Background Research

SEARCH: Smart Electronic Assistance and Retrieval Companion for Home

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Background

In the United States, over 50% of the elderly population struggle with mental impairments, such as dementia, memory decline, and conditions of forgetfulness (Imhof et al., 2006). Mental impairments and memory decline in the elderly can have significant impacts on their daily lives. Tasks that were once simple and routine can become challenging and frustrating, leading to feelings of helplessness and dependence on others (Mol et al., 2007). These mental impairments cause not only a decrease in the quality of life in the elderly, but often cause embarrassment as they cope with growing forgetfulness (Mol et al., 2007). Furthermore, as the age of a person increases, their short-term memory capabilities decline, such as in the ability to remember where they placed an important item (Mol et al., 2007).

Memory loss, defined as unusual forgetfulness, is a usual symptom of aging. While memory loss is commonly associated with aging, it is important to note that not all individuals experience the same degree of memory impairment. Some may experience only mild forgetfulness, while others may suffer from more severe forms of memory loss that can impact their ability to perform daily activities and maintain their independence. One of the most well-known and serious forms of memory loss is dementia, which is a general term for a decline in cognitive function that interferes with daily activities. Dementia can be caused by various conditions such as Alzheimer's disease, Parkinson's disease, and Huntington's disease. Individuals with dementia require significant support from caregivers as their memory loss and other cognitive impairments worsen over time (Camepellone, 2021). One of the most common impacts of memory loss is misplaced items, which can be frustrating and time-consuming for both the individual experiencing memory loss and their caregivers. This can include misplacing important documents, keys, or other personal items (E. Morris, personal communication, March 1, 2023).

Currently, the global economic burden for Alzheimer's and related dementias is $2.8 trillion, with this figure expected to rise six-fold to $16.9 trillion by 2050 (Nandi et al., 2022). Moreover, over 1 in 5 Americans are actively caring for someone with dementia or memory loss (Robinson et al., 2020), showing the prevalence of this issue in general society. As elderly patients age, they tend to already be in difficult financial states. For instance, one sign of dementia occurs with money management errors. Given that the elderly may struggle with financial situations, the loss of items only poses an additional burden for their livelihood. One common issue that the elderly face is forgetting to pay taxes (Boden, S., 2023). Such errors mean that losing a valued item only exacerbates their current situation.

Target Audience

Based on prior studies, populations throughout the world are seeing a shift towards a disproportionate number of elderly patients (World Health Organization, 2022). The Population Reference Bureau predicts that the elderly population (65 years and up) in the next 35 years will increase by 8% (2019). With this shift in demographic, a common issue that occurs is the inability for the elderly to practice proper habits of exercise. Once these habits set in, the elderly are more prone to face health challenges, such as dementia. For instance, only 28% of elderly patients are able to exercise at healthy levels (The National Council on Aging, 2023).

Although many elderly patients require care from caretakers or facilities, elderly patients typically have the desire to be independent and self-sufficient. A common association within the elderly care field is that greater independence for the elderly yields a higher quality of living. A strong measure for independence is characterized as the avoidance of visiting a care center for a period of time, such that the elderly will be able to remain in the comfort of their own homes. Furthermore, by the year 2030, 1 in every 6 people will be 60 years or older, meaning that providing a method to allow the elderly to live healthier lives will become increasingly important (World Health Organization, 2023).

Current Technologies

Brief Overview

Competitor #1	Apple AirTag – Apple ecosystem device
Competitor #2	Tile Technologies – Bluetooth-based device
Competitor #3	Wearable Camera Design – Camera-based wearable design
Competitor #4	Cloud-Based Service – Database with reporting features

Apple AirTags

One of the most prominent current technologies that aims to prevent misplaced items is the Apple Airtag, introduced by Apple Inc. in 2020. The Apple Airtag is designed as an attachment onto commonly misplaced items, which uses bluetooth signals to communicate with the Apple interface to locate a misplaced item, such as a key or a wallet. See Figure 1 for a sketch of the Apple Airtag. Although the Apple Airtag is low cost, the usability of the device across numerous misplaced items raises questions about cost and feasibility—since each misplaced item would need a separate location device. For example, if one were to use an Airtag for each misplaced item, the cost of both an Apple device and an Apple Airtag could cost upwards of $500.00. Furthermore, in the elderly population, Apple Airtags pose a significant learning curve as the setup process and usage would be difficult for those not inclined towards technology (E. Morris, personal communication, March 1, 2023). Thus, there exists a need for addressing memory decline with a more streamlined system.

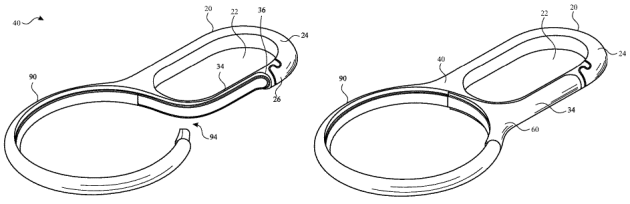

Figure 1: **Apple Airtag Sketch.** A diagram of the key components of an Airtag (Treadwell, 2021).

