enabled: false
- service: light.turn_on
data:
  rgb_color: "{{ states.sensor.light_colors.state }}"
  target:
    entity_id: "{{ states ('sensor.set_lights') }}"
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
      - condition: state
        entity_id: input_boolean.phone
        state: "on"
      - condition: state
        entity_id: input_boolean.speaker
        state: "off"
sequence:
  - parallel:
    - service: >-
      notify.mobile_app_{{ states ('sensor.noti_device1') }}
    data:
      title: Medication Reminder!
      data:
      push:
        sound: Mom Med Reminder - Num.wav
        message: "{{ states.input_text.reminder_meds1.state }}"
    - service: light.turn_on
data:
rgb_color: "{{ states.sensor.light_colors.state }}"

target:
   entity_id: "{{ states('sensor.set_lights') }}"

- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
      - condition: state
        entity_id: input_boolean.phone
        state: "on"
      - condition: state
        entity_id: input_boolean.speaker
        state: "on"

sequence:
  - parallel:
    - service: notify.mobile_app_{{ states('sensor.noti_device1') }}
      data:
        title: Medication Reminder!
        data:
          push:
            sound: Mom Med Reminder - Num.wav
            message: "{{ states.input_text.reminder_meds1.state }}"
    - service: notify.alexa_media
      data:
        message: "{{ states('input_text.announce_meds1') }}"
        target: "{{ states('sensor.set_medspeaker1') }}"
    - service: media_player.play_media
      target:
        entity_id: media_player.living_room
      data:
        media_content_id: "media://media_source/local/Mom Med Reminder - Num.mp3"
        media_content_type: audio/mpeg
        metadata:
          title: Mom Med Reminder - Num.mp3
          thumbnail: null
          media_class: music
          children_media_class: null
          navigateIds:
            - {}
        - media_content_type: app
media_content_id: media-source://media_source
enabled: false
- service: light.turn_on
data:
  rgb_color: "{{ states.sensor.light_colors.state }}"
target:
  entity_id: "{{ states('sensor.set_lights') }}"
- wait_for_trigger:
  - platform: event
event_type: zha_event
event_data:
    device_id: f41bee7bef622ec3c135de4ab09abc2b
timeout:
  hours: 0
  minutes: 0
  seconds: "{{ states.input_number.wait_time1.state | int }}"
  milliseconds: 0
- choose:
  - condition: template
    value_template: >-
      {{ wait.trigger and wait.trigger.event.data.command == "single" }}
sequence:
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.medication_reminder
- parallel:
  - condition: state
    entity_id: input_boolean.notify_success
    state: "on"
    then:
    - service: >-
      notify.mobile_app_{{ states('sensor.noti_device2') }}
data:
      title: Medication Reminder!
      message: >-
        Mom already took her {{ as_timestamp(states.input_boolean.medication_reminder.last_updated) | timestamp_custom('%A\'s medicine at %I:%M %p') }}
- service: logbook.log
data:
name: Medication Reminder!
message: Success - Medication taken at the time shown
- service: input_number.set_value
data:
  value: 3
target:
  entity_id: input_number.value
- service: light.turn_off
target:
  entity_id: "{{ states ('sensor.set_lights') }}"
- service: input_number.set_value
data:
  value: 2
target:
  entity_id: input_number.nb1
- choose:
  - conditions:
    - condition: or
      conditions:
        - condition: and
          conditions:
            - condition: state
              entity_id: input_boolean.medication_reminder
              state: "on"
            - type: is_vibration
              condition: device
              device_id: bc50a608e3d99c563efae1bd2716ff60
              entity_id: a9ce4bca64c06e2f87108f466d822dfd
              domain: binary_sensor
            - condition: or
              conditions:
                - condition: template
                  value_template: "{{ states ('input_number.value') | int == 0 }}"
                - condition: template
                  value_template: "{{ states ('input_number.value') | int == 4 }}"
      conditions:
        - condition: state
          entity_id: input_boolean.medication_reminder
          state: "on"
        - type: is_occupied
          condition: device
          device_id: 9a0cf3f9b8bf3f244c4daa4ccbb2a8a0
          entity_id: aaa420614c87106d7b65e5749b6dee4
          domain: binary_sensor
- type: is_motion
c  
condition: device
  
device_id: 9a0cf3f9b8bf3f244c4d4a4ccbb2a8a0
entity_id: feb7df8f03e076c69f76f5ce841f59
domain: binary_sensor
  
- condition: or
  
conditions:
  
  - condition: template
    value_template: "{{ states('input_number.value') | int == 0 }}"
  
  - condition: template
    value_template: "{{ states('input_number.value') | int == 4 }}"

sequence:
  
  - choose:
    
    - conditions:
      
      - condition: state
        entity_id: input_boolean.speaker
        state: "on"
      
      - condition: state
        entity_id: input_boolean.phone
        state: "off"

      sequence:
        
        - service: notify.alexa_media
          data:
            message: "{{ states('input_text.announce_meds2') }}"
            target: "{{ states('sensor.set_medspeaker1') }}"

        - service: media_player.play_media
          target:
            entity_id: media_player.living_room
          data:
            media_content_id: >-
              media-source://media_source/local/Confirmation
              statement - Num.mp3
            media_content_type: audio/mpeg
          metadata:
            title: Confirmation statement - Num.mp3
            thumbnail: null
            media_class: music
            children_media_class: null
            navigateIds:
              - {}
            - media_content_type: app
              media_content_id: media-source://media_source
              enabled: false
          
        - condition: state
          entity_id: input_boolean.phone
state: "on"
- condition: state
title: Medication Reminder!
data:
  push:
    sound: Confirmation question - Num.wav
message: "{{ states.input_text.reminder_meds2.state }}"
- service: notify.mobile_app_{{ states ('sensor.noti_device1') }}
data:
  title: Medication Reminder!
data:
  push:
    sound: Confirmation question - Num.wav
message: "{{ states.input_text.reminder_meds2.state }}"
- condition: state
  entity_id: input_boolean.phone
state: "on"
- condition: state
  entity_id: input_boolean.speaker
state: "on"
- parallel:
  service: notify.alexa_media
data:
  message: "{{ states('input_text.announce_meds2') }}"
target: "{{ states('sensor.set_medspeaker1') }}"
- service: media_player.play_media
target:
  entity_id: media_player.living_room
data:
  media_content_id: media://media_source/local/Confirmation
  statement - Num.mp3
  metadata:
    title: Confirmation statement - Num.mp3
- wait_for_trigger:
  - platform: event
    event_type: zha_event
    event_data:
      device_id: f41bee7bef62ec3c135de4ab09abc2b
    timeout:
      hours: 0
      minutes: 0
      seconds: "{{ states.input_number.wait_time2.state | int }}"
      milliseconds: 0
  - if:
    - condition: template
      value_template: >-
        {{ wait.trigger and wait.trigger.event.data.command == "single" }}
    then:
      - service: input_boolean.turn_off
        data: {}
        target:
          entity_id: input_boolean.medication_reminder
    - parallel:
      - if:
        - condition: state
          entity_id: input_boolean.notify_success
          state: "on"
        then:
          - service: >-
            notify.mobile_app_{ { states ('sensor.noti_device2') } }
            data:
            title: Medication Reminder!
            message: >-
              Mom already took her {{ as_timestamp(states.input_boolean.medication_reminder.last_updated) | timestamp_custom('%A\'s medicine at %I:%M %p') }}
      - service: logbook.log
data:
  name: Medication Reminder!
  message: Success - Medication taken at the time shown
  entity_id: input_boolean.medication_logbook
- service: input_number.set_value
  data:
    value: 3
  target:
    entity_id: input_number.value
- service: light.turn_off
  target:
    entity_id: "{ { states('sensor.set_lights') } }"
- service: input_number.set_value
  data:
    value: 2
  target:
    entity_id: input_number.nb1
- if:
  - condition: and
    conditions:
      - condition: or
        conditions:
          - condition: template
            value_template: "{ { states('input_number.value') | int == 0 } }"
          - condition: template
            value_template: "{ { states('input_number.value') | int == 4 } }"
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
  then:
    - choose:
      - conditions:
        - condition: state
          entity_id: input_boolean.speaker
          state: "on"
        - condition: state
          entity_id: input_boolean.phone
          state: "off"
  sequence:
    - service: notify.alexa_media
      data:
        message: "{ { states('input_text.announce_meds3') } }"
        target: "{ { states('sensor.set_medspeaker1') } }"
    - service: media_player.play_media
      target:
        entity_id: media_player.living_room

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data:
  media_content_id: >-
    media-source://media_source/local/Confirmation
    statement - Num.mp3
  media_content_type: audio/mpeg
metadata:
  title: Confirmation statement - Num.mp3
  thumbnail: null
  media_class: music
  children_media_class: null
  navigateIds:
    - {}
    - media_content_type: app
      media_content_id: media-source://media_source
  enabled: false
- conditions:
  - condition: state
    entity_id: input_boolean.phone
    state: "on"
  - condition: state
    entity_id: input_boolean.speaker
    state: "off"
sequence:
  - service: >-
    notify.mobile_app_{{ states
      ('sensor.noti_device1') }}
  data:
    title: Medication Reminder!
    data:
    push:
      sound: Confirmation statement - Num.wav
      message: "{{ states.input_text.reminder_meds3.state }}"
- conditions:
  - condition: state
    entity_id: input_boolean.phone
    state: "on"
  - condition: state
    entity_id: input_boolean.speaker
    state: "on"
sequence:
  - parallel:
    - service: >-
      notify.mobile_app_{{ states
        ('sensor.noti_device1') }}
    data:
      title: Medication Reminder!
data:
  push:
    sound: Confirmation statement - Num.wav
message: >-
  
  {{ states.input_text.reminder_meds3.state }}
- service: notify.alexa_media
data:
  message: "{{ states ('input_text.announce_meds3') }}"
target: "{{ states ('sensor.set_medspeaker1') }}"
- service: media_player.play_media
target:
  entity_id: media_player.living_room
data:
  media_content_id: >-
  
  media-source://media_source/local/Confirmation statement - Num.mp3
media_content_type: audio/mpeg
metadata:
  title: Confirmation statement - Num.mp3
thumbnail: null
media_class: music
children_media_class: null
navigateIds:
  - {}
  - media_content_type: app
    media_content_id: media-source://media_source
enabled: false
- wait_for_trigger:
  - platform: event
    event_type: zha_event
    event_data:
      device_id: f41bee7bef622ec3c135de4ab09abc2b
timeout:
  hours: 0
  minutes: 0
  seconds: "{{ states.input_number.wait_time3.state | int }}"
  milliseconds: 0
- if:
  - condition: template
    value_template: >-
    
    {{ wait.trigger and wait.trigger.event.data.command == "single" }}
then:
  - service: input_boolean.turn_off
    data: {}

