Activity Analyzer for Guided Independent Living Environments (AAGILE)

A preliminary study on healthy young adults

Tanya Wang, Josh Harvey, Eugene Chabot, PhD, Ying Sun, PhD, Patricia Burbank, DNSc, RN*
Department of Electrical, Computer and Biomedical Engineering, University of Rhode Island, Kingston, RI 02881, USA;
*College of Nursing, University of Rhode Island, Kingston, RI, 02881, USA

***Abstract* – The AAGILE is a device designed to reinforce a healthy daily regimen for those who choose to live independently, especially those with diminishing cognitive or physical functions. The device does so by setting goals, providing personalized interactive reminder messages, and monitoring daily activity in 5-minute increments. The purpose of this study is to minimize the overall device size and footprint of the motherboard, further develop the functions of the AAGILE and test the overall health benefits with respect to different physical and cognitive limitations and in comparison to different commercially available monitoring devices.**

I. Introduction

Self-monitoring devices are one of the latest and most popular devices targeted to help individuals be self-motivating. These track an array of different statistics, ranging from sleep cycles, blood pressure, blood glucose, calories burned, and daily activity. Despite the fact that these devices themselves make no change in an individual's activity or health, the theory is that knowledge is power, and that the constant monitoring will motivate individuals to better themselves. This theory is great, so long as the individual is proactive with the technology and is self-motivated enough to make a change. The AAGILE is geared more towards individuals whom may benefit from additional encouragement or feedback. This is targeted for the elderly and forgetful, but can range in application to cardiac rehabilitation patients, obese individuals, and even fitness buffs.

According to the Transtheoretical Model of Behavior Change (TTM)[1], helping relationships such as that of a family member, play an important role in supporting behavior change. This has been proven effective in cases of recovering addicts, obese individuals, and even parent-child encouragement.

The purpose of this study is to obtain preliminary results as to how the levels of productivity are affected by a) monitoring alone, b) monitoring with generic feedback, or c) monitoring with personalized feedback from the individual's family. Additionally, we will observe the battery life of the 9-volt rechargeable battery.

II. Methods

A. Device Design

In order to decrease the unit size and increase the overall user-interface features, the device is divided into two units, a mobile unit and a docking station. The mobile unit records activity in 5-minute intervals with corresponding timestamps. The activity is stored as a score of 1 to 15, with an option of three different sensitivity levels. Additionally, if the calculated hourly scores fall below a threshold, a feedback message is played. An additional 7 messages can be set to play at certain set times throughout the day, as reminders. The mobile unit has no user-interface other than the power switch, and a message re-play button that repeats the last message. The docking station is what the mobile unit would be plugged into at the end of the day, and is used to collect the data, charge the battery, and set the device functions such as the time, record personalized messages, set the play time of messages, set the sensitivity, erase the memory, and send the data to a P.C.

B. Human Trials

In order to test the effectiveness of the device, we conducted an experiment with two test subjects in the 18-24 age range, one male and one female. Both participants are active students, and were required to wear the device for three non-consecutive 6 hour intervals. The first interval monitors exercise with no feedback or encouragement, and provides control data for the experiment. The second interval responds to activity with a computer generated voice message. The third interval records activity and gives customized voice reminders and encouragement from the test subject's loved ones. The trials were all preformed under strict IRB approval and guidelines at the University of Rhode Island.