Tile Technologies

Tile Inc. is another company focusing on devices that can keep track of commonly misplaced items. Similar to an Airtag, a “Tile” can be attached to commonly misplaced items and are triangulated using Low Energy Bluetooth 4.0 technology (Evans, 2013). Tiles also have a speaker which can play a sound similar to the “Find My iPhone” feature developed by Apple. Beyond the 100ft range of Bluetooth technologies, Tiles can use “crowd GPS” and notify the original user if the Tile comes in contact with another user’s phone. See Figure 2 for a schematic of the Tile device. Despite this ability to track various objects, a new Tile device is required for each misplaced item and can easily cost hundreds or thousands of dollars in total. Moreover, there are many possible models that make it hard for the elderly to choose and compare the best Tile model for them. Lastly, there are also security concerns about “crowd GPS” usage, where valuable items may accidentally have their location revealed and become stolen. Thus, there exists a need for a simplistic model without a steep learning curve.

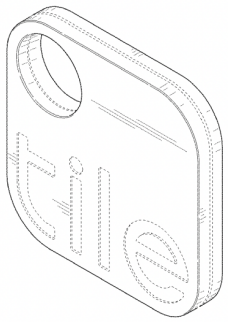

Figure 2: **Tile Sketch.** A schematic of the key components of a “Tile” (Evans, 2013).

Wearable Camera Design

In 2015, Wexler & Shashua proposed a wearable camera system for collecting real-time images of handled objects. The system would be worn around the neck of an individual, and could be used to support a person’s day to day functions with reminders and suggestions on contacting various items

(Figure 3). For example, this device could warn a client for allergens, or remember the previously seen location of a misplaced item. Wexler & Shashua also devised that this device could be attached as a camera system to different commonly used items, such as glasses, necklaces, and more. The proposed system, however, may breach privacy concerns regarding the day-to-day lifestyle of clients. Furthermore, the computer vision software used may be outdated, thus recommendations are inaccurate. Lastly, clients who have limited mobility (i.e. wheelchair limitations) would not be able to use this device to retrieve misplaced items easily.

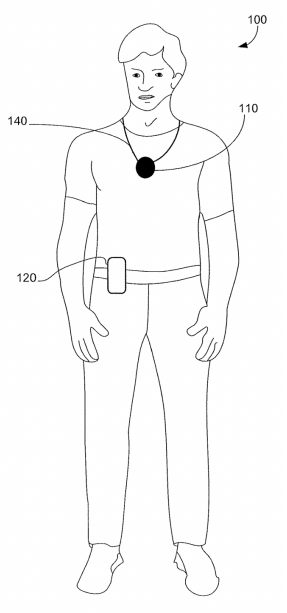

Figure 3: **Wearable Item Locator Design.** A diagram of how this device can be worn on an individual (Wexler & Shashua, 2015).

Cloud-Based Service

Due to the growth in cloud-based services, numerous ideas have been proposed about cloud-based databases for reporting, retrieving, and collecting lost items (Evans & Farley, 2020; Daub, 2019). One such patent, filed by Daub (2019), discusses a lost-item database that can be accessible from mobile devices. This system, as shown in Figure 4, displays missing item alerts via telecommunication

and mobile alerts, as well as allowing clients to submit lost item alerts. The system, which would provide user-reports of lost items and directions via mobile devices, would be completely unfeasible in an elderly setting. The dependence on difficult-to-learn technologies, such as mobile applications and cloud-based reporting features, makes this application inaccessible to the elderly population. Additionally, Dr. Sheikh (personal communication, March 1, 2023) explains that the majority of elderly with mental impairments, such as memory loss, struggle with adapting to technology. Thus, the market shows a need for a simple, and effective product for combating the misplaced item problem.

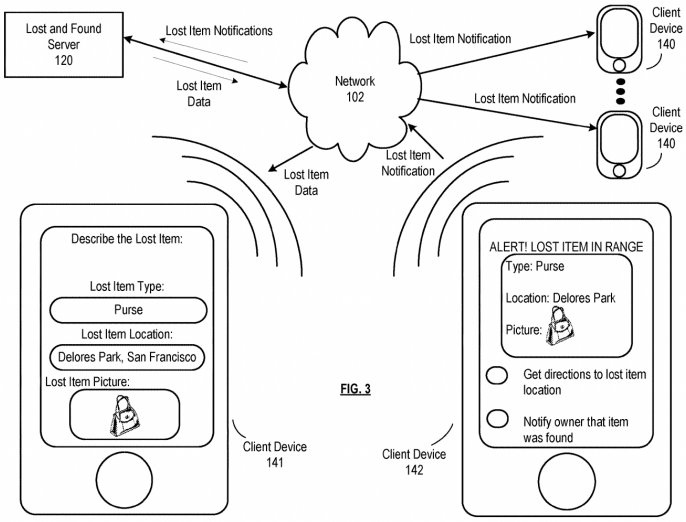

Figure 4: **Lost Item Database.** A diagram of the virtual lost-item database with self-reporting features (Daub, 2019).

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