Development of an Estimote App to Understand Routine Activities and Compensatory Strategy Use in Older Adults

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Introduction

- Older adults want to maintain independence as they age and to remain in their own homes.
- Estimotes (see Figure 1) are sensors that affix to objects and transmit radio signals about the objects' motion.
- Deploying Estimotes in the homes of older adults could improve understanding of everyday routine activities and the strategies that older adults use to remain functionally independent.

Objectives

- Test the accuracy of data transmitted from Estimote sensors when attached to items (e.g., medications, doors) in a home environment
- Examine whether Estimote data can be used to predict routines

Methods

- An iOS app (see Figure 2) was developed to receive information from the Estimote sensors and produce sensor data in a specific JSON format.
- A python script was also developed to parse the JSON file and compute time calculations to be used for data analyses.
- Estimote sensors were installed in the homes of six young adults for approximately one week.
- Two participants were excluded from analyses due to missing data.
- The frequency of motion of 8 to 20 items in each home was tracked by Estimote sensors.
- Participants chose two days that were representative of their typical routines to track their use of the designated items using hourly time-logs.

Figure 1: Estimote sensors

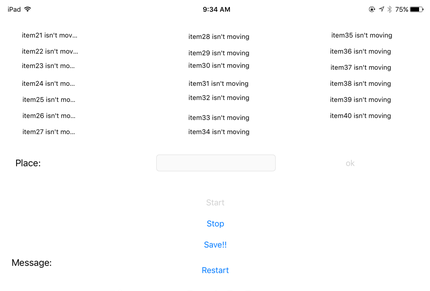


Figure 2: iOS app

Results

Comparisons of Estimote and Self-Report Data

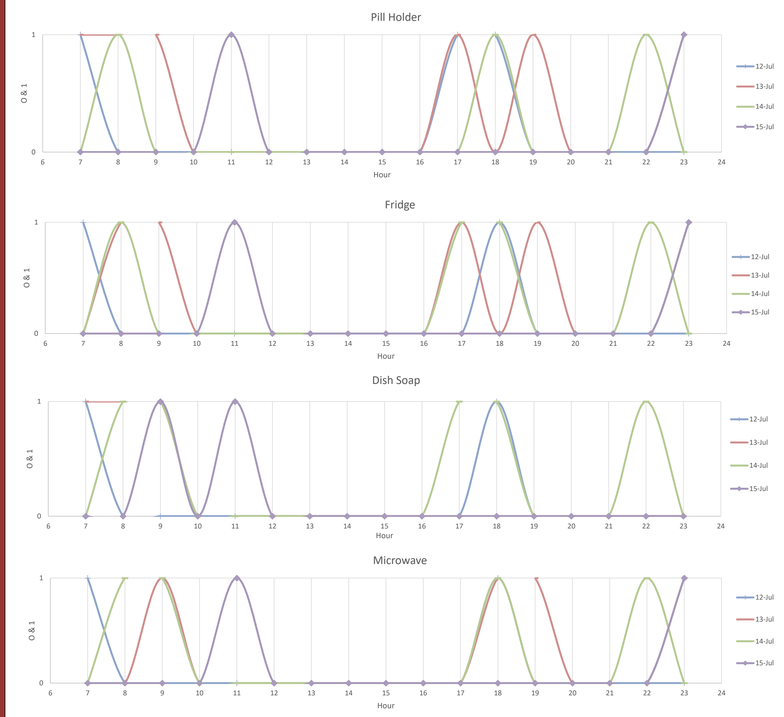
- Frequency data from the Estimotes was collapsed to indicate whether each item was used per day and compared to the participants' self-report of whether they used each item per day.
- A Spearman's rank-order correlation was performed to determine the relationship between participants' self-reported item use and item use indicated by the Estimote data.
- Across participants, data was recorded from 40 stickers for two days and from 8 stickers for one day. Accounting for the total number of items and days across participants, 88 cases were used for data analyses.
- There was a strong, positive correlation between self-report data and Estimote data across two days, which was statistically significant, $r_s(86) = .723$, $p < .001$.

Prediction of Routine

- To examine routine, frequency data was collapsed to indicate whether items were used per hour and graphed across four days(see Figure 3-6).
- Two participants experienced technical difficulties while using the Estimote app, resulting in a loss of data. Routine item use was examined in the remaining participants (n = 2).
- Item use was considered routine when similar patterns of data emerged for at least three of the five days for a given item.

Routine Items	Non-routine Items
Pill Holder	Dish Soap
Laptop	Detergent
Fridge	Toothpaste
Dresser Drawer	
Notebook/Planner	
Front Door	
Silverware Drawer	
Microwave	

Table 1: Perceived successfulness of routine depiction per item



Figures 3-6 : Frequency data for routine and non-routine items across four days

Conclusions

- This preliminary data is promising and suggests that Estimotes could be used to provide information about daily item use and routine in a home environment.
- Future work should examine the accuracy of Estimote data at an hourly level and for individual items.
- Continued work on the iOS app is necessary to ensure accurate and successful collection of data, without loss of data.
- While this study utilized a convenience sample of college students, future work should examine the use of Estimotes in the homes of older adults.
- Rather than placing Estimotes on the same items across participants, customizing the list of items to match each participant's individual routine could provide better depictions of routine.
- Data collection should also occur over longer periods of time to more accurately predict routine.

This work was supported by the National Institute on Aging grant R25AG046114.