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target:
  entity_id: input_boolean.medication_reminder
- parallel:
  - if:
    - condition: state
      entity_id: input_boolon.notify_success
      state: "on"
    then:
    - service: >-
      notify.mobile_app_{{ states('sensor.noti_device2') }}
data:
      title: Medication Reminder!
      message: >-
        Mom already took her {{ now().strftime('%A\'s medicine at %I:%M %p') }}
    - service: logbook.log
      data:
        name: Medication Reminder!
        message: Success - Medication taken at the time shown
      entity_id: input_boolean.medication_logbook
    - service: input_number.set_value
      data:
        value: 3
      target:
        entity_id: input_number.value
    - service: light.turn_off
      target:
        entity_id: "{{ states('sensor.set_lights') }}"
    - service: input_number.set_value
      data:
        value: 2
      target:
        entity_id: input_number.nb1
  - if:
    - condition: and
      conditions:
      - condition: or
        conditions:
        - condition: template
          value_template: >-
            {{ states('input_number.value') | int == 0 | int == 0 }}
        - condition: template
          value_template: >-
          { { states('input_number.value') | int == 0 }}
          - condition: template
            value_template: >-
            { { states('input_number.value') | int == 0 }}
{{ states('input_number.value') | int == 4 }}
- condition: state
  entity_id: input_boolean.medication_reminder
  state: "on"
then:
- service: input_number.set_value
  data:
    value: 2
  target:
    entity_id: input_number.value
- service: input_number.set_value
  data:
    value: 1
  target:
    entity_id: input_number.nb1
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
      - condition: template
        value_template: "{{ states('input_number.value') | int == 0 }}"
    sequence:
      - service: input_number.set_value
        data:
          value: 4
        target:
          entity_id:
            - input_number.value
      - service: light.turn_off
        target:
          entity_id: "{{ states('sensor.set_lights') }}"
- condition: template
  value_template: "{{ repeat.last }}"
- choose:
  - conditions:
    - condition: and
      conditions:
        - condition: state
          entity_id: input_boolean.medication_reminder
          state: "on"
        - condition: template
          value_template: "{{ states('input_number.value') | int == 4 }}"
    sequence:
- parallel:
  - service: logbook.log
data:
  message: >-
    Failed - Reminders sent {{
    states.input_number.repeat_meds.state | int }} time(s)
    with no response.
  name: Medication Reminder!
  entity_id: input_boolean.medication_logbook
- service: light.turn_off
target:
  entity_id: "{{ states ('sensor.set_lights') }}"
- service: input_number.set_value
data:
  value: 1
target:
  entity_id:
    - input_number.value
- if:
  - condition: state
    entity_id: input_boolean.notify_failed
    state: "on"
then:
  - service: >-
    notify.mobile_app_{{ states ('sensor.noti_device2') }}
data:
  title: Medication Reminder!
  message: >-
    Mom has not taken her medicine yet. Reminders were
    sent {{ states.input_number.repeat_meds.state | int }} times with no response. You may want to
    check in to see if everything is okay.
- service: input_number.set_value
data:
  value: 0
target:
  entity_id: input_number.nb1
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.medication_reminder
        state: "on"
      - condition: template
        value_template: "{{ states ('input_number.value') | int == 2 }}"
sequence:
- parallel:
  - if:
    - condition: state
      entity_id: input_boolean.notify_uncertain
      state: "on"
    then:
      - service: notify.mobile_app_
        { { states ('sensor.noti_device2') } }
        data:
          title: Medication Reminder!
          message: >-
            There is no confirmation if Mom has taken her {{ now().strftime('%A') }}'s medicine yet. She was last seen in {{ states('input_select.medspeaker_list1') }} at {{ as_timestamp(states.binary_sensor.everything_presence_one_f0f050_occupancy.last_changed) | timestamp_custom ('%I:%M %p') }}.
      - service: logbook.log
        data:
          name: Medication Reminder!
          message: Uncertain - Motion is detected but no confirmation
          entity_id: input_boolean.medication_logbook
      - service: light.turn_off
        target:
          entity_id: "{{ states ('sensor.set_lights') }}"
  - choose:
    - conditions:
      - condition: time
        weekday:
          - mon
          - wed
          - fri
        sequence:
          - service: input_number.set_value
            data:
              value: 1
            target:
              entity_id: input_number.med_ytd1
    - conditions:
      - condition: time
        weekday:
          - tue
enabled: false

- delay:
  
  - hours: 0
  - minutes: 0
  - seconds: 3
  - milliseconds: 0

- parallel:
  
  - service: input_boolean.turn_on
    data: {}
    target:
      entity_id: input_boolean.medication_reminder
  - service: input_number.set_value
    data:
      value: 0
    target:
      entity_id:
        - input_number.value
        - input_number.med_ytd1
  - service: input_number.set_value
    data:
      value: 3
    target:
      entity_id: input_number.nb1

enabled: true

else:

  - wait_for_trigger:
    
    - platform: time
      at: "23:59:00"

enabled: false

- parallel:

  - service: input_boolean.turn_on
    data: {}
    target:
      entity_id: input_boolean.medication_reminder
  - service: input_number.set_value
    data:
      value: 0
    target:
      entity_id: input_number.value
  - service: input_number.set_value
    data:
      value: 4
    target:
      entity_id: input_number.nb1

enabled: false

enabled: true
Appendix B.1.3 Extreme Temperature Alert

*High Temperature Alert*

alias: High Temperature Alert
description: ""
trigger:
- platform: state
  entity_id:
  - sensor.hot_temp_diff
- platform: state
  entity_id:
  - sensor.hot_temp_diff_sim
condition:
- condition: template
  value_template: "{{ states('sensor.home') == 'Home' }}"
  enabled: true
action:
- choose:
  - conditions:
    - condition: template
      value_template: "{{ states('sensor.hot_temp_diff') | int > 0 }}"
    sequence:
    - repeat:
      sequence:
      - choose:
        - conditions:
          - condition: and
            conditions:
              - condition: state
                entity_id: input_boolean.notify_user
                state: "on"
              - condition: state
                entity_id: input_boolean.notify_cgv
                state: "off"
            sequence:
            - service: notify.mobile_app_{{states('sensor.noti_device1')}}
data:
  title: Temperature Alert!
  message: >-
    Home temperature is currently
    "{{states('sensor.airthings_temperature') }} °F"
which is over the temperature threshold by {{
states('sensor.hot_temp_diff')| float | abs  }}°F.
Make sure you stay cool! You may want to close
your blinds, open the windows, and/or turn the air
conditioning on.
enabled: true
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "off"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"
sequence:
  - parallel:
    - service: >-
      notify.mobile_app_{{states('sensor.noti_device2')}}
data:
      title: Temperature Alert!
      message: >-
        
        Home temperature is currently

"{{states('sensor.airthings_temperature')}} °F", which is over the temperature threshold by \{{ states('sensor.hot_temp_diff')| float | abs \} \}°F. Make sure you stay cool! You may want to close your blinds, open the windows, and/or turn the air conditioning on.

enabled: true
- service: >-
  notify.mobile_app_{\{states('sensor.noti_device2')\} }
data:
  title: Temperature Alert!
  message: >-
    \{{ states('sensor.name') \}'s home temperature is currently
    "\{{states('input_number.temp')|int}\} °F", which is over the temperature threshold by \{{ states('sensor.hot_temp_diff_sim')| float | abs \} \}°F. You may want to check in to make sure they are doing okay with the heat.

enabled: true
enabled: true
- service: logbook.log
data:
  entity_id: input_boolean.temperature_logbook
  name: High Temperature Alert!
  message: >-
    \{{ states('sensor.name') \}'s home temperature is currently "\{{states('sensor.airthings_temperature') \} \} °F", which is over the temperature threshold by \{{ states('sensor.hot_temp_diff')| float | abs \} \}°F. You may want to check in to make sure they are doing okay with the heat.

- delay:
  hours: 0
  minutes: "\{{ states.input_number.temp_alert.state | int \}"
  seconds: 0
  milliseconds: 0
until:
- condition: template
  value_template: >-
    \{{ (states('input_number.temp') | float >= states('input_number.cold_temperature') | float and states('input_number.temp') | float <= states('input_number.hot_temperature') | float) \}

- conditions:
  - condition: and
conditions:
- condition: template
  value_template: "{{ states('sensor.hot_temp_diff_sim') | int > 0 }}"
- condition: state
  entity_id: input_boolean.simulation
  state: "on"

sequence:
- repeat:
  sequence:
  - choose:
    - conditions:
      - condition: and
        conditions:
          - condition: state
            entity_id: input_boolean.notify_user
            state: "on"
          - condition: state
            entity_id: input_boolean.notify_cgv
            state: "off"

sequence:
- service: notify.mobile_app_{{states('sensor.noti_device1')}}
data:
  title: Temperature Alert!
  message: Home temperature is currently
           {{states('input_number.temp')|int}} °F, which is
           over the temperature threshold by {{
           states('sensor.hot_temp_diff_sim')| float | abs
           }}°F. Make sure you stay cool! You may want to
           close your blinds, open the windows, and/or turn
           the air conditioning on.
  enabled: true

- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "off"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"

sequence:
- service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
  title: Temperature Alert!
  message: >-
{{ states('sensor.name') }}'s home temperature is currently "{{states('input_number.temp')|int}} °F", which is over the temperature threshold by {{states('sensor.hot_temp_diff_sim')| float | abs }}°F. Make sure you stay cool! You may want to close your blinds, open the windows, and/or turn the air conditioning on.

enabled: true

- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"

sequence:
- parallel:
  - service: >-
    notify.mobile_app_{{states('sensor.noti_device1')}}
    data:
    title: Temperature Alert!
    message: >-
      Home temperature is currently
      "{{states('input_number.temp')|int}} °F", which is over the temperature threshold by {{states('sensor.hot_temp_diff_sim')| float | abs }}°F. Make sure you stay cool! You may want to close your blinds, open the windows, and/or turn the air conditioning on.
    enabled: true
  - service: >-
    notify.mobile_app_{{states('sensor.noti_device2')}}
    data:
    title: Temperature Alert!
    message: >-
      {{ states('sensor.name') }}'s home temperature is currently
      "{{states('input_number.temp')|int}} °F", which is over the temperature threshold by {{states('sensor.hot_temp_diff_sim')| float | abs }}°F. Make sure you stay cool! You may want to close your blinds, open the windows, and/or turn the air conditioning on.
    enabled: true
enabled: true
- service: logbook.log
data:
  entity_id: input_boolean.temperature_logbook
  name: High Temperature Alert!
  message: >-
    {{ states('sensor.name') }}'s home temperature is currently "{{ states('input_number.temp')|int }} °F", which is over the temperature threshold by {{ states('sensor.hot_temp_diff_sim')| float | abs }}°F. Make sure you stay cool! You may want to close your blinds, open the windows, and/or turn the air conditioning on.
- delay:
  hours: 0
  minutes: "{{ states.input_number.temp_alert.state | int }}"
  seconds: 0
  milliseconds: 0
  until:
    - condition: template
      value_template: >-
        {{ (states('input_number.temp') | float >= states('input_number.cold_temperature') | float and states('input_number.temp') | float <= states('input_number.hot_temperature') | float) }}
      mode: single

