PERSUASIVE USER INTERFACE FOR THE ELDERLY

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Abstract

Self-care and self-orchestration are focal points for transformations in human health. This project presents preliminary investigation and approach towards a physical-virtual technology for stimulating social interactions among and with older adults. It report on set of surveys, and focus groups aiming at understanding the different motivations and obstacles in promoting social interactions. The focus of this research is based on computer-based personal assistance that helps to behave healthy by persuading and guiding older adults. For effective persuasion, the assistant express social behaviors to be trustworthy and show empathy. This research will be develop with a framework that supports of variable exercises as software plugins and persuasion techniques which has dedicated training plan. The exercises can be Instruction-based (how-to instruction in form of Video, audio or text). Each exercise can come with different levels. The exercises are pushed to the system repository. The interface of the system will be design to run under WINDOWS environment with Visual Studio (2015) programming language and the backend will be constructed with SQL.

Keywords: *Social interactions, older adults, physical activity, persuasion strategies, preventive health*

1. INTRODUCTION

As time goes on and humans continue to develop, people are living longer and can enjoy better socioeconomic conditions. But, this has also led to an aging world. According to Mazzeo et. Al, (2015), one of the main consequences of the progressive aging of our society is the rise of expensive age-related disabilities and diseases.

Experts have also drawn an extensive list of benefits that healthy exercise can bring to the physical and psychological function of older individuals Nied and Franklin (2013).

Ageing is not only associated with improved living conditions, but also with the in-creased risk of developing health diseases and decreasing functionality in later life.

The increased cost and sustainability issues, related to providing the support older adults need, is one of the most growing concerns today.

This rapid increase in the elderly population has revealed weaknesses in the design of the healthcare system in accommodating the needs of the elderly. The conventional healthcare system is often structured to diagnose and treat time-limited health conditions in an episodic approach rather than long-term that may be more beneficial for the elderly.

In ambient-assisted living scenarios there is the need of providing adequate support to elderly so that they can improve their quality of life. One of the most emergent needs is the capability of a system to be capable of adapting and reacting to user behavior changes. This is even more relevant when considering age related changes.

The use of context-aware technology enables new ways to stimulate elderly in increasing their exercise levels, and consequently prevent age-related health issues amongst an increasing elderly population.

The technology enables new ways to encourage healthy walking among the elderly. Using context aware technology, actual activity patterns can be monitored, elderly people can be made aware of their activity patterns, and a system can pro-actively promote exercise. According to Bravata et. Al., (2017) Advancements in the design of pedometers, which now often have on-board memory and wireless connectivity, have made it possible to monitor walking patterns in a non-obtrusive way.

The research area that covers the use of technology to persuade people in changing their behavior has been labeled *persuasive technology* by Fogg. B. J. Fogg, (2013)

Fogg makes a distinction between intrinsic and extrinsic strategies that can be used to persuade people into a behavior change. Individual motivation is based on triggering the intrinsic drive of the individual, e.g., by setting goals, creating awareness, or by conditioning through positive reinforcement. Extrinsic strategies build on social psychology; other people can be the source of motivation, e.g., through competition, cooperation or comparison.

Apart from intrinsic and extrinsic persuasion strategies, Fogg identifies four strategies that can be used to increase the persuasive power of persuasive systems. First, a persuasive system can best be bundled with an application that has value to the user; value integration increases the likelihood of adoption. Second, interactive experiences that are easy to access and convenient have greater opportunity to persuade.

Third, simplicity of tasks and technology increases the chances of success. Fourth, in order to achieve the optimal result, a system should trigger the user when the user is most open to persuasion. This capability to select the opportune moments, kairos, could be linked to contextual information such as physical location, living routines, tasks or emotions.

Persuasive technology has been applied in many application domains, including education, Internet commerce, and entertainment. For example, Nawyn, Intille, and Larson showed how a persuasive remote control could lead to reduced TV watching levels by steering the user towards more dynamic activities [8]. In the health domain, there are several examples of how persuasive technology can be used to encourage healthy behavior.

