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

Kily Nhan¹, Bryan Minor¹, Kaci Wilson², Catherine Sumida², and Maureen Schmitter-Edgecombe²
School of Electrical Engineering and Computer Science¹, Washington State University
Department of Psychology², Washington State University

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.

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.

<table>
<thead>
<tr>
<th>Routine Items</th>
<th>Non-routine Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pill Holder</td>
<td>Dish Soap</td>
</tr>
<tr>
<td>Laptop</td>
<td>Detergent</td>
</tr>
<tr>
<td>Fridge</td>
<td>Toothpaste</td>
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<tr>
<td>Dresser Drawer</td>
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<tr>
<td>Notebook/Planner</td>
<td></td>
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<tr>
<td>Front Door</td>
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<tr>
<td>Silverware Drawer</td>
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<tr>
<td>Microwave</td>
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</tbody>
</table>

Table 1: Perceived successfulness of routine depiction per item

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.

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