CONTEXT OF USE AND USER INTERFACE REQUIREMENTS

Presented to Professor Andrew O'Connor

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ACKNOWLEDGEMENT OF COUNTRY

We respectfully acknowledge the Wurundjeri People of the Kulin Nation, who are the Traditional Owners of the land on which Swinburne's Australian campuses are located in Melbourne's east and outer-east, and pay our respect to their Elders past, present and emerging.

We are honoured to recognise our connection to Wurundjeri Country, history, culture and spirituality through these locations, and strive to ensure that we operate in a manner that respects and honours the Elders and Ancestors of these lands.

We also respectfully acknowledge Swinburne's Aboriginal and Torres Strait Islander staff, students, alumni, partners and visitors.

We also acknowledge and respect the Traditional Owners of lands across Australia, their Elders, Ancestors, cultures and heritage, and recognise the continuing sovereignties of all Aboriginal and Torres Strait Islander Nations.

CONTRIBUTION STATEMENTS

Name	Role	Contribution
Peili Xu	Team member	HTI Model, User Requirements
Su Thao Phuoc Ho	Team leader	Persona model, HTI Model, Executive Summary, Background, Discussion and Conclusion
Dat Nguyen	Team member	Context of use, Environment Model, User Requirements

EXECUTIVE SUMMARY

The objective of the Wandering Detection Project is to create a prototype system that caters to the requirements of caregivers to ensure the safety of persons with early-stage dementia who display wandering behaviour. Analysis of the interview data reveals that carers face challenges to ensure the safety of the person with dementia, especially when they cannot be physically present with them. Leveraging advancements in mobile and sensor technologies, the prototype aims to create a technological solution that allows caregivers to remotely monitor their movements. The three key user groups include primary users (caregivers), secondary users (individuals with dementia), and tertiary users (community members such as police and healthcare professionals). Key features of the prototype include real-time location tracking, home location settings, notifications when the person with dementia leaves the home, routine settings, and hazardous area alerts. The project, however, is subject to constraints that may affect its success. The study's small sample size, consisting of only two participants, limits the generalizability of findings and may not fully represent the diverse experiences of all caregivers. Additionally, reliance on self-reported data introduces potential biases that may distort the actual needs and challenges faced by caregivers. These limitations highlight the need for a broader and more diverse sample in future research to ensure that the system is inclusive and effectively addresses the varied scenarios and technological proficiencies of caregivers.

1 BACKGROUND

Dementia is a neurodegenerative disorder mainly associated with aging, characterized by a range of symptoms such as memory loss, decreased reasoning abilities, etc. One of the most complex, challenging, potentially dangerous dementia-related behaviors is wandering, characterized by aimless or disoriented ambulating movements (CIPRIANI et al., 2014). Wandering could pose serious risks to the demented person's safety and be very distressing for their caregivers. This stress is exacerbated when caregivers cannot be physically present with the person, which is a common scenario given work commitments, personal responsibilities, or geographical distance (Kwak et al., 2015).

Recent advancements in mobile and sensor technologies have opened new possibilities for alleviating the constant vigilance required from caregivers. According to Neubauer et al., 2018's study, 83 technologies have been implemented into 26 types of wander management devices; The most common devices are electronic tracking devices with the use of GPS. The Wandering Detection Project aims to leverage these technological advancements to develop a prototype system that addresses the critical need for improved safety for people with early-stage dementia by allowing caregivers to remotely monitor their movements. Through the development of this prototype, the project aims to contribute to the growing body of assistive technologies for dementia care, potentially paving the way for more comprehensive and integrated care solutions in the future.

2 CONTEXT OF USE

This context highlights the challenges and needs associated with caregiving for people with dementia, particularly focusing on safety and effective communication. Solutions include user groups, goals and environment.

2.1 User groups

- **Primary user group (Caregiver):** Partners, children, grandchildren, neighbours, or friends who are responsible for ensuring the safety and well-being of people with dementia.
- **Secondary user group (People with Dementia):** Individuals who tend to wander and require minimal but vigilant care from their caregivers.
- **Tertiary user group (Public Community):** Police, doctors, or neighbours who are not directly involved in caregiving and may be hesitated to engage in the care of people with dementia.