Lindtner, G. Delajoux, and H. Strub, (2016) use pedometer-driven interventions to encourage respectively teenage girls and adults to walk within a cooperative framework.

Among the factors known to encourage healthy ageing is routine physical activity, a behavior that is not common among the older age group. A Persuasive System Design (PSD) model offers guidelines for designing and evaluating systems aimed at reinforcing, changing or shaping underlying human behavior and attitudes.

This research examines how persuasive technology can be used by the elderly. For this purpose, a theoretical framework for supporting health systems is proposed.

2. PROBLEM GOAL AND OBJECTIVES

The deterioration in health that is common among individuals aged 50 years old and above has become a major concern in terms of the productivity and work ability of the population. Individual in these bracket suffer from at least one chronic disease such as diabetes, obesity, hypertension or cardiovascular disease. In order to prevent the development of these chronic diseases and to maintain the overall health and well-being of older workers it is necessary that they live a healthy lifestyle and sustain an appropriate level of physical activity.

This study creates a prototype for user interface and interaction design best suitable for the elderly people. The objectives is to design an interface that serve as input and output for the system utilizing persuasive strategies to maintain or improve elderly social activity and to ensure the designed interface require little to none reading or previous training.

However, one of the preliminary and most important features of a persuasive system is its use context. The use of interactive technology in the health arena is still in its early stages, technological developments in computing and ambient intelligence allow for new opportunities in this area. In particular, the result of this research in turn, will provide a meta-design for domain experts to implement dedicated training applications with customized exercises and personalized persuasion strategies which can validate models through pilot and longitudinal user studies with the elderly and will assess the usability of the framework according to its coverage.

3. RELATED LITERATURE

Fogg (2003) founded a research area called Persuasive Technology “technology that is designed to change the attitudes or behaviors of users through persuasion and social influence, but not through coercion”. Rather than exogenous persuasion, where users are being persuaded by external factors, persuasive technology focuses on endogenous persuasion i.e. the persuasive intent of the system is delivered through computing products (Fogg, 2003). Furthermore, there are two levels of this endogenous persuasion, i.e. macro suasion, where changing the user’s behavior is the main reason for the development of the system (e.g. the Nike + Running App) or micro suasion, where the system is not exclusively developed for a change in behavior but for integrating persuasive design elements in order to achieve a specific goal (e.g. the one click shopping features of Amazon.com encourage users to buy more than one product).

In order to assist designers in developing persuasive systems, Oinas-Kukkonen and Harjumaa (2015) introduced a conceptual-theoretical framework called the Persuasive System Design (PSD) model that offers systematic ways of understanding and analyzing the persuasion context. Further, the PSD model enlists persuasive design principles that comprised of four categories, i.e.

- **a.** Primary task support,
- **b.** Dialogue support,
- **c.** System credibility support, and
- **d.** Social support.

The design principles in the primary task category involve assisting users in doing primary tasks and accomplishing their goals. The design principles in the dialogue category focus on supporting users by providing some degree of feedback in the form of praise, rewards or reminders that could enhance the user’s motivation

towards achieving their targeted behavior. The system credibility support category enlists persuasive principles that can enhance a user's trust in the system, whereas the design principles of the social support category largely manipulate the user's interpersonal relationship with other human beings (family, friends, colleagues) as a way to enhance their motivation and self-confidence in achieving their targeted behaviour (Oinas-Kukkonen and Harjumaa, 2009).

Numerous persuasive applications targeting changes in diverse types of health behaviour have been developed. For example, Quitty was developed to persuade people to quit smoking (Paay et al., 2014), MoviPill was aimed at enhancing medication adherence among elderly patients (de

Oliveira et al., 2010), and SitCoach, researched on persuasive mobile phone application that was developed to reduce sedentary behavior among office workers (Dantzig et al., 2013). For the purposes of this study, the focus was only on persuasive applications targeting the enhancement of physical activity among individuals aged 50 years and above.