Low Temperature Alert

alias: Low Temperature Alert
description: ""
trigger:
- platform: state
  entity_id:
    - sensor.cold_temp_diff
- platform: state
  entity_id:
    - sensor.cold_temp_diff_sim
condition:
- condition: template
  value_template: "{{ states ('sensor.home') == 'Home' }}"
  enabled: true
action:
- choose:
  - conditions:
- condition: template
  value_template: "{{ states('sensor.cold_temp_diff') | int > 0 }}"
sequence:
- repeat:
  sequence:
  - service: logbook.log
    data:
      entity_id: input_boolean.temperature_logbook
      name: Low Temperature Alert!
      message: >-
        {{ states('sensor.name')}}'s Home temperature is currently
        "{{states('sensor.airthings_temperature')}} °F", which is
        below the temperature threshold by {{
        states('sensor.cold_temp_diff') | float | abs }}°F.
        Please check in on them to make sure they are warm enough.
- choose:
  - conditions:
    - condition: and
      conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "off"
  sequence:
  - service: notify.mobile_app_{{states('sensor.noti_device1')}}
    data:
      title: Temperature Alert!
      message: >-
        Home temperature is currently "{{
        states('sensor.airthings_temperature') }} °F", which is
        below the temperature threshold by {{
        states('sensor.cold_temp_diff') | float | abs }}°F. Make sure you stay warm! Don't forget to
        turn on your heater.
      enabled: true
  - conditions:
    - condition: and
      conditions:
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_user
        state: "off"
sequence:
- service: notify.mobile_app_{{states('sensor.noti_device2')}}
  data:
    title: Temperature Alert!
    message: >-
      {{ states('sensor.name') }}'s Home temperature is currently
      "{{states('sensor.airthings_temperature')}} °F", which is below the temperature threshold by {{ states('sensor.cold_temp_diff') | float | abs }}°F. Please check in on them to make sure they are warm enough.
  enabled: true
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"
sequence:
- parallel:
  - service: >-
    notify.mobile_app_{{states('sensor.noti_device1')}}
    data:
      title: Temperature Alert!
      message: >-
        Home temperature is currently
        "{{states('sensor.airthings_temperature')}} °F", which is below the temperature threshold by {{ states('sensor.cold_temp_diff') | float | abs }}°F. Make sure you stay warm! Don't forget to turn on your heater.
  - service: >-
    notify.mobile_app_{{states('sensor.noti_device2')}}
    data:
      title: Temperature Alert!
      message: >-
        {{ states('sensor.name') }}'s Home temperature is currently
        "{{states('sensor.airthings_temperature')}} °F", which is below the temperature threshold by {{ states('sensor.cold_temp_diff') | float | abs }}°F. Please check in on them to make
sure they are warm enough.

enabled: true

- delay:
  hours: 0
  minutes: "{{ states.input_number.temp_alert.state | int }}"
  seconds: 0
  milliseconds: 0
until:
- condition: template
  value_template: >-
    {{ (states('input_number.temp') | float >= states('input_number.cold_temperature') | float and states('input_number.temp') | float <= states('input_number.hot_temperature') | float) }}

- conditions:
  - condition: and
    conditions:
      - condition: template
        value_template: "{{ states('sensor.cold_temp_diff_sim') | int > 0 }}"
      - condition: state
        entity_id: input_boolean.simulation
        state: "on"

sequence:
- repeat:
  sequence:
    - service: logbook.log
      data:
        entity_id: input_boolean.temperature_logbook
        name: Low Temperature Alert!
        message: >-
          {{ states('sensor.name') }}’s Home temperature is currently "{{states('input_number.temp')|int}} °F", which is below the temperature threshold by {{ states('sensor.cold_temp_diff_sim') | float | abs }} °F. Please check in on them to make sure they are warm enough.

- choose:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "off"
- service: notify.mobile_app_{{states('sensor.noti_device1')}}
data:
  title: Temperature Alert!
  message: >-
    Home temperature is currently
    "{{ states('input_number.temp') | int }} °F", which
    is below the temperature threshold by
    "{{ states('sensor.cold_temp_diff_sim') | float | abs }}°F. Make sure you stay warm! Don't forget to
    turn on your heater.
  enabled: true
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_user
        state: "off"
  sequence:
    - service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
      title: Temperature Alert!
      message: >-
        {{ states('sensor.name') }}'s Home temperature is
        currently "{{ states('input_number.temp') | int }}°F", which
        is below the temperature threshold by
        "{{ states('sensor.cold_temp_diff_sim') | float | abs }}°F. Please check in on them to make sure
        they are warm enough.
      enabled: true
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: input_boolean.notify_user
        state: "on"
      - condition: state
        entity_id: input_boolean.notify_cgv
        state: "on"
  sequence:
    - parallel:
      - service: >-
        notify.mobile_app_{{states('sensor.noti_device1')}}
data:
Appendix B.1.4 Temperature Control

alias: Temperature Control
sequence:
  - service: climate.turn_on
data: {}
target:
    device_id: bb171107f52734c0175d34d605516629
  - service: climate.set_temperature
data:
  temperature: "{{ states.input_number.temperature.state | float }}"

target:
  entity_id: "{{ (states('sensor.set_ac')) }}"

- service: logbook.log
data:
  entity_id: input_boolean.temperature_logbook
  name: Temperature Control
  message: >-
    Temperature in {{ states ('input_select.ac_list') }} was adjusted to "{{
    states.input_number.temperature.state | float }}" °F at {{
    now().timestamp() | timestamp_custom('%I:%M %p') }}

mode: restart
icon: mdi:home-thermometer-outline

---

Appendix B.1.5 Bathroom Visit with No Movement Alert

alias: Bathroom Visit with no movement
description: ""
trigger:
  - platform: state
    entity_id:
      - binary_sensor.presence_sensor_fp2_670e_presence_sensor_1
to: "on"
enabled: true
for:
  hours: 0
  minutes: 3
  seconds: 0
condition: []
action:
  - if:
    
    - condition: and
      conditions:
        - condition: state
          entity_id: binary_sensor.motion_bathroom
          state: "off"
          for:
            hours: 0
            minutes: "{{ states('input_number.bathroom_timer2') | int }}"
            seconds: 0
        - condition: state
          entity_id: binary_sensor.presence_sensor_fp2_670e_presence_sensor_1
state: "on"
then:
- service: input_boolean.turn_on
data: {}
target:
  entity_id: input_boolean.bathroom_button
- service: input_number.set_value
data:
  value: 1
target:
  entity_id: input_number.extended_bathroom
- service: notify.alexa_media
data:
  message: "{{ states ('input_text.announce_bath1') }}"
target: media_player.bathroom_echo_dot
- wait_for_trigger:
  - platform: event
    event_type: zha_event
    event_data:
      device_id: f41bee7bef622ec3c135de4ab09abc2b
timeout:
  hours: 0
  minutes: 0
  seconds: "{{ states.input_number.bathroom_timer3.state | int }}"
  milliseconds: 0
  continue_on_timeout: true
- if:
  - condition: template
    value_template: "{{ wait.trigger and wait.trigger.event.data.command == "single" }}"
then:
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.bathroom_button
- parallel:
  - if:
    - condition: state
      entity_id: input_boolean.notify_phonebath
      state: "on"
    then:
      - service: notify.mobile_app_{{ states ('sensor.noti_device2') }}
data:
        message: >-
          Mom has been in the bathroom for {{ (as_timestamp(now())}}
as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0) | int ) | timestamp_custom ('%Hh %Mm %Ss', false)).

- service: logbook.log
data:message: on

Mom has been in the bathroom for {{ as_timestamp(now()) -
as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0) | int ) | timestamp_custom ('%Hh %Mm %Ss', false))}}.

entity_id: input_boolean.bathroom_logbook
name: Bathroom Notifications
enabled: true
- if:
  - condition: state
    entity_id: input_boolean.bathroom_button
    state: "on"
  then:
    - service: notify.alexa_media
data:message: "{{ states ('input_text.announce_bath2') }}"
target: media_player.bathroom_echo_dot
enabled: true
- wait_for_trigger:
  - platform: event
    event_type: zha_event
    event_data:
      device_id: f41bee7bef622ec3c135de4ab09abc2b
timeout:
    hours: 0
    minutes: 0
    seconds: "{{ states.input_number.bathroom_timer4.state | int }}"
    milliseconds: 0
    continue_on_timeout: true
  - if:
    - condition: template
      value_template: "{{ wait.trigger and wait.trigger.event.data.command == "single" }}"
    then:
      - service: logbook.log
data:message: on
        Mom has been in the bathroom for {{ as_timestamp(now()) -
as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0) | int ) | timestamp_custom ('%Hh %Mm %Ss', false))}}.

111
as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0)) | int | timestamp_custom('%Hh %Mm %Ss', false)}. You may want to check on her to make sure she is alright.

title: Bathroom Alerts
- service: notify.mobile_app_{{ states('sensor.noti_device2') }}
data:
  message: >-
  Mom has been in the bathroom for {{ (as_timestamp(now()) -
as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0)) | int | timestamp_custom('%Hh %Mm %Ss', false))}}. You may want to check on her to make sure she is alright.

- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.bathroom_button
enabled: true
- if:
  - condition: state
    entity_id: input_boolean.bathroom_button
    state: "on"
then:
  - parallel:
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonebath
        state: "on"
then:
  - service: notify.mobile_app_{{ states('sensor.noti_device2') }}
data:
    title: "!! URGENT !! Potential Fall in Bathroom !!"
    message: >-
    Mom has been in the bathroom for {{ (as_timestamp(now()) -
    as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed | default(0)) | int | timestamp_custom('%Hh %Mm %Ss', false))}} with no response. There is a high risk of her falling. Please check on her as soon as possible!
  - service: logbook.log
data:
name: "!! URGENT !! Potential Fall in Bathroom !!"
message: >-
  Mom has been in the bathroom for {{{ (as_timestamp(now())
- as_timestamp(states.binary_sensor.presence_sensor_fp2_670e_presence_sensor_1.last_changed
  | default(0)) | int ) | timestamp_custom ('%Hh %Mm',
  false)}}} with no response. There is a high risk of her falling. Please check on her as soon as possible!
  entity_id: input_boolean.bathroom_logbook
  enabled: true
  - service: input_number.set_value
data:
  value: 0
target:
  entity_id: input_number.extended_bathroom
else:
  - delay:
    hours: 0
    minutes: 0
    seconds: 0
    milliseconds: 10
  mode: single

Appendix B.1.6 Late Wake-up Time and Bedtime Alert

Late Wake-up Time Alert
  alias: Late Wake Up Weekday
description: ""
trigger:
  - platform: state
target:
  entity_id:
    - input_boolean.sleep_monitor
to: "off"
condition: []
action:
  - if:
    - condition: and
      conditions:
        - condition: time
          weekday:
            - mon
            - tue
            - wed
- thu
- fri
- condition: template
  value_template: "{{ states('sensor.up_wd_diff') | int <= 0 }}"
then:
- parallel:
  - condition: state
    entity_id: input_boolean.notify_phonebed3
    state: "on"
then:
  - service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
    title: Late Wake-Up Time Alert!
    message: >
      {% set hour = states('sensor.up_time')[0:2]|int %} {% set period = states('sensor.up_time')[6:8] %} {% set uphour = hour + 12 if period == 'PM' else hour %} {% set dsrhour = states('input_datetime.uptime_weekday')[0:2]|int %} {% set diffhour = uphour - dsrhour %} {{ states('sensor.name') }} got up at {{ states('sensor.up_time') }}, which is {{ diffhour }} hours later than the regular wake-up time.
  - service: logbook.log
data:
    entity_id: input_boolean.bedroom_logbook
    name: Late Wake-Up Time Alert!
    message: >
      {% set hour = states('sensor.up_time')[0:2]|int %} {% set period = states('sensor.up_time')[6:8] %} {% set uphour = hour + 12 if period == 'PM' else hour %} {% set dsrhour = states('input_datetime.uptime_weekday')[0:2]|int %} {% set diffhour = uphour - dsrhour %} {{ states('sensor.name') }} got up at {{ states('sensor.up_time') }}, which is {{ diffhour }} hours later than the regular wake-up time.
else:
  - delay:
    hours: 0
    minutes: 0
    seconds: 0
    milliseconds: 10