2.2 Goals of primary user groups

- **Goals**: To ensure the safety of person with dementia, it is crucial to prevent them from wandering into dangerous situations.
- **Problem:**
    - Caregivers often struggle with not knowing the whereabouts of person with dementia, which can lead to situations where they become lost or are exposed to dangerous conditions.
    - Many caregivers do not live with the person with dementia, making it difficult for them to allocate time to search or locate them, especially when they go missing.
    - People with dementia may not carry or use mobile phones, making it nearly impossible for caregivers to establish contact when needed, further complicating efforts to ensure their safety.
- **Tasks:**
    - Caregivers must often physically search for the person with dementia, relying on their knowledge of the individual's routine and habits to determine possible locations.
    - Engaging with neighbours, friends, and others in the area is crucial for gathering information and assistance in locating the demented person.
    - If the situation escalates, caregivers may need to contact the police or other authorities to help locate and safely return the person with dementia.
    - Once found, the caregiver’s priority is to bring the person with dementia home safely, ensuring that they are secure and out of harm's way.

2.3 Environment

- **Physical:**
    - Home: The immediate environment where the person with dementia resides, which serves as the primary location for ensuring their safety and well-being.
    - Local Area: The surrounding neighborhood, where caregivers may need to search for a person with dementia if they have wandered from home.
    - Local Community: Broader community spaces, including parks, shops, and public areas, where the person with dementia might be found if they have wandered beyond their immediate neighborhood.
    - Shops: Local businesses and commercial areas where people with dementia might wander, often requiring caregivers to search these places to locate them.
- **Technological:**
    - Mobile phone: Used by caregivers to communicate with people with dementia, although effectiveness is often limited if the person does not carry or use the phone.
    - Tablet: May be used by caregivers for tracking, organizing care routines, or communicating, though their utility is also dependent on the person with dementia's familiarity and comfort with the technology.
- **Social:** Caregivers may face difficulties in sharing responsibilities and obtaining support from neighbours, friends, and the broader community. This lack of support can make the caregiving process more isolating and stressful, complicating efforts to ensure the safety and well-being of people with dementia.

3 MODELS

3.1 Persona Model

Below is the persona model of the primary user – caregiver.

Figure 1. Illustrative photo of the primary user (caregiver) – Susan Johnson (Freepik 2020)

"It's always in the back of my mind - is he safe at home at night or wandering around somewhere."

- Background

Susan Johnson is a 55-year-old woman who lives an hour and a half drive from her 85-year-old father, who was diagnosed with Alzheimer's three years ago. Susan is juggling the responsibilities of providing care for her father while raising her three children and managing a full-time job. Since the passing of her mother 4 years ago, Susan's father has been living alone in the family home of 50 years. Susan has become more concerned about her father's wellbeing as his cognitive abilities have started to decline. Due to the far distance and other responsibilities, Anna faces difficulties in constantly keeping an eye on his father.

- Key attributes
    - Nurturing and compassionate:

Susan is a deeply caring and dedicated to her father's wellbeing. She is emotionally invested and committed to support her father's independence while ensuring his safety.

    - Time-Constrained:

Susan's caregiving role is at odds with other responsibilities such as a mother and a full-time employee, thus leaving her with little free time. Frequently, Susan is compelled to drive down to address her father's problems, further complicating her schedule.

- Practical:

Susan is looking for a practical solution that could seamlessly integrate into her busy life. She values techniques that do not require significant time to adopt and use.

- Technologically cautious:

Susan is reasonably comfortable with modern technology, she could use it effectively in her personal, professional life. She is willing to adopt new technology if it ensures her father's safety but would prefer the one that is intuitive and easy-to-use, which does not add another layer of stress for her.

- Tasks:

- Susan's top priority is to ensure her father's safety during his walks and outings.
- Susan wants to be alerted when her father wanders too far from home or enter dangerous zones.
- Susan wants to be able to communicate with her father when needed when they are not physically together.

3.2 HTI Model

The hierarchical task inventory (HTI) is used to demonstrate the task structure by breaking it down into a sequence of subtasks. This model will highlight the specific features that we must include into the new interface and establish their interrelationships (Figure 2).