Similar with Ayubi et al. (2014), the persuasive principles of the credibility support category were absent. However, understandably, the reasons were probably due to the presence of therapists/carers in the day care centre where the study was conducted, who supervised, and offered support and guidance to the older adults in using the system, which indirectly built their trust in it. Thus, it would be interesting to know whether the use of Fit For All without the presence of therapists/carers (e.g. by enabling older adults to use the Fit For All exergaming platform at their home) would result in a similar successful outcome.

However, contrary to these previous works, our study was aimed at optimizing the efficacy of a persuasive physical activity application by integrating persuasive principles across the four categories of the PSD model, i.e. primary task support, dialogue support, credibility support and social support. Thus, investigating end-user perceptions toward persuasive principles that fall under these categories was crucial to obtain information on the needs and requirements for the development of persuasive physical activity applications targeting older workers.

In fact, one of the claims of the persuasive system proposed by Oinas-Kukkonen and Harjumaa (2019) was that "persuasion should always be open", which implies that the designer's intention of persuading people to change their behaviour through the system should be visible to the user. Besides, we were motivated to investigate the perceptions of older workers, as previous reports on the relationship between the age structure of the workforce and ICT adoption indicated that there is a low level of adoption and acceptance of newly introduced technologies among the population (Meyer, 2007).

4. ANALYSIS OF THE SYSTEM USING UML

The design process is iterative, with a user panel involved at several stages. The process concludes with a final prototype, and recommendations for improving the design towards a final system. The user panel, which will be consulted in several occasions throughout the design process, which consisted of three phases:

- **Pre-Intervention:** For three consecutive operations, baseline activity levels were collected. The baseline activity levels were used to set the walking goals for the intervention phase.

- **Intervention:** After pre-Intervention, the touch screen with the user interface installed in the living room of the user, at a location visible when walking into and out of the room. Users could monitor their activity levels using the interface. During the intervention phase, both the walking levels and the statistics regarding the use of the user interface were logged for later analysis.

- **Post-Intervention: User** will be interviewed regarding the exercise, the usability of the system and the motivational mechanisms used in the prototype. To better assess the acceptability, the persuasive technology acceptance model (PTAM).

4.1 USE CASE DIAGRAM

Use case diagrams give a graphic overview of the actors involved in the system, different functions needed by those actors and how these different functions interact.

It's a great starting point for any project discussion because someone can easily identify the main actors involved and the main processes of the system

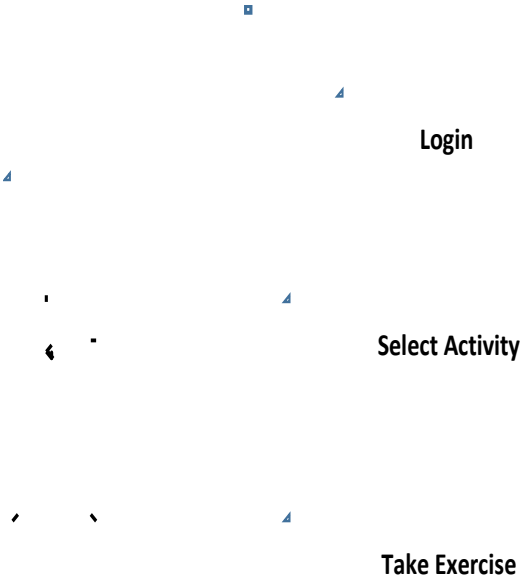

Fig. 1: Use case diagram

5. ARCHITECTURE

To be able to offer persuasion and adaptation features, the platform is characterized by an architecture consisting of Context Manager and Behavior Analysis. The Context Manager is the module that gathers and manages contextual data. It is composed of a server and several delegates installed in a device. These delegates collect data and pass them to the server. Data is gathered from sensors (physical activity, temperature, noise, light, etc.) or external services (e.g. weather forecast).