*Late Bedtime Alert*

alias: Late Bedtime Weekday
description: ""
trigger:
  - platform: state
entity_id:
  - input_boolean.sleep_monitor
to: "on"
condition: []
action:
  - if:
    - condition: time
      weekday:
        - mon
        - tue
        - wed
        - thu
        - fri
    - condition: template
      value_template: "{{ states('sensor.sleep_wd_time_diff') | int <= 0 }}"
then:
  - parallel:
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonebed4
        state: "on"
      then:
        - service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
          title: Late Bedtime Alert!
          message: >-
            {% set hour = states('sensor.sleep_time')[0:2]|int %} {% set period = states('sensor.sleep_time')[6:8] %} {% if period == 'PM' and hour != 12 %}
            {% set bedhour = hour + 12 %}
            {% elif period == 'AM' and hour == 12 %}
            {% set bedhour = 24 %}
            {% else %}
            {% set bedhour = hour %}
            {% endif %}
            {% set dsrhour = states('input_datetime.bedtime_weekday')[0:2]|int %}   {% set diffhour = bedhour - dsrhour %}
            {{ states('sensor.name') }} went to bed at {{ states('sensor.sleep_time') }}, which is {{ diffhour }}
            hours later than the regular bedtime.
    - service: logbook.log
data:
      entity_id: input_boolean.bedroom_logbook
      name: Late Bedtime Alert!
      message: >-
{% set hour = states('sensor.sleep_time')[0:2]|int %} {% set period = states('sensor.sleep_time')[6:8] %} {% if period == 'PM' and hour != 12 %}
{% set bedhour = hour + 12 %}
{% elif period == 'AM' and hour == 12 %}
{% set bedhour = 24 %}
{% else %}
{% set bedhour = hour %}
{% endif %} {% set dsrhour = states('input_datetime.bedtime_weekday')[0:2]|int %}   {% set diffhour = bedhour - dsrhour %}

{{ states('sensor.name') }} went to bed at {{ states('sensor.sleep_time') }}, which is {{ diffhour }} hours later than the regular bedtime.

else:
  - delay:
    hours: 0
    minutes: 0
    seconds: 0
    milliseconds: 10
  mode: single

**Appendix B.1.7 Post-Bedtime Exits Alert**

alias: Post-Bedtime Exits Alert
description: ""
trigger:
  - platform: state
    entity_id: sensor.out_of_bed_frequency
action:
  - variables:
    out_of_bed_count: "{{ states('sensor.out_of_bed_frequency') | int }}"
    desired_frequency: "{{ states('input_number.out_of_bed_frequency') | int }}"
  - choose:
    - conditions:
      - "{{ out_of_bed_count >= desired_frequency and out_of_bed_count > 0 }}"
    sequence:
      - parallel:
        - if:
          - condition: state
            entity_id: input_boolean.notify_phonebed1
            state: "on"
          then:
- service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
  title: Out of Bed Alert!
  message: |
    {{ states('sensor.name') }} has been out of bed {{
    states('sensor.out_of_bed_frequency') }} times tonight.
    It might be a good idea to check in to make sure they
    are comfortable and safe.
- service: logbook.log
data:
  name: Out of Bed Alert!
  entity_id: input_boolean.bedroom_logbook
  message: " {{ states('sensor.name') }} has been out of bed {{
  states('sensor.out_of_bed_frequency') }} times tonight. It might be a good idea to check in to
  make sure they are comfortable and safe."

**Appendix B.1.8 Sleeping Time Monitoring**

alias: Sleep and Wake-up Time Monitor
description: ""

trigger:
- platform: time
  at: input_datetime.bedtime

condition:
- condition: and
  conditions:
  - condition: state
    entity_id: binary_sensor.motion_bedroom
    state: "off"
  - condition: state
    entity_id: sun.sun
state: below_horizon

enabled: false

- condition: template

  value_template: "{{ states ('sensor.home') == 'Home' }}"

action:

- service: input_boolean.turn_on

  data: {}

  target:

    entity_id: input_boolean.sleep_monitor

- wait_for_trigger:

  - platform: time

    at: input_datetime.wake_up_time

  continue_on_timeout: true

  timeout:

    hours: 24

    minutes: 0

    seconds: 0

    milliseconds: 0

  - service: input_boolean.turn_off

    data: {}

    target:

      entity_id: input_boolean.sleep_monitor

mode: restart
Appendix B.1.9 Sleep Duration Alert

alias: Sleep Duration Alert
description: ""
trigger:
  - platform: template
    value_template: "{{ states('sensor.sleep_diff') | float < 0 }}"
condition: []
action:
  - parallel:
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonebed2
        state: "on"
      then:
        - service: notify.mobile_app_{{states('sensor.noti_device2')}}
          data:
            title: Sleep Duration Alert!
            message: >-
              {{ states('sensor.name')}} slept for only {{
                states('sensor.sleep_monitor_weekday') | float }} hours last
              night.
        - service: logbook.log
          data:
            name: Sleep Duration Alert!
            entity_id: input_boolean.bedroom_logbook
            message: >-
              {{ states('sensor.name')}} slept for only {{
                states('sensor.sleep_monitor_weekday') | float }} hours last night.
mode: restart

Appendix B.1.10 Wandering at Night

alias: Wandering at night
description: ""
trigger:
  - platform: state
    entity_id:
      - sensor.in_off_bed
to: Off Bed
for:
  hours: 0
minutes: 0
seconds: 0
condition:
  - condition: and
    conditions:
      - condition: time
        after: input_datetime.start_nighttime
        before: input_datetime.end_nighttime
      - condition: state
        entity_id: input_boolean.wandering_behavior
        state: "on"
action:
  - service: input_boolean.turn_on
    data: {}
    target:
      entity_id:
        - input_boolean.oob
        - input_boolean.wandering
  - service: input_number.set_value
    data:
      value: 0
    target:
      entity_id: input_number.nb_wandbed
  - service: light.turn_on
    data: {}
    target:
      device_id:
        - 0fc34c12a41a22616bfdb265f01e8b04
        - 5614c6cea06581f76559abff6b50a0f6
  - wait_for_trigger:
    - platform: state
      entity_id:
        - binary_sensor.motion_entrance
      to: "on"
  timeout:
    hours: 0
    minutes: 0
    seconds: "{{ states.input_number.out_of_bed1.state | int }}"
milliseconds: 0
  - alias: Entrance 1st
choose:
  - conditions:
    - condition: and
      conditions:
        - condition: state
          entity_id: sensor.in_off_bed
state: Off Bed
for:
  hours: 0
  minutes: 0
  seconds: 0
- condition: state
data:
  entity_id: binary_sensor.motion_entrance
  state: "on"
  for:
    hours: 0
    minutes: 0
    seconds: 0
- condition: state
data:
  entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
  state: "off"
  for:
    hours: 0
    minutes: 0
    seconds: 0
sequence:
- parallel:
  - service: notify.alexa_media
    data:
      message: "{{ states ('input_text.announce_wand1') }}"
      target: "{{ states ('sensor.set_wandspeaker1') }}"
  - if:
    - condition: state
data:
      entity_id: input_boolean.notify_phonewand3
      state: "on"
    then:
      - service: notify.mobile_app_{{ states ('sensor.noni_device2') }}
        data:
          title: Wandering Behavior Alert!
          message: >-
            Mom did not return to bed. She was last seen at the
            entrance at {{
            as_timestamp(states.binary_sensor.motion_entrance.last_changed)
            | timestamp_custom ('%I:%M %p') }}
      - service: logbook.log
        data:
          entity_id: input_boolean.wandering_logbook
          name: Wandering Behavior Alert!
          message: >-
            Mom did not return to bed. She was last seen at the
            entrance at {{
            as_timestamp(states.binary_sensor.motion_entrance.last_changed)
timestamp_custom ('%I:%M %p') }}

- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.wandering

- choose:
  - conditions:
    - alias: Return Bed 1st
      condition: and
      conditions:
        - condition: state
          entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
          state: "off"
          for:
            hours: 0
            minutes: 0
            seconds: 0
        - condition: state
          entity_id: sensor.in_off_bed
          state: In Bed
          for:
            hours: 0
            minutes: 0
            seconds: 3
          alias: Return Bed 1st
      sequence:
        - service: light.turn_off
data: {}
target:
  device_id:
    - 0fc34c12a41a22616bfdb265f01e8b04
    - 5614c6cea06581f76559abff6b50a0f6
  parallel:
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonewand1
        state: "on"
      then:
        - service: notify.mobile_app_{{states('sensor.noti_device2')}}
          data:
            title: Nighttime Notification
            message: Mom already went back to bed. She was out of bed for
states.sensor.off_bed_sensor.state } } hours.
- service: logbook.log
data:
etity_id: input_boolean.wandering_logbook
message: >-
  Mom already went back to bed. She was out of bed for {{
  states.sensor.off_bed_sensor.state } } hours.
name: Nighttime Notification
- service: input_boolean.turn_off
data: {}
target:
etity_id: input_boolean.oob
- service: input_number.set_value
data:
  value: 1
target:
etity_id: input_number.nb_wandbed
- conditions:
  - condition: and
    conditions:
      - condition: state
etity_id: sensor.in_off_bed
state: Off Bed
      - condition: state
etity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
state: "on"
for:
  hours: 0
  minutes: 0
  seconds: 0
alias: Door Open 1st
sequence:
  - parallel:
    - service: notify.alexa_media
data:
      message: "{{ states('input_text.announce_wand2') }}"
target: "{{ states('sensor.set_wandspeaker2') }}"
    - service: logbook.log
data:
etity_id: input_boolean.wandering_logbook
name: Highest Wandering Behavior Alert!
message: >-
  The main door is open! {{ states('sensor.name') }} was last
seen at the entrance at {{
as_timestamp(states.binary_sensor.motion_entrance.last_changed)
| timestamp_custom ('%I:%M %p') }} They may have left home!
- service: notify.mobile_app_{{ states('sensor.noti_device2') }}
data:
  title: "!! URGENT !!"
  message: >-
  The main door is opened! {{ states('sensor.name') }} was
  last seen at the entrance at {{
  as_timestamp(states.binary_sensor.motion_entrance.last_changed)
  | timestamp_custom('%I:%M %p') }} They may have left home!
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.wandering
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: sensor.in_off_bed
        state: Off Bed
      - condition: state
        entity_id: binary_sensor.motion_entrance
        state: "off"
      - condition: state
        entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
        state: "off"
    alias: Other Area 1st
sequence:
  - parallel:
    - service: notify.alexa_media
data:
      message: "{{ states ('input_text.announce_wand3') }}"
      target: "{{ states ('sensor.set_wandspeaker3') }}"
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonewand4
        state: "on"
    then:
      - parallel:
        - service: logbook.log
data:
          name: Nighttime Notification
          message: >-
          Mom did not return to bed. She was last seen in {{
          states('sensor.last_motion') }} at {{
          now().timestamp() | timestamp_custom('%I:%M %p') }}
          entity_id: input_boolean.wandering_logbook
- service: notify.mobile_app_ {{states('sensor.noti_device2')}}
data:
  title: Nighttime Notification
  message: Mom did not return to bed. She was last seen in {{states('sensor.last_motion')}} at {{now().timestamp() | timestamp_custom('%I:%M %p')}}
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.wandering
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.oob
- if:
  - condition: and
    conditions:
      - condition: state
        entity_id: sensor.in_off_bed
        state: Off Bed
      - condition: state
        entity_id: binary_sensor.motion_bedroom
        state: "off"
        enabled: true
    then:
      - service: input_boolean.turn_on
data: {}
target:
    entity_id:
      - input_boolean.wandering
      - input_boolean.oob
- wait_for_trigger:
  - platform: state
    entity_id:
      - binary_sensor.motion_entrance
    to: "on"
timeout:
  hours: 0
  minutes: 0
  seconds: "{{ states.input_number.out_of_bed2.state | int }}"
  milliseconds: 0
- alias: Entrance 2nd
choose:
  - conditions:
- condition: and
  conditions:
  - condition: state
    entity_id: sensor.in_off_bed
    state: Off Bed
    for:
      hours: 0
      minutes: 0
      seconds: 0
  - condition: state
    entity_id: binary_sensor.motion_entrance
    state: "on"
    for:
      hours: 0
      minutes: 0
      seconds: 0
  - condition: state
    entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
    state: "off"
    for:
      hours: 0
      minutes: 0
      seconds: 0