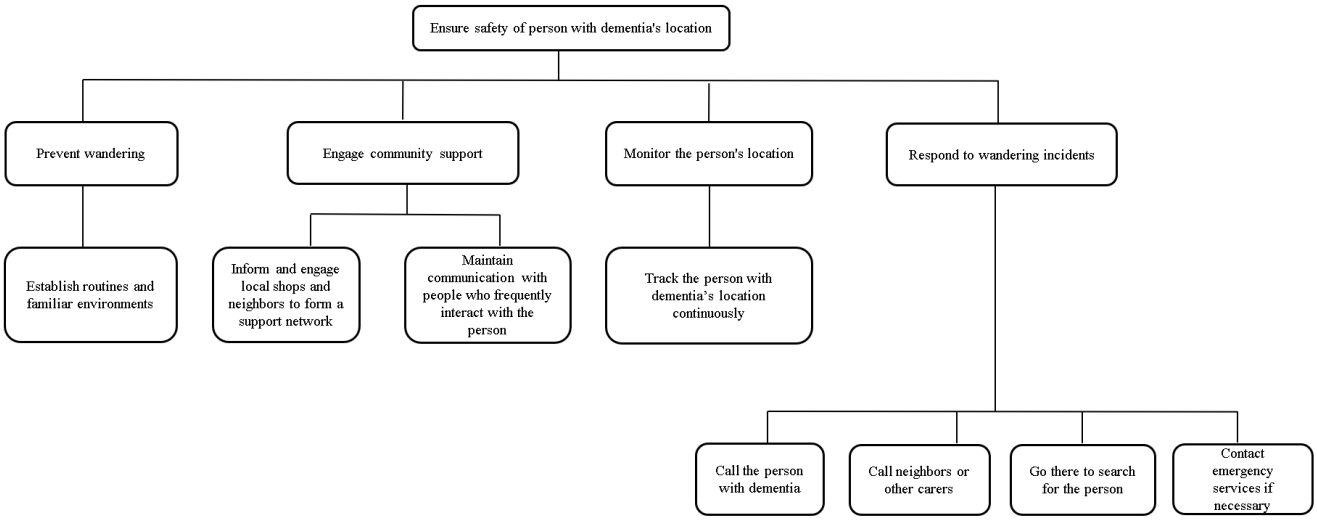

Figure 2. HTI Model

3.3 Environment Model

This model of the physical environment in which people with dementia may roam (e.g., home, local area, and community spaces) emphasizes critical aspects of caregiving, such as the caregiver's role, home safety, and the importance of monitoring and intervention in surrounding areas (Figure 3).

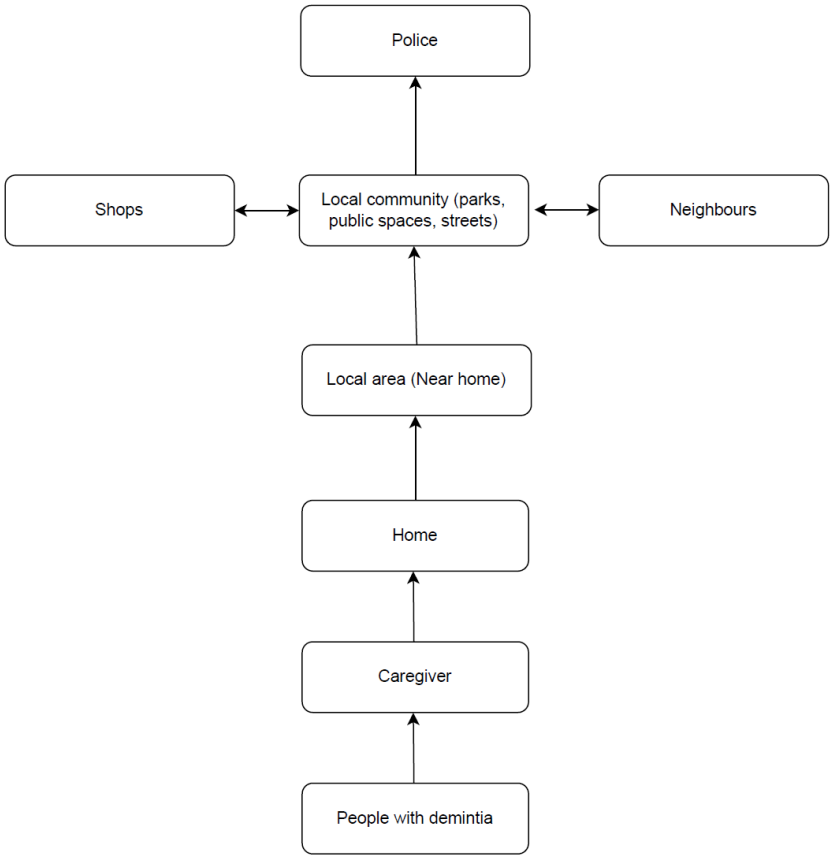

Figure 3. Environment model

- **People with Dementia:** The central focus of the caregiving process.
- **Caregiver:** Directly responsible for ensuring the safety of the person with dementia.
- **Home:** The primary and most secure environment.
- **Local Area:** The immediate surroundings outside the home, where caregivers begin searching if the person with dementia wanders.
- **Local Community:** Broader community areas, including parks, public spaces, and streets.
- **Shops:** Commercial areas where a person with dementia might wander.