This plan to monitor the elderly's activities and aid when behavior deviates from the expected one. The Behavior Analysis module is will analyze the data collected in the context manager, model the elderly's behavior (activity levels, social interaction, etc.) and detect deviations from standard behavior showing that the individual behavior is deteriorating, or situations of no progress towards elderly's goals. The output of this analysis is then passed to:

i) The Persuasion module identify what and how necessary persuasions are going to be applied, and
ii) The Adaptation module adapts the outcome of user behavior analysis before being delivered to the elderly.

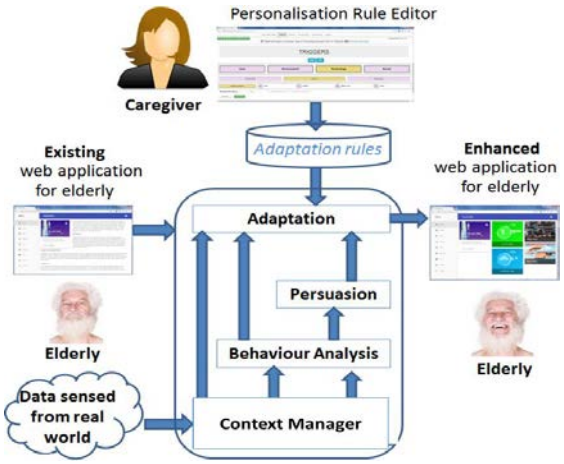

Fig. 3: Architecture of the Solution

The Persuasion module is expected to identify situations in which persuasive mechanisms should be provided to change current behaviors. It needs to, based on the elderly's characteristics, goals, and motivation, identify the appropriate behavioral changing techniques and instantiate them for the current situation. The output of the persuasion module is a set of rules which establish relations between the system applications, modalities, messages and the user characteristics or contexts. These rules can be refined by caregivers, through a personalization rule editor (described ahead).

6. CHOICE OF TOOLS

Microsoft Visual Studio was selected because it provides easy access to underlying server functionality by giving developers access to server functions like message queuing and event logging, as well as a variety of designers from the VS environment. Designers are the key component of Visual Studio; allowing developers to be guided through complex development of specific components. These designers, including XML Data Designer, Web Services Designer, Windows Forms Designer, and Web Forms Designer, provide easy access to generated code based on class frameworks. The generated code is accessible to the developer, allowing the developer to modify or add code. This is a fully object oriented programming tool excellent for window based, application, web and other related software development. It ensures readability and ease of debugging.