sequence:
- parallel:
  - service: notify.alexa_media
    data:
      message: "{{ states ('input_text.announce_wand1') }}"
      target: "{{ states ('sensor.set_wandspeaker1') }}"
  - if:
    - condition: state
      entity_id: input_boolean.notify_phonewand3
      state: "on"
    then:
      - service: notify.mobile_app_{{ states ('sensor.noti_device2') }}
        data:
          title: Wandering Behavior Alert!
          message: >-
            Mom did not return to bed. She was last seen at the entrance at {{
            as_timestamp(states.binary_sensor.motion_entrance.last_changed)
            | timestamp_custom ('%I:%M %p')
            }}
  - service: logbook.log
    data:
      entity_id: input_boolean.wandering_logbook
      name: Wandering Behavior Alert!
message: >-
   Mom did not return to bed. She was last seen at the
   entrance at {{
   as_timestamp(states.binary_sensor.motion_entrance.last_changed)
   | timestamp_custom ('%I:%M %p') }}
- service: input_boolean.turn_off
  data: {}
  target:
    entity_id: input_boolean.wandering
- choose:
  - conditions:
    - alias: Return Bed 2nd
      condition: and
      conditions:
        - condition: state
          entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
          state: "off"
          for:
            hours: 0
            minutes: 0
            seconds: 0
        - condition: state
          entity_id: sensor.in_off_bed
          state: In Bed
          for:
            hours: 0
            minutes: 0
            seconds: 3
          alias: Return Bed 1st
    - condition: state
      entity_id: binary_sensor.motion_entrance
      state: "off"
      for:
        hours: 0
        minutes: 0
        seconds: 3
    sequence:
    - service: light.turn_off
      data: {}
      target:
        device_id:
        - 0fc34c12a41a22616bfdb265f01e8b04
        - 5614c6cea06581f76559abff6b50a0f6
    - parallel:
      - if:
        - condition: state
          entity_id: input_boolean.notify_phonewand1
          state: "on"
        then:
          - service: notify.mobile_app_{{states('sensor.noti_device2')}}}
- service: logbook.log
data:
  entity_id: input_boolean.wandering_logbook
message: >-
  Mom already went back to bed. She was out of bed for
  {{ states.sensor.off_bed_sensor.state }} hours.
- service: input_boolean.turn_off
data: {}target:
  entity_id: input_boolean.oob
- service: input_number.set_value
data:
  value: 1
target:
  entity_id: input_number.nb_wandbed
- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: sensor.in_off_bed
        state: Off Bed
      - condition: state
        entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
        state: "on"
for:
  hours: 0
  minutes: 0
  seconds: 0
alias: Door Open 2nd
sequence:
  - parallel:
    - service: notify.alexa_media
data:
      message: "{{ states ('input_text.announce_wand2') }}"
      target: "{{ states ('sensor.set_wandspeaker2') }}"
    - service: logbook.log
data:
      entity_id: input_boolean.wandering_logbook
name: Highest Wandering Behavior Alert!
message: >-
The main door is open! {{ states('sensor.name') }} was last seen at the entrance at {{ as_timestamp(states.binary_sensor.motion_entrance.last_changed) | timestamp_custom ('%I:%M %p') }} They may have left home!

- service: notify.mobile_app_{{ states ('sensor.noti_device2') }}
  data:
  title: "!! URGENT !!"
  message: >-
  The main door is opened! {{ states('sensor.name') }} was last seen at the entrance at {{ as_timestamp(states.binary_sensor.motion_entrance.last_changed) | timestamp_custom ('%I:%M %p') }} They may have left home!

- service: input_boolean.turn_off
  data: {}
  target:
    entity_id: input_boolean.wandering

- conditions:
  - condition: and
    conditions:
      - condition: state
        entity_id: sensor.in_off_bed
        state: Off Bed
      - condition: state
        entity_id: binary_sensor.motion_entrance
        state: "off"
      - condition: state
        entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_4
        state: "off"
      alias: Other Area 2nd

sequence:
  - parallel:
    - service: notify.alexa_media
      data:
        message: "{{ states ('input_text.announce_wand3') }}"
        target: "{{ states ('sensor.set_wandspeaker3') }}"
    - if:
      - condition: state
        entity_id: input_boolean.notify_phonewand4
        state: "on"
      then:
      - parallel:
        - service: logbook.log
          data:
            name: Nighttime Notification
message: >-
  Mom did not return to bed. She was last seen in
  {{ states('sensor.last_motion') }} at {{
  now().timestamp() | timestamp_custom ('%I:%M
  %p') }}
entity_id: input_boolean.wandering_logbook
- service: >-
  notify.mobile_app_{{states('sensor.noti_device2')}}
data:
title: Nighttime Notification
message: >-
  Mom did not return to bed. She was last seen in
  {{ states('sensor.last_motion') }} at {{
  now().timestamp() | timestamp_custom ('%I:%M
  %p') }}
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.wandering
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.oob
else:
- service: light.turn_off
data: {}
target:
  device_id:
    - 0fc34c12a41a22616bfdb265f01e8b04
    - 5614c6cea06581f76559abff6b50a0f6
- parallel:
  - if:
    - condition: state
      entity_id: input_boolean.notify_phonewand1
      state: "on"
    then:
    - service: notify.mobile_app_{{states('sensor.noti_device2')}}
data:
title: Nighttime Notification
message: >-
  Mom already went back to bed. She was out of bed for {{
  states.sensor.off_bed_sensor.state }} hours.
- service: logbook.log
data:
  entity_id: input_boolean.wandering_logbook
message: >-
Mom already went back to bed. She was out of bed for {{ states.sensor.off_bed_sensor.state }} hours.

name: Nighttime Notification
- service: input_boolean.turn_off
data: {}
target:
  entity_id: input_boolean.oob
- wait_for_trigger:
  - platform: time
    at: input_datetime.start_nighttime
- service: input_boolean.turn_off
data: {}
target:
  entity_id:
    - input_boolean.wandering
    - input_boolean.oob
mode: single
# Appendix B.2 YAML Code for Configuration of Sensor Integration

sensor:
  # today's med status
  - platform: history_stats
    name: med day s
    entity_id: sensor.medication_tracker
    state: 'Success'
    type: count
    start: "{{ now().replace(hour=0, minute=0, second=0) }}"
    end: "{{ now() }}"
  - platform: history_stats
    name: med day u
    entity_id: sensor.medication_tracker
    state: 'Uncertain'
    type: count
    start: "{{ now().replace(hour=0, minute=0, second=0) }}"
    end: "{{ now() }}"
  - platform: history_stats
    name: med day f
    entity_id: sensor.medication_tracker
    state: 'Failed'
    type: count
    start: "{{ now().replace(hour=0, minute=0, second=0) }}"
    end: "{{ now() }}"

# today's med status time1
  - platform: history_stats
    name: med_time1_s
    entity_id: input_number.nb1
    state: '2.0'
    type: count
    start: "{{ now().replace(hour=0, minute=0, second=0) }}"
    end: "{{ now() }}"
  - platform: history_stats
    name: med_time1_u
    entity_id: input_number.nb1
    state: '1.0'
    type: count
    start: "{{ now().replace(hour=0, minute=0, second=0) }}"
    end: "{{ now() }}"
  - platform: history_stats
    name: med_time1_f
    entity_id: input_number.nb1
    state: '0.0'
    type: count
```yaml
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"

# today's med status time2
- platform: history_stats
  name: med_time2_s
  entity_id: input_number.nb2
  state: '2.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time2_u
  entity_id: input_number.nb2
  state: '1.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time2_f
  entity_id: input_number.nb2
  state: '0.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"

# today's med status time3
- platform: history_stats
  name: med_time3_s
  entity_id: input_number.nb3
  state: '2.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time3_u
  entity_id: input_number.nb3
  state: '1.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time3_f
  entity_id: input_number.nb3
  state: '0.0'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
```

# yesterday's med status
- platform: history_stats
  name: med yesterday's
  entity_id: sensor.medication_tracker
  state: 'Success'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24

# room
- platform: history_stats
  name: entrance
  entity_id: sensor.last_motion
  state: 'Entrance'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: dining room
  entity_id: sensor.last_motion
  state: 'Dining Room'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: living room
  entity_id: sensor.last_motion
  state: 'Living Room'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: kitchen
  entity_id: sensor.last_motion
  state: 'Kitchen'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: bedroom
  entity_id: sensor.last_motion
  state: 'Bedroom'
  type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
name: bathroom
entity_id: sensor.last_motion
state: 'Bathroom'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"

# yesterday's med status
- platform: history_stats
  name: med yesterday u
  entity_id: sensor.medication_tracker
  state: 'Uncertain'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  hours: 24
- platform: history_stats
  name: med yesterday f
  entity_id: sensor.medication_tracker
  state: 'Failed'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  hours: 24