III. Results

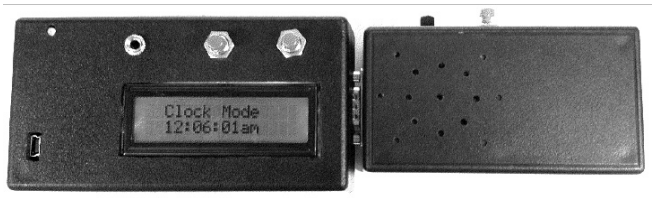

Figure 1: Docking Station and Mobile Unit

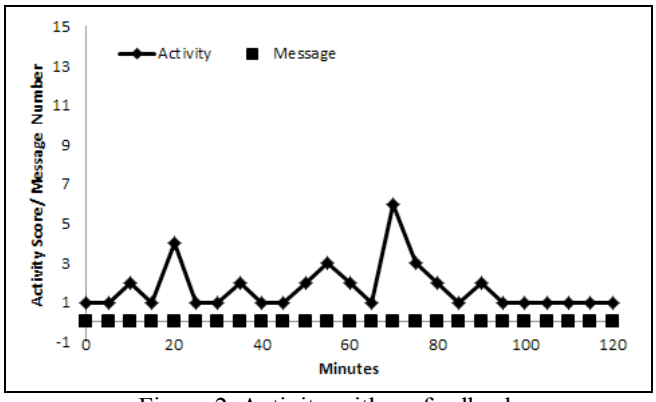

Figure 2: Activity with no feedback

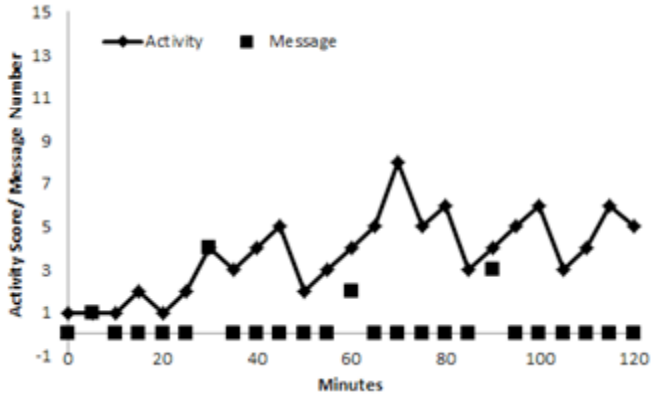

Figure 3: With generic feedback

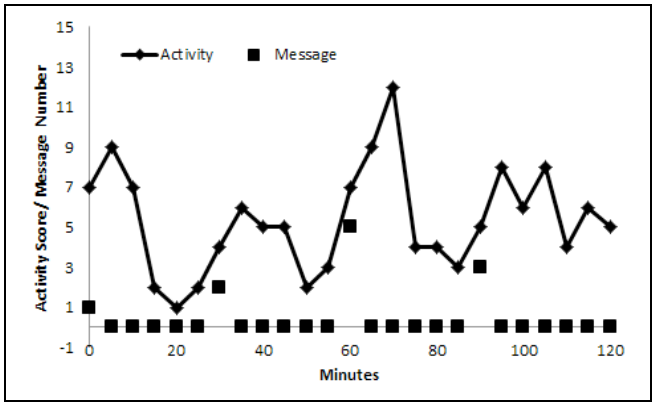

Figure 3: Results with personalized feedback

The results collected are shown in figures 2-4. The line is a numerical representation of activity levels on a scale of 1 to 15, and the squares indicate the message that was played at that time stamp. The amount of activity suggests a strong correlation in response to the addition of personalized and impersonalized messages. After averaging the scores for all three sessions, the total activity level is shown to increase by 114% with a computer generated encouragement, and by 211% with the encouragement of a loved one. The study also tested the device's battery life in real-world applications. The lifespan of the rechargeable 9 volt battery far exceed the designed expectation, and can last for more than three 14 hour sessions in full message response mode.

IV. Discussion

The overall result of this study shows a very positive correlation to the theories presented in Burbank and Riebe's article, Promoting Exercise and Behavior Change in Older Adults [1]. It is important to consider that the age group studied is much different than the intended population. This affects both the daily activity levels, and the response to encouragement from loved ones. Another consideration is the short span of the trials conducted. Because the duration of the monitoring is in such a short span, the long-run results may vary. The overall study conducted had extremely positive results, dramatically more so than expected. Future testing will include more age ranges, more specifically the older adult population, and will include a specific 'loved ones' category, namely children of the individual being studied.

Acknowledgements

The authors thank Rachel Gingras from the University of Rhode Island Nursing department. This study was supported in part by a grant from the National Institutes of Health (2R44NS048682-02A1, PI: Sun)

References

[1] P.M Burbank and D. Riebe. Promoting Exercise and Behavior Change in Older Adults: Interventions and Transtheoretical Model. NY: Springer, 2002.

[2] K. Rafferty, T. Alberg, H. Green, Y.Sun, and P.M. Burbank. *Development of an Activity Analyzer with Voice Directions for Exercises*. 38th Annual Northeast Bioengineering Conference, Temple University, Philadelphia, PA, March 16-18, 2012

[3] H. Greene, C. Dulude, A. Neves, Y.Sun, and P.M. Burbank. *Performance Evaluation of the Activity Analyzer.* 38th Annual Northeast Bioengineering Conference, Temple University, Philadelphia, PA, March 16-18, 2012