- **Police & Neighbors:** External entities that can assist in finding and returning the person with dementia home safely.

4 USER REQUIREMENTS

1. Real-Time location tracking setting

- **Requirement**: The system must provide real-time location of the people with dementia.
- **Rationale**: This is crucial because both P1 and P2 expressed concerns about managing the person when they wander outside [HTI] [Ref 1.06, 1.08, 2.07]. Real-time tracking ensures caregivers can quickly locate the person if they wander, reducing anxiety and improving safety.

2. Home setting

- **Requirement:** The system must allow caregiver to set home location settings.
- **Rationale**: Setting a home location is crucial for reassuring caregivers that the person with dementia is in a safe and familiar environment [HTI] [Ref 1.06]. By defining the home location within the system, caregivers can receive confirmation that the individual is at home, thus reducing anxiety and ensuring there is no immediate risk.

3. Not at home setting

- **Requirement:** The system must send a notification when people with dementia go out.
- **Rationale**: To enhance the safety and monitoring of people with dementia, the system will send a notification to caregivers whenever the individual leaves home area [HTI] [Ref 1.1]. This feature ensures that caregivers are promptly informed if the people with dementia is at risk of wandering, allowing for quick intervention to prevent potential dangers.

4. Routine setting

- **Requirement:** The system must allow caregivers to set routine
- **Rationale**: Establishing routines is essential for maintaining the safety and well-being of individuals with dementia [HTI] [Ref 1.07]. People with dementia often follow familiar patterns, visiting certain places that they find comforting or are accustomed to. By enabling caregivers to set these routines within the system, the person with dementia could navigate these safe areas while still being monitored.

5. Dangerous area setting

- **Requirement:** The system must allow caregivers to set dangerous area
- **Rationale**: The system will alert caregivers whenever the individual enters a designated dangerous area [HTI] [Ref 2.08]. By allowing caregivers to mark specific locations as hazardous, the system ensures immediate notifications if the person with dementia approaches or enters these zones. This feature enables caregivers to respond quickly, preventing potential harm and ensuring the individual's safety in environments that may pose risks.

6. Near dangerous area setting

- **Requirement:** The system must allow caregivers to set near dangerous area
- **Rationale**: To enhance preventive safety measures, the system will notify caregivers when a person with dementia approaches a designated dangerous area [Ref 2.08]. By allowing caregivers to set proximity alerts for these hazardous zones, the system provides an early warning, enabling caregivers to intervene before the individual reaches a potentially unsafe location

7. Time limit setting

- **Requirement:** The system must allow caregivers to set time limit
- **Rationale**: To help monitor the well-being of people with dementia, the system will notify caregivers if the individual remains in the same location beyond a predetermined time limit. This feature notifies caregivers of potential issues, such as wandering or difficulty finding their way home, allowing for prompt intervention.

5 DISCUSSION AND CONCLUSION

The project aims to develop a prototype system that could ensure the safety of individuals with dementia's location, thereby addressing the critical issue of wandering. The user groups identified in the project include primary users (caregivers), secondary users (individuals with dementia), and tertiary users (community members such as police and healthcare professionals). The primary goal for caregivers is to ensure the safety of individuals with dementia and prevent them from entering

dangerous situations. Key insights reveal that caregivers often struggle with uncertainty regarding the whereabouts of the individuals they care for, which can lead to distressing situations, especially when they cannot be physically present due to work or other commitments. As a result, the system must include features such as real-time location tracking, home location settings, notifications when the person with dementia leaves the home, routine settings, and dangerous area alerts. These features are essential in ensuring that caregivers can always effectively monitor and protect the person with dementia.

Notwithstanding, some limitations regarding the data and analysis used for this project have been identified. As the sample size only includes two participants - one spouse and one adult child, it could not fully represent the diverse experiences of all caregivers. As the design relies on data that is specific to participants' individual contexts and technological familiarity, the resulting design may not be inclusive or applicable to other caregiver scenarios. For instance, the needs and challenges might be different for professional caregivers or individuals with different technological proficiency, geographic locations, cultural contexts, age range, etc. Besides, there might be bias in caregivers' self-reported data due to selective memory, exaggeration, or understatement of problems. These biases could lead to misinterpretation of caregivers' actual needs and challenges, thus hindering the resulting solutions to adequately address the real-world challenges that they face.

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Note. Adult woman at therapy session. From *Freepik*, by Freepik, 2020, (https://www.freepik.com/free-photo/adult-woman-therapy-session_11198917.htm#fromView=search&page=1&position=41&uuid=30c5c2df-6be8-47aa-bdc9-de12272a3eb0).