# yesterday's med status time1
- platform: history_stats
  name: med_yesterday_time1_s
  entity_id: input_number.nb1
  state: '2.0'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  hours: 24
- platform: history_stats
  name: med_yesterday_time1_u
  entity_id: input_number.nb1
  state: '1.0'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  hours: 24
- platform: history_stats
  name: med_yesterday_time1_f
  entity_id: input_number.nb1
  state: '0.0'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  hours: 24
# yesterday's med status time2
- platform: history_stats
  name: med_yesterday_time2_s
  entity_id: input_number.nb2
  state: '2.0'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24
- platform: history_stats
  name: med_yesterday_time2_u
  entity_id: input_number.nb2
  state: '1.0'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24
- platform: history_stats
  name: med_yesterday_time2_f
  entity_id: input_number.nb2
  state: '0.0'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24
# yesterday's med status time3
- platform: history_stats
  name: med_yesterday_time3_s
  entity_id: input_number.nb3
  state: '2.0'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24
- platform: history_stats
  name: med_yesterday_time3_u
  entity_id: input_number.nb3
  state: '1.0'
  type: count
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"
  duration:
    hours: 24
- platform: history_stats
  name: med_yesterday_time3_f
entity_id: input_number.nb3
state: '0.0'
type: count
duration: 
  hours: 24

# today's out of home duration
- platform: history_stats
  name: out of home d
  entity_id: device_tracker.hhl_samsung_phone
  state: 'not_home'
type: time
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"

# today's out of home times
- platform: history_stats
  name: out of home times
  entity_id: device_tracker.hhl_samsung_phone
  state: 'not_home'
type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now().replace(hour=0, minute=0, second=0) }}"

# toilet
- platform: history_stats
  name: toilet sensor
  entity_id: binary_sensor.toilet_sensor
  state: 'off'
type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now().replace(hour=13, minute=0, second=0) }}"
- platform: history_stats
  name: extended bathroom
  entity_id: input_number.extended_bathroom
  state: '1.0'
type: count
  start: "{{ now().replace(hour=0, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: post toilet sensor
  entity_id: binary_sensor.toilet_sensor
  state: 'off'
type: count
  start: "{{ now().replace(hour=13, minute=0, second=0) }}"
  end: "{{ now() }}"
- platform: history_stats
  name: showering sensor
entity_id: binary_sensor.showering
state: 'on'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: bathroom times
  entity_id: sensor.inbathroom_track
  state: '1'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now().replace(hour=13, minute=0, second=0) }}"

# bed
- platform: history_stats
  name: out of bed frequency
  entity_id: sensor.in_off_bed
  state: 'Off Bed'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: out of bed ytd frequency
  entity_id: sensor.in_off_bed
  state: 'Off Bed'
type: count
end: "{{ now().replace(hour=0, minute=0, second=0) }}"
duration:
  days: 1

# wandering
- platform: history_stats
  name: wand duration
  entity_id: input_boolean.wandering
  state: 'on'
type: time
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: off bed sensor
  entity_id: input_boolean.oob
  state: 'on'
type: time
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: wandalert
  entity_id: input_number.nb_wandentrance
state: '1.0'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: wandhighalert
  entity_id: input_number.nb_wanddoor
  state: '1.0'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: wandalerts
  entity_id: input_boolean.wandering
  state: 'on'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
- platform: history_stats
  name: returnbed
  entity_id: input_number.nb_wandbed
  state: '1.0'
type: count
start: "{{ now().replace(hour=0, minute=0, second=0) }}"
end: "{{ now() }}"
# weekly med status
- platform: history_stats
  name: med week s
  entity_id: sensor.medication_tracker
  state: 'Success'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"
- platform: history_stats
  name: med week u
  entity_id: sensor.medication_tracker
  state: 'Uncertain'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"
- platform: history_stats
  name: med week f
  entity_id: sensor.medication_tracker
  state: 'Failed'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

# weekly med status time1
- platform: history_stats
  name: med_time1_s_w
  entity_id: input_number.nb1
  state: '2.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

- platform: history_stats
  name: med_time1_u_w
  entity_id: input_number.nb1
  state: '1.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

- platform: history_stats
  name: med_time1_f_w
  entity_id: input_number.nb1
  state: '0.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

# weekly med status time2
- platform: history_stats
  name: med_time2_s_w
  entity_id: input_number.nb2
  state: '2.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

- platform: history_stats
  name: med_time2_u_w
  entity_id: input_number.nb2
  state: '1.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"

- platform: history_stats
  name: med_time2_f_w
  entity_id: input_number.nb2
  state: '0.0'
type: count
start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
end: "{{ now() }}"
- platform: history_stats
  name: med_time2_f_w
  entity_id: input_number.nb2
  state: '0.0'
  type: count
  start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
  end: "{{ now() }}"

# weekly med status time3
- platform: history_stats
  name: med_time3_s_w
  entity_id: input_number.nb3
  state: '2.0'
  type: count
  start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time3_u_w
  entity_id: input_number.nb3
  state: '1.0'
  type: count
  start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
  end: "{{ now() }}"
- platform: history_stats
  name: med_time3_f_w
  entity_id: input_number.nb3
  state: '0.0'
  type: count
  start: "{{ as_timestamp( now().replace(hour=0, minute=0, second=0, microsecond=0) ) - now().weekday() * 86400 }}"
  end: "{{ now() }}"

# new format
template:
  - binary_sensor:
    - name: "in_off_bed"
      delay_off:
        milliseconds: 500
      delay_on:
        milliseconds: 500
      state: >
        {% if is_state('binary_sensor.bed_sensor', 'off') %}
          {{ "off" }}
        {% else %}
          {{ "on" }}
        {% endif %}
- sensor:
  - name: date
    state: '{ { now().timestamp() | timestamp_custom('%B %d, %Y') } }'
  - name: time
    state: '{ { now().timestamp() | timestamp_custom('%I:%M %p') } }'
  - name: weekday
    state: '{ { now().timestamp() | timestamp_custom('%A') } }'
  - name: "in_off_bed"
    state: >
      {% if is_state('binary_sensor.in_off_bed', 'off') %}
        In Bed
      {% else %}
        Off Bed
      {% endif %}
  - name: "set_lights"
    state: >
      {% if is_state('input_select.light_list', 'Dining Table Lamp') %}
        light.hue_ambiance_lamp_1
      {% elif is_state('input_select.light_list', 'Bedroom Lamp') %}
        light.med_light
      {% elif is_state('input_select.light_list', 'Bathroom Light') %}
        light.bathroom_light
      {% endif %}
  - name: "set_lights2"
    state: >
      {% if is_state('input_select.light_list2', 'Dining Table Lamp') %}
        light.hue_ambiance_lamp_1
      {% elif is_state('input_select.light_list2', 'Bedroom Lamp') %}
        light.med_light
      {% elif is_state('input_select.light_list2', 'Bathroom Light') %}
        light.bathroom_light
      {% endif %}
  - name: "set_lights3"
    state: >
      {% if is_state('input_select.light_list3', 'Dining Table Lamp') %}
        light.hue_ambiance_lamp_1
      {% elif is_state('input_select.light_list3', 'Bedroom Lamp') %}
        light.med_light
      {% elif is_state('input_select.light_list3', 'Bathroom Light') %}
        light.bathroom_light
      {% endif %}
  - name: "light_colors"
    state: >
      {% if is_state('input_select.med_colors', 'Red') %}
        [255, 0, 0]
{% elif is_state('input_select.med_colors', 'Green') %}
[0, 255, 0]
{% elif is_state('input_select.med_colors', 'Blue') %}
[0, 0, 255]
{% endif %}

- name: "light_colors2"
  state: >
  {% if is_state('input_select.med_colors2', 'Red') %}
  [255, 0, 0]
  {% elif is_state('input_select.med_colors2', 'Green') %}
  [0, 255, 0]
  {% elif is_state('input_select.med_colors2', 'Blue') %}
  [0, 0, 255]
  {% endif %}

- name: "light_colors3"
  state: >
  {% if is_state('input_select.med_colors3', 'Red') %}
  [255, 0, 0]
  {% elif is_state('input_select.med_colors3', 'Green') %}
  [0, 255, 0]
  {% elif is_state('input_select.med_colors3', 'Blue') %}
  [0, 0, 255]
  {% endif %}

- name: "set_medspeaker1"
  state: >
  {% if is_state('input_select.medspeaker_list1', 'Dining Room') %}
  media_player.living_room_echo_dot
  {% elif is_state('input_select.medspeaker_list1', 'Kitchen') %}
  media_player.kitchen_echo_show
  {% elif is_state('input_select.medspeaker_list1', 'Bedroom') %}
  media_player.bedroom_echo_dot
  {% elif is_state('input_select.medspeaker_list1', 'Bathroom') %}
  media_player.bathroom_echo_dot
  {% elif is_state('input_select.medspeaker_list1', 'Entrance') %}
  media_player.hallway_echo_show
  {% endif %}

- name: "set_medspeaker2"
  state: >
  {% if is_state('input_select.medspeaker_list2', 'Dining Room') %}
  media_player.living_room_echo_dot
  {% elif is_state('input_select.medspeaker_list2', 'Kitchen') %}
  media_player.kitchen_echo_show
  }
{% elif is_state('input_select.medspeaker_list2', 'Bedroom') %}
    media_player.bedroom_echo_dot
{% elif is_state('input_select.medspeaker_list2', 'Bathroom') %}
    media_player.bathroom_echo_dot
{% elif is_state('input_select.medspeaker_list2', 'Entrance') %}
    media_player.hallway_echo_show
{% elif is_state('input_select.medspeaker_list1', 'All Speakers') %}
    media_player.living_room_echo_dot, media_player.kitchen_echo_show,
    media_player.bedroom_echo_dot, media_player.bathroom_echo_dot,
    media_player.hallway_echo_show
    {%- endif %}

- name: "set_medspeaker3"
  state: >
    {%- if is_state('input_select.medspeaker_list3','Dining Room') -%}
    media_player.living_room_echo_dot
    {%- elif is_state('input_select.medspeaker_list3', 'Kitchen') %}
    media_player.kitchen_echo_show
    {%- elif is_state('input_select.medspeaker_list3', 'Bedroom') %}
    media_player.bedroom_echo_dot
    {%- elif is_state('input_select.medspeaker_list3', 'Bathroom') %}
    media_player.bathroom_echo_dot
    {%- elif is_state('input_select.medspeaker_list3', 'Entrance') %}
    media_player.hallway_echo_show
    {%- elif is_state('input_select.medspeaker_list1', 'All Speakers') %}
    media_player.living_room_echo_dot, media_player.kitchen_echo_show,
    media_player.bedroom_echo_dot, media_player.bathroom_echo_dot,
    media_player.hallway_echo_show
    {%- endif %}

- name: "set_wandspeaker1"
  state: >
    {%- if is_state('input_select.wandspeaker_list1','Dining Room') -%}
    media_player.living_room_echo_dot
    {%- elif is_state('input_select.wandspeaker_list1', 'Kitchen') %}
    media_player.kitchen_echo_show
    {%- elif is_state('input_select.wandspeaker_list1', 'Entrance') %}
    media_player.bedroom_echo_dot
    {%- endif %}