7. SYSTEM IMPLEMENTATION

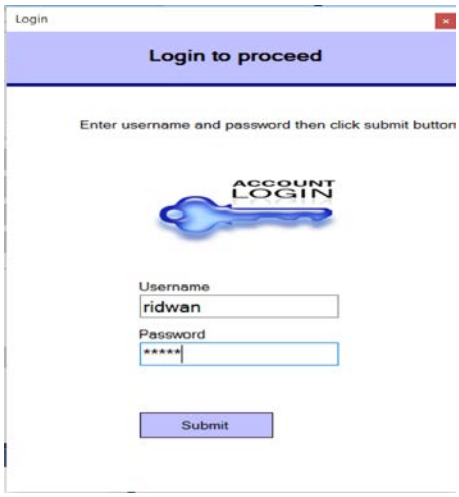

Figure 4: Login Authentication Display

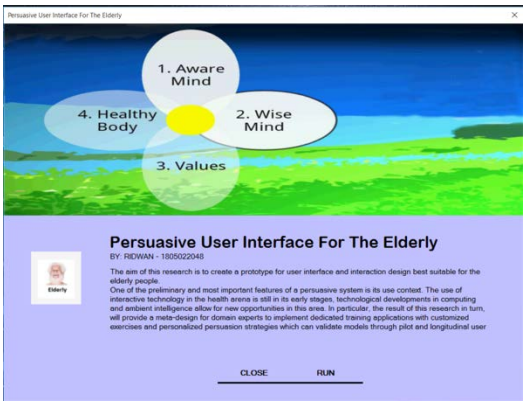

Fig. 5: Main Menu Display

Fig 6: Registration Display

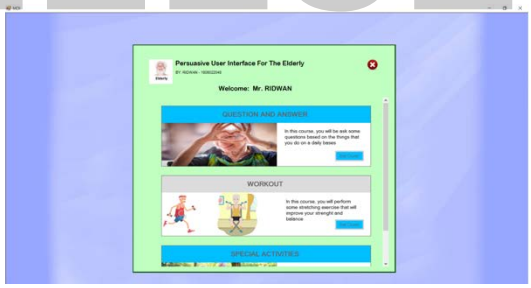

Fig 7: Activities Menu

8. INSTALLATION REQUIREMENTS

Installation requirements are the required specifications a device must have in order to use certain hardware or software. For example, a computer may require a specific I/O port to work with a peripheral device. A smartphone may need a specific operating system to run a particular application. However, in the case of this research software design, the installation requirement for both software and hardware specification that system must have in order to run a software application successfully is listed below;

8.1 HARDWARE REQUIREMENT

The following hardware configuration is required to successfully complete the installation of this project software:

i. 2.0 GHz processor, or faster.
ii. 2GB for x32 processor, 3GB for an x64 processor, of available, physical RAM for better experience.
iii. Video (1024 × 768 or higher resolution) monitor with at least 256 colors.

iv. CD-ROM or DVD-ROM drive.

8.2 SOFTWARE REQUIREMENT

The following software's are required to complete the installation of this project software:

a. Microsoft Windows operating system such as (Win10 is recommend for better experience)
b. Microsoft Visual Studio 2015 Standard, Visual Studio 2015 Professional, or Microsoft
c. Antivirus Software

9. CONCLUSION

The study of attitudes and persuasion remains a defining characteristic of contemporary social psychology. Over the last 70 years, attitude still remains a "most distinctive and indispensable" concept and "a prime factor that must be considered when reflecting on persuasion . . . Most accept the view that an attitude represents an evaluative integration of cognitions and affects experienced in relation to an object. Attitudes are the evaluative judgments that integrate and summarize these cognitive/affective reactions. These evaluative abstractions vary in strength, which in turn has implications for persistence, resistance, and attitude-behavior consistency." Designers have to understand that processes of attitude formation and change are not identical, nor are their outcomes. Factors that do affect attitude change have been a staple of social psychology from its earliest days. The fundamental premise of attitude change says that messages are presented, processed, and if successful, move recipients attitudes toward the advocated position. The revised attitude, in turn, may influence subsequent behavior under appropriate conditions. The well-known dual-process model says that message reception can lead to attitude change and then behavior change. If receivers are able and properly motivated, they will elaborate, or systematically analyze, persuasive messages. If the message is well reasoned, data based, and logical (i.e., strong), it will persuade; if it is not, it will fail.

With the latest advancements in Internet and mobile communications technology, a number of avenues are available to help designers promote adoption of persuasive applications and technologies to their intended end-users. The success of the adoption of these technologies will depend on the grounded understanding of the theories above. This should become a fertile ground for providing persuasion toward healthy living.

10. RECOMMENDATION

The research gives reason for a number of recommendations and the first recommendation deals with what researchers can do to help safeguard substantial control of users over their mental states and behavior. Determining the extent to which persuasive strategies and methods employed in a persuasive technology grant users such control requires detailed knowledge of the underlying psychological processes.

Regarding the design and use of persuasive technology, the identified guideline archetypes covering the most important ability and interaction design dimensions, such as design of multimedia content to address social activities.

The research area is related to the touchscreen interaction of older adults this will indicate the potential gaps that could benefit from future research.

Regardless of the design recommendations, developing a tools that can facilitate the process of discovering design guidelines and embedding them in the design process is also recommend.

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