A Mobile Testing Use Case with AWARE Framework and Mobile Testing Overview

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Abstract: The population in the world is aging and this presents many challenges in both health care and economy. Preventing or delaying the outbreak of age related diseases like Alzheimer's disease can help in bringing down the cost in health care as early intervention could be facilitated. Novel and more effective methods of both data collection and data analytics are needed to improve the performance of the systems used by elderly people and their caretakers. This paper presents a use case where a mobile questionnaire was developed within the AWARE Framework to test the efficacy of such a mobile platform in testing a group of elderly and older adults. Also presented are the results of a literary survey performed to learn about the average properties of mobile testing.

Key Words: AWARE Framework, elderly, mobile

1. Introduction

The European prevalence of dementia in age groups 65-74, 75-84, and 85+, are 1.6-3.5, 7.4-15.7, and 26.2-46.3 respectively[1]. An estimated 46.8 million people were living with dementia in 2015, and the number is estimated to be 131.5 million by the year 2050, according to the "World Alzheimer Report 2015".

According to our literature survey, mobile testing is done e.g. to use the mobile device to deliver a service, application, or questionnaire; to get user originated data, or to use the sensors in the mobile device to get meta data from the user i.e. acceleration, location etc.

Some examples from the literary survey on objectives of mobile testing are, e.g. to obtain daily mood ratings[2], to provide ecological momentary assessment (EMA) for mood, arousal/valence, and meta data from sensors[3], to measure sociability and physical activity in a group of the elderly[4], to study the usability of an eHealth intervention service for depression[5], to explore community attitudes toward the appropriation of mobile phones for mental health monitoring and management[6], to both identify persons with depression based on sensor information and explore potential of delivering context sensitive support[7], to explore the detection of daily-life behavioral markers using GPS and usage sensors, in identifying depressive symptom severity[8] and to test if self-monitored, and automatically generated objective, mobile phone data correlate with clinical ratings of depressive and manic symptoms in patients with bipolar disorder[9].

Using a mobile testing method was found effective and well received in most cases. Also, many correlations, positive or negative, were found between meta data and depression related indicators, e.g. between the duration of incoming and outgoing calls/day and scores on the HDRS-17 test[9], between sensed time speaking and the mental component score of the SF-36 test[4], and features from GPS data, including circadian movement and normalized entropy, were found related to depressive symptom severity measured with PHQ-9 test[8]. Indication of mobile intervention efficacy was found when data was compared between treatment as usual and mobile intervention in addition to treatment as usual, results suggested potential of the intervention to improve both medication adherence and outcome measures of treatment[5].

Some average values were calculated from the literary survey; the average length of a mobile study was found to be 93.3 days and the average polling frequency was found to be 1.01 times/day.

Some common tests to evaluate the possibility a person has depression or problems with cognition are MMSE (Mini Mental State Exam) for cognition and BDI (Becks Depression Index) for depression [10]. BDI is a self-report questionnaire in pen and paper and MMSE is conducted by a clinician.

To detect memory problems or decline in cognition it is common to perform first MMSE and then CERAD and other measurements for a possible diagnosis [10]. Also used are CANTAB cognitive test batteries from Cambridge Cognition that you can perform on a tablet computer [11].

2. Questionnaire Requirements

To decide what to measure to get information of possible depression and/or memory disorder or the risk of developing one, the Finnish "käypä hoito" source of information with reference to depression and memory disorders was studied.

In result, six areas of interest were chosen to be included in the questionnaire. First to include was sleeping because sleep disorders are part of the symptomatology in depression [10]. Second to include was nourishment because it is found that nourishment has a big role in the wellbeing of a senior citizen [10] Orientation of time and/or place was included because finding out if the person is oriented in time, place and person is recommended to be a part of the interview to someone with memory issues [10]. Physical activity was also included for it is found that physical exercise is beneficial in the treatment process in depression and also regular exercise is a part in the pre-

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vention, treatment and rehabilitation of memory disorders [10]. Social activity and mood were included because isolation is part of the symptomology in depression and also a long-term drop in mood can be a symptom of depression [10].

3. Test Group

Six questions were included in the questionnaire. One of the questions is presented in Fig. 1 as it appears on the screen of a mobile phone. The questionnaire language was decided to be Finnish.

Aware Framework was chosen as a platform because of it's flexibility to perform both text based questionnaires and sensor based studies. Studying the sensory data was discarded in this study mostly because of limitations in time.

The questionnaire was technically created with the AWARE Framework web interface ESM (Experience Sampling Method) builder. The AWARE Framework web interface created a database to store the data from the questionnaire-user exchanges. The devices used to deliver the questionnaire were android mobile phones.

The test group was chosen to be 6 individuals, older adults or elderly, as the next stage pilot was planned to be conducted in a group of elderly living in a service home environment.

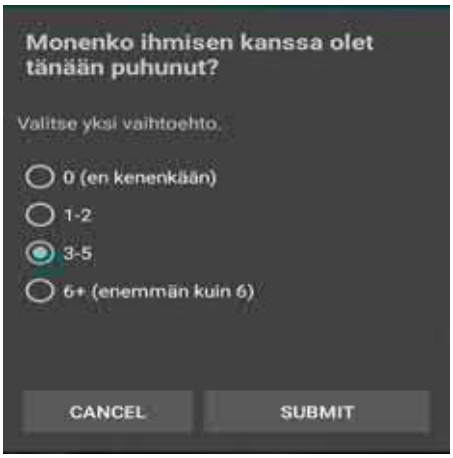

Fig. 1 This question was aimed at testing the social activity of a person: With how many people have you spoken today?

4. Testing procedure and results

The testing was performed in the course of seven days. Total amount of testing events was 18, giving an average of 3 times per person. After testing, the person was given the opportunity to give feedback by answering a poll.

The testing was well received with the post-testing poll question: "Would you consider using a similar application daily if there were health benefits to be gained?", answered "yes", by 5 of the 6 participants. Also the AWARE Framework system back end worked well in storing the answers given to the questionnaire in a data base.

5. Conclusions

Restrictions in time prevented a lengthier study, which would have provided more data on the usability of the questionnaire.

Some issues were found in usability with the eldest of the test group. These issues involved difficulties in seeing and touching the screen with 2 of the 6 participants. The use of a larger screen and a touchscreen pen is recommended when mobile testing in the elderly population.

The literary survey provided an interesting overview on the field of mobile testing and the connections found between phone usage and meta data, and indications of depression.

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