- name: "set_wandspeaker2"
  state: >
    {%- if is_state('input_select.wandspeaker_list2','Dining Room') -%}
    media_player.living_room_echo_dot
    {%- elif is_state('input_select.wandspeaker_list2', 'Kitchen') %}
    media_player.kitchen_echo_show
    {%- elif is_state('input_select.wandspeaker_list2', 'Entrance') %}
    media_player.bedroom_echo_dot
    {%- endif %}
- name: "set_wandspeaker3"
  state:>
  {% if is_state('input_select.wandspeaker_list3','Dining Room') %}
    media_player.living_room_echo_dot
  {% elif is_state('input_select.wandspeaker_list3','Kitchen') %}
    media_player.kitchen_echo_show
  {% elif is_state('input_select.wandspeaker_list3','Entrance') %}
    media_player.bedroom_echo_dot
  {%- endif %}
- name: "set_ac"
  state:>
  {% if is_state('input_select.ac_list','Living Room') %}
    climate.dan_s_device
  {% elif is_state('input_select.ac_list','Bedroom') %}
    climate.dan_s_device
  {% elif is_state('input_select.ac_list','All ACs') %}
    climate.dan_s_device
  {%- endif %}
- name: "Medication_sensor"
  state:>
  {% if states('input_number.value') | int == 1 %}
    No
  {% elif states('input_number.value') | int == 2 %}
    No Confirmation
  {% elif states('input_number.value') | int == 3 %}
    Yes
  {% elif states('input_number.value') | int == 4 %}
    No
  {%- elseif states('input_number.value') | int == 0 %}
    Not yet
  {%- endif %}
- name: "Medication_tracker"
  state:>
  {% if states('input_number.value') | int == 1 %}
    Failed
  {% elif states('input_number.value') | int == 2 %}
    Uncertain
  {% elif states('input_number.value') | int == 3 %}
    Success
  {% elif states('input_number.value') | int == 4 %}
    Unknown
  {%- elseif states('input_number.value') | int == 0 %}
    Unknown
  {%- endif %}
- name: "ytd_track1"
  state: >
{% if now().weekday() == 2 or now().weekday() == 4 or now().weekday() == 6 %}
  2
{% elif now().weekday() == 1 or now().weekday() == 3 or now().weekday() == 5 %}
  1
{% elif now().weekday() == 0 %}
  3
{% endif %}

- name: "ytd_track2"
  state: >
  {% if now().weekday() == 2 or now().weekday() == 4 or now().weekday() == 6 %}
    2
  {% elif now().weekday() == 1 or now().weekday() == 3 or now().weekday() == 5 %}
    1
  {% elif now().weekday() == 0 %}
    3
  {% endif %}

- name: "ytd_track3"
  state: >
  {% if now().weekday() == 2 or now().weekday() == 4 or now().weekday() == 6 %}
    2
  {% elif now().weekday() == 1 or now().weekday() == 3 or now().weekday() == 5 %}
    1
  {% elif now().weekday() == 0 %}
    3
  {% endif %}

##

- name: "Medication_failed"
  unit_of_measurement: "%"
  state: >
  {{ (states('sensor.med_week_f') | float * 100 / (states('sensor.med_week_f') | float + states('sensor.med_week_u') | float + states('sensor.med_week_s') | float)) | round(2) }}

- name: "Medication_uncertain"
  unit_of_measurement: "%"
  state: >
  {{ (states('sensor.med_week_u') | float * 100 / (states('sensor.med_week_f') | float + states('sensor.med_week_u') | float + states('sensor.med_week_s') | float)) | round(2) }}

- name: "Medication_success"
  unit_of_measurement: "%"
  state: >
  {{ (states('sensor.med_week_s') | float *100 / (states('sensor.med_week_f') | float + states('sensor.med_week_u') | float + states('sensor.med_week_s') | float)) | round(2) }}

##

- name: "Med_failed"
  unit_of_measurement: "%"
  state: >
# Med Reminder time 1

- name: "Med_uncertain"
  unit_of_measurement: "%"
  state: >
  
- name: "Med_success"
  unit_of_measurement: "%"
  state: >

# Med Reminder time 1

- name: "failed_time1"
  unit_of_measurement: "%"
  state: >

- name: "uncertain_time1"
  unit_of_measurement: "%"
  state: >

- name: "success_time1"
  unit_of_measurement: "%"
  state: >

##

- name: "failed_time1_rate"
  unit_of_measurement: "%"
  state: >

- name: "uncertain_time1_rate"
  unit_of_measurement: "%"
  state: >

- name: "success_time1_rate"
  unit_of_measurement: "%"
  state: >
state: >
  ( { (states('sensor.med_time1_s_w') | float * 100 / (states('sensor.med_time1_s_w') | float + states('sensor.med_time2_s_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) } )
##
# Med Reminder time 2
- name: "failed_time2"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_f_w') | float * 100 / (states('sensor.med_time2_f_w') | float + states('sensor.med_time2_u_w') | float + states('sensor.med_time2_s_w') | float) ) | round(2) } )
- name: "uncertain_time2"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_u_w') | float * 100 / (states('sensor.med_time2_f_w') | float + states('sensor.med_time2_u_w') | float + states('sensor.med_time2_s_w') | float) ) | round(2) } )
- name: "success_time2"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_s_w') | float * 100 / (states('sensor.med_time2_f_w') | float + states('sensor.med_time2_u_w') | float + states('sensor.med_time2_s_w') | float) ) | round(2) } )
##
- name: "failed_time2_rate"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_f_w') | float * 100 / (states('sensor.med_time1_f_w') | float + states('sensor.med_time2_f_w') | float + states('sensor.med_time3_f_w') | float) ) | round(2) } )
- name: "uncertain_time2_rate"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_u_w') | float * 100 / (states('sensor.med_time1_u_w') | float + states('sensor.med_time2_u_w') | float + states('sensor.med_time3_u_w') | float) ) | round(2) } )
- name: "success_time2_rate"
  unit_of_measurement: "%"
  state: >
    ( { (states('sensor.med_time2_s_w') | float * 100 / (states('sensor.med_time1_s_w') | float + states('sensor.med_time2_s_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) } )
##
# Med Reminder time 3
- name: "failed_time3"
unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_f_w') | float * 100 / (states('sensor.med_time3_f_w') | float + states('sensor.med_time3_u_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) }}
- name: "uncertain_time3"
  unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_u_w') | float * 100 / (states('sensor.med_time3_f_w') | float + states('sensor.med_time3_u_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) }}
- name: "success_time3"
  unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_s_w') | float * 100 / (states('sensor.med_time3_f_w') | float + states('sensor.med_time3_u_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) }}
##
- name: "failed_time3_rate"
  unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_f_w') | float * 100 / (states('sensor.med_time1_f_w') | float + states('sensor.med_time2_f_w') | float + states('sensor.med_time3_f_w') | float) ) | round(2) }}
- name: "uncertain_time3_rate"
  unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_u_w') | float * 100 / (states('sensor.med_time1_u_w') | float + states('sensor.med_time2_u_w') | float + states('sensor.med_time3_u_w') | float) ) | round(2) }}
- name: "success_time3_rate"
  unit_of_measurement: "%"
state: >
  {{ (states('sensor.med_time3_s_w') | float * 100 / (states('sensor.med_time1_s_w') | float + states('sensor.med_time2_s_w') | float + states('sensor.med_time3_s_w') | float) ) | round(2) }}
##
- name: "noti_device1"
state: >
  {% if is_state('input_select.devicelist_1','DD\'s Phone') %}
    hhl_samsung_phone
  {% elif is_state('input_select.devicelist_1', 'Tesla\'s Phone') %}
    iphone_dd
  {% elif is_state('input_select.devicelist_1', 'Number\'s Phone') %}
    tn
  {% endif %}
- name: "noti_device2"
  state: >
  {% if is_state('input_select.devicelist_2','DD\'s Phone') -%}
    hhl_samsung_phone
  {% elif is_state('input_select.devicelist_2', 'Tesla\'s Phone') %}
    iphone_dd
  {% elif is_state('input_select.devicelist_2', 'Num\'s Phone') %}
    tn
  {%- endif %}
- name: "Name"
  state: >
  {% if is_state('input_select.devicelist_1','DD\'s Phone') -%}
    DD
  {% elif is_state('input_select.devicelist_1', 'Tesla\'s Phone') %}
    Tesla
  {% elif is_state('input_select.devicelist_1', 'Num\'s Phone') %}
    Num
  {%- endif %}
- name: "Home"
  state: >
  {% set choice = states('input_select.devicelist_1') %}
  {% set mapper = {
    'Num\'s Phone': 'sensor.num_track',
    'DD\'s Phone': 'sensor.dd_track',
    'Tesla\'s Phone': 'device_tracker.iphone_dd'} %}
  {% set selected = mapper.get(choice) %}
  {{ states(selected) }}
- name: dd_track
  state: >
  {% if is_state('device_tracker.hhl_samsung_phone', 'not_home') %}
    Away
  {% elif is_state('device_tracker.hhl_samsung_phone', 'home') %}
    Home
  {%- endif %}
- name: num_track
  state: >
  {% if is_state('device_tracker.iphone_tn', 'not_home') %}
    Away
  {% elif is_state('device_tracker.iphone_tn', 'home') %}
    Home
  {%- endif %}
- name: toilet_track
  state: >
  {% if is_state('binary_sensor.toilet_sensor', 'off') %}
    1
  {% else %}
0
  {% endif %}
- name: showering_track
  state: >
    {% if is_state('binary_sensor.showering', 'on') %}
    1
    {% else %}
    0
    {% endif %}
- name: inbathroom_track
  state: >
    {% if is_state('binary_sensor.presence_sensor_fp2_670e_presence_sensor_1', 'on') %}
    1
    {% else %}
    0
    {% endif %}
- name: offbathroom_track
  state: >
    {% if is_state('binary_sensor.presence_sensor_fp2_670e_presence_sensor_1', 'off') %}
    1
    {% else %}
    0
    {% endif %}
- name: offbed_track
  state: >
    {% if is_state('sensor.in_off_bed', 'Off Bed') %}
    1
    {% else %}
    0
    {% endif %}
- name: inbed_track
  state: >
    {% if is_state('sensor.in_off_bed', 'In Bed') %}
    1
    {% else %}
    0
    {% endif %}
- name: up wd diff
  state: >
    {% set hour = states('sensor.up_time_weekday')[0:2]|int %}
    {% set period = states('sensor.up_time_weekday')[6:8] %}
    {% set uphour = hour + 12 if period == 'PM' else hour %}
    {% set dsrhour = states('input_datetime.uptime_weekday')[0:2]|int %}
    {% set uplate = states('input_number.up_threshold')|int %}
{% set diffhour = uphour - dsrhour %}
{% set diff_up = uplate - diffhour %}

- name: up wn diff
  state: >
  {% set hour = states('sensor.up_time_weekend')[0:2]|int %}
  {% set period = states('sensor.up_time_weekend')[6:8] %}
  {% set uphour = hour + 12 if period == 'PM' else hour %}
  {% set dsrhour = states('input_datetime.uptime_weekend')[0:2]|int %}
  {% set uplate = states('input_number.up_threshold')%}
  {% set diffhour = uphour - dsrhour %}
  {% set diff_up = uplate - diffhour %}
  {{ diff_up }}

- name: sleep wd time diff
  state: >
  {% set hour = states('sensor.sleep_time_weekday')[0:2]|int %}
  {% set period = states('sensor.sleep_time_weekday')[6:8] %}
  {% if period == 'PM' and hour != 12 %}
    {% set bedhour = hour + 12 %}
  {% elif period == 'AM' and hour == 12 %}
    {% set bedhour = 24 %}
  {% else %}
    {% set bedhour = hour %}
  {% endif %}
  {% set dsrhour = states('input_datetime.bedtime_weekday')[0:2]|int %}
  {% set bedlate = states('input_number.bed_threshold')%}
  {% set diffhour = bedhour - dsrhour %}
  {% set diff_bed = bedlate - diffhour %}
  {{ diff_bed }}

- name: sleep wn time diff
  state: >
  {% set hour = states('sensor.sleep_time_weekend')[0:2]|int %}
  {% set period = states('sensor.sleep_time_weekend')[6:8] %}
  {% if period == 'PM' and hour != 12 %}
    {% set bedhour = hour + 12 %}
  {% elif period == 'AM' and hour == 12 %}
    {% set bedhour = 24 %}
  {% else %}
    {% set bedhour = hour %}
  {% endif %}
  {% set dsrhour = states('input_datetime.bedtime_weekend')[0:2]|int %}
  {% set bedlate = states('input_number.bed_threshold')%}
  {% set diffhour = bedhour - dsrhour %}
  {% set diff_bed = bedlate - diffhour %}
  {{ diff_bed }}

- name: sleep diff wd
state: >
  (states('sensor.sleep_monitor_weekday') | float - (states('input_number.sleep_duration') | float) )
- name: sleep diff wn
  state: >
  (states('sensor.sleep_monitor_weekend') | float - (states('input_number.sleep_duration') | float) )
##
- name: cold temp diff
  unit_of_measurement: "°F"
  state: >
  (states('input_number.cold_temperature') | float - (states('sensor.airthings_temperature') | float) )
- name: hot temp diff
  unit_of_measurement: "°F"
  state: >
  (states('sensor.airthings_temperature') | float - (states('input_number.hot_temperature') | float) )
- name: cold temp diff sim
  unit_of_measurement: "°F"
  state: >
  (states('input_number.cold_temperature') | float - (states('input_number.temp') | float) )
- name: hot temp diff sim
  unit_of_measurement: "°F"
  state: >
  (states('input_number.temp') | float - (states('input_number.hot_temperature') | float) )
##
- name: meds_time1
  state: >
  (% set hour = states('input_datetime.medication_reminder_time1')[0:2]|int %)
  (% set minute = states('input_datetime.medication_reminder_time1')[3:5] %)
  (% set period = "AM" if hour < 12 else "PM" %)
  (% set hour = hour if hour <= 12 else hour - 12 %)
  {{ hour }}:{{ minute }} {{ period }}
- name: meds_time2
  state: >
  (% set hour = states('input_datetime.medication_reminder_time2')[0:2]|int %)
  (% set minute = states('input_datetime.medication_reminder_time2')[3:5] %)
  (% set period = "AM" if hour < 12 else "PM" %)
  (% set hour = hour if hour <= 12 else hour - 12 %)
  {{ hour }}:{{ minute }} {{ period }}
- name: meds_time3
  state: >
  (% set hour = states('input_datetime.medication_reminder_time3')[0:2]|int %)
{% set minute = states('input_datetime.medication_reminder_time3')[3:5] %}
{% set period = "AM" if hour < 12 else "PM" %}
{% set hour = hour if hour <= 12 else hour - 12 %}

{{ hour }}:{{ minute }} {{ period }}

- trigger:
  - platform: state
  entity_id:
    - binary_sensor.motion_entrance
    - binary_sensor.motion_living
    - binary_sensor.motion_dining
    - binary_sensor.motion_kitchen
    - binary_sensor.motion_bathroom
    - binary_sensor.motion_bedroom
  to: 'on'
sensor:
  - name: last_motion
    state: >
    {{trigger.to_state.name.split(' sensor Motion')[0]}}
    attributes:
      entity_id: >
      {{trigger.entity_id}}

- trigger:
  - platform: state
  entity_id: binary_sensor.toilet_sensor
  from: 'on'
to: 'off'
sensor:
  - name: toilet flush
    state: "{{ as_timestamp(states.binary_sensor.toilet_sensor.last_updated) | timestamp_custom ('%b %d, %I:%M%p') }}"

- trigger:
  - platform: state
  entity_id: binary_sensor.showering
  from: 'on'
to: 'off'
sensor:
  - name: showering duration
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"

- trigger:
  - platform: state
  entity_id: sensor.in_off_bed
  to: 'Off Bed'
sensor:
  - name: bedtime
    state: "{{ (now()).timestamp() | timestamp_custom ('%b %d, %I:%M%p') }}"
- trigger:
  - platform: state
    entity_id: sensor.in_off_bed
    from: 'In Bed'
    to: 'Off Bed'
sensor:
  - name: sleep duration bed sensor
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%H.%M.%S',false) }}"
  - trigger:
    - platform: state
      entity_id: device_tracker.hhl_samsung_phone
      from: 'not_home'
      to: 'home'
sensor:
  - name: ooh duration
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"
  - trigger:
    - platform: state
      entity_id: binary_sensor.presence_sensor_fp2_670e_presence_sensor_1
      from: 'on'
      to: 'off'
sensor:
  - name: Bathroom duration
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"
  - trigger:
    - platform: state
      entity_id: binary_sensor.lumi_lumi_sensor_magnet_aq2_opening_2
      from: 'off'
      to: 'on'
sensor:
  - name: toilet duration
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"
  - trigger:
    - platform: state
      entity_id: input_boolean.postbath
      from: 'on'
      to: 'off'
sensor:
  - name: post bathroom sensor
    state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"
- platform: state
  entity_id: binary_sensor.everything_presence_one_f0f050_occupancy
  from: 'on'
  to: 'off'
  sensor:
    - name: bedroom duration
      state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%M.%S',false) }}"
    - trigger:
      - platform: state
        entity_id: input_boolean.sleep_monitor_weekdays
        from: 'on'
        to: 'off'
  sensor:
    - name: sleep monitor weekday
      state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%H.%M.%S',false) }}"
      - trigger:
        - platform: state
          entity_id: input_boolean.sleep_monitor_weekends
          from: 'on'
          to: 'off'
  sensor:
    - name: sleep monitor weekend
      state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%H.%M.%S',false) }}"
      - trigger:
        - platform: state
          entity_id: input_boolean.sleep_monitor
          from: 'on'
          to: 'off'
  sensor:
    - name: sleep monitor
      state: "{{ (as_timestamp(trigger.to_state.last_changed) - as_timestamp(trigger.from_state.last_changed)) | timestamp_custom('%H.%M.%S',false) }}"
      - trigger:
        - platform: state
          entity_id: input_boolean.sleep_monitor_weekdays
          from: 'off'
          to: 'on'
    - name: sleep time weekday
      state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p')}}"
      - trigger:
        - platform: state
          entity_id: input_boolean.sleep_monitor_weekends
from: 'off'
to: 'on'
sensor:
  - name: sleep time weekend
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
  - trigger:
    - platform: state
      entity_id: input_boolean.sleep_monitor_weekdays
      from: 'on'
to: 'off'
sensor:
  - name: up time weekday
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
  - trigger:
    - platform: state
      entity_id: input_boolean.sleep_monitor_weekends
      from: 'on'
to: 'off'
sensor:
  - name: up time weekend
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

##
- trigger:
  - platform: state
    entity_id: input_number.nb_up
    to: '1.0'
sensor:
  - name: uptime
    state: "{{ (now().timestamp()) | timestamp_custom('%H') | float }}"
- trigger:
  - platform: state
    entity_id: input_number.nb_bed
    to: '1.0'
sensor:
  - name: sleeptime
    state: "{{ (now().timestamp()) | timestamp_custom('%H') | float }}"

##
# today
- trigger:
  - platform: state
    entity_id: input_number.nb1
    to: '2.0'
sensor:
  - name: time1_s
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb1
    to: '1.0'
sensor:
  - name: time1_u
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb1
    to: '0.0'
sensor:
  - name: time1_f
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb2
    to: '2.0'
sensor:
  - name: time2_s
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb2
    to: '1.0'
sensor:
  - name: time2_u
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb2
    to: '0.0'
sensor:
  - name: time2_f
    state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb3
    to: '2.0'
sensor:
  - name: time3_s
  - name: time3_u
  - name: time3_f
  - name: time3_f
state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb3
    to: '1.0'
  sensor:
    - name: time3_u
      state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.nb3
    to: '0.0'
  sensor:
    - name: time3_f
      state: "{{ as_timestamp(trigger.to_state.last_updated) | timestamp_custom('%I:%M %p') }}"

# yesterday
## success 1st reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '1.0'
  sensor:
    - name: time1_yesterday_s_1
      state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '2.0'
  sensor:
    - name: time1_yesterday_s_2
      state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '3.0'
  sensor:
    - name: time1_yesterday_s_3
      state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
## uncertain 1st reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '1.0'
sensor:
- name: time1_yesterday_u_1
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '2.0'
sensor:
- name: time1_yesterday_u_2
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '3.0'
sensor:
- name: time1_yesterday_u_3
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## failed 1st reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '1.0'
sensor:
- name: time1_yesterday_f_1
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '2.0'
sensor:
- name: time1_yesterday_f_2
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd1
    to: '3.0'
sensor:
- name: time1_yesterday_f_3
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## success 2nd reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
    to: '1.0'
sensor:
- name: time2_yesterday_s_1
state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '2.0'
sensor:
  - name: time2_yesterday_s_2
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '3.0'
sensor:
  - name: time2_yesterday_s_3
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## uncertain 2nd reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '1.0'
sensor:
  - name: time2_yesterday_u_1
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '2.0'
sensor:
  - name: time2_yesterday_u_2
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '3.0'
sensor:
  - name: time2_yesterday_u_3
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## failed 2nd reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd2
to: '1.0'
sensor:
  - name: time2_yesterday_f_1
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- platform: state
to: '2.0'
sensor:
- name: time2_yesterday_f_2
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
to: '3.0'
sensor:
- name: time2_yesterday_f_3
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## success 3rd reminder
- trigger:
  - platform: state
to: '1.0'
sensor:
- name: time3_yesterday_s_1
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
to: '2.0'
sensor:
- name: time3_yesterday_s_2
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
  - platform: state
to: '3.0'
sensor:
- name: time3_yesterday_s_3
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## uncertain 3rd reminder
- trigger:
  - platform: state
to: '1.0'
sensor:
- name: time3_yesterday_u_1
  state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
- trigger:
to: '2.0'
sensor:
  - name: time3_yesterday_u_2
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
  - trigger:
    - platform: state
      entity_id: input_number.med_ytd3
to: '3.0'
sensor:
  - name: time3_yesterday_u_3
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"

## failed 3rd reminder
- trigger:
  - platform: state
    entity_id: input_number.med_ytd3
to: '1.0'
sensor:
  - name: time3_yesterday_f_1
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
  - trigger:
    - platform: state
      entity_id: input_number.med_ytd3
to: '2.0'
sensor:
  - name: time3_yesterday_f_2
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
  - trigger:
    - platform: state
      entity_id: input_number.med_ytd3
to: '3.0'
sensor:
  - name: time3_yesterday_f_3
    state: "{{ (now().timestamp()) | timestamp_custom('%I:%M %p') }}"
Bibliography


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