

Blackbox System For The Elderly

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1. Background

According to WHO's report on dementia in 2015, 47.5 million people in the world are suffering from some form of dementia [1]. Every year nearly 7.7 million new cases of dementia are diagnosed [2]. It is a serious and possibly fatal disease being faced by people all over the world. The most prominent and common symptom of any form of dementia is forgetfulness. Poor memory can range from simply losing track of time in the early stages of the disease to more serious problems like not even recognising your family in the advanced stages. Apart from dementia patients, many senior citizens across the globe also face the problem of declining memory due to ageing.

The most common problem as a result of poor memory is getting lost. In Hong Kong, according to a local telephone survey conducted by the government in 2007 nearly 30% people suffering from dementia or their caregivers had reported having gotten lost at least once [3]. Losing one's way can have serious and possibly fatal repercussions. These include problems like dehydration, starvation, falling prey to criminal activities and possible traffic accidents. However, it would be inhuman to stop the elderly from going out alone especially their condition is not very serious. There are GPS devices and name tags that the caregivers or family make the elderly wear so that they can be located in case they lose their way. While these are useful they often create a belittling and even possibly insulting feeling among the elderly. Many feel like they are being equated with criminals who are fitted with GPS trackers. Also, currently there are almost no mobile applications designed specifically for the elderly to increase their safety when they step out of their homes.

Therefore, this Final Year Project aims to build a mobile application that can help increase the safety of the elderly and also possibly allow them a chance to safely move around alone and independently, despite their memory problems. The application basically will be a background app that will routinely log the position of the elderly into a database. This position can then be viewed by a family member or caretaker to locate them in case they get lost. It will also provide more features to help the elderly reach safety in case of an emergency (See Section 3).

2. Objectives

The development of this application is not just about programming its features and functionalities, it is also about doing it in a way that ensures maximum penetration and best experience. Keeping these in mind there are four objectives and areas of focus.

2.1 Platform

As mentioned in the previous section, the Final Year Project will include the development of a mobile application that will allow the elderly to safely move around alone and independently. This application will be built on the Android platform because it is the most popular type of smart phone used today, with nearly 78% share of all users globally (as per 2014 records) [4]. In addition, its open source nature has allowed for many companies to release cheap Android phones that are affordable by majority of the population irrespective of their economic background. In many countries including India one can buy an Android phone for as low as HK\$195 (as seen on indian e-commerce websites). Therefore using Android will ensure maximum user reachability. This is vital to ensure that anyone who needs the app can use it, irrespective of their financial background. The app will also be built adaptable to maximum possible Android versions. This is in line with the project's maximum user reachability principle. Currently the proposed minimum supported Android version is 4.0 (Ice cream Sandwich), API level 14. This Android version has been chosen because versions below this are known to have very less market share of 0.4% or less individually [5]. In the future however, if it is possible to use lower API levels to support the application efficiently, without much need for customisation and depending on availability of time, lowering the API level will also be considered.

2.2 Usability

The app also needs to be user friendly for the elderly. While there are many safety apps present in the market today, none of them cater specifically to the elderly. This is important because their requirements are slightly different. They are not always as adept to using technology and smartphones. There are additional factors as well like visual capabilities of the elderly that need to be kept in mind while designing the user interface of the app.

2.3 Efficiency

Another important aspect of the application is the need for efficiency. As mentioned in the first section, this is a background app i.e. it will run continuously on the phone. Such an app can put huge load on the phone's battery and data usage. While newer phones might still be able to manage the load without getting affected much, the performance of older phones may definitely suffer because of such a load. Too much data usage can also be extremely costly for the user. To combat these issues, additional features will be required. One such feature will be, varying the frequency at which the user's location is logged into the database, depending on his/her speed. Thus if they move faster the location will be logged more frequently and if they are moving slowly it can be logged less frequently.

2.4 Security

The last and possibly most important consideration and requirement for this application is security. GPS tracking for long has been under scrutiny for being a huge security and privacy risk. The location and movement of a person is a piece of private information that if gets into the wrong hands can lead to disastrous consequences. Thus while developing the application, it needs to be ensured that the location stored in the database remains secure and only authorised people are

allowed to view the location. This will be achieved through encryption and password based verification procedures.

3. List of Proposed Features

The application will have a range of features that can help ensure that the elderly remain safe and also to minimise the negative consequence of any emergency.

The application will support two roles -

- Elderly
- Family

The “Elderly” role as the name suggests is of the elderly whose location will be tracked and the “Family” role is that of family members or caregivers who will be tracking the elderly. The application will have two sets of functionalities and user interfaces depending on the role that the user selects. In the beginning of development, a user will be assigned only one role however, in the future users will be allowed to adopt both roles simultaneously.

Below are the set of features for each role. These features have been divided into two categories - Basic and Advanced. Basic features are those, which will definitely be included in the application. Advanced features on the other hand will be included depending on the availability of time.

3.1 Features for “Elderly” role

● Basic

- As mentioned a few times before, the location of the elderly will be logged into a database. The frequency of this logging will be done depending on the speed of the person to minimise battery and mobile data consumption.
- There will also be instructions about which is the closest transport system to get back home.
- The elderly can also locate the closest hospital and police station.
- There will be an SOS button which will immediately send an emergency message to the family members with the elderly’s current location. The elderly can also add a photo of his surroundings and send with the message if he/she wants.
- There will be an ID page that will contain all personal particulars and medical information of the elderly which can be used by someone to help them get home in case they forget their address or how to get home.
- The app will also give a notification or alert to the elderly and their family members if the elderly is outside and his/her phone’s battery is low. While this feature is not directly linked to tracking it is important because older people especially dementia patients might not understand the battery low notifications on their phone. Therefore, it’ll be useful when they are out and their phone runs out of battery.

● Advanced

- For dementia patients the app should be able to raise an alert if they stray too much from a pre-defined path. While this is an extremely restrictive feature it can be essential for people with early stage dementia who do go out alone.
- All instructions on the app will be made voice based as well. This is to accommodate people who might have weaker eyesight.
- It has been seen that the elderly are usually more comfortable in their local language. Thus the app will be made multilingual i.e. in English, Cantonese and Hindi. These three languages have been chosen because English is a universally accepted language, Cantonese is the local language of where I live currently (Hong Kong) and Hindi is the most widely used language in my home country (India).

3.2 Features for “Family” role

For now the “Family” role will just have a basic user interface to view the time and location of the last 10 logged positions in the database. They will also be able to view the pre-defined path of the elderly if it has been specified (Refer to point 1 of Advanced in Section 3.1)

3.3. Authentication

As mentioned in Section 2, security of the data being stored is of primary importance . One way of doing this is to restrict the people who can view the location through the app. For this a robust sign in and authentication process will be used. The app will first be downloaded on the phone of the elderly. During the registration process, they will be asked to enter the phone numbers of all family members and/or caretakers (maximum 5). This will generate a common password, visible only on the elderly’s phone, for the family members and/or caretakers. They will then register on their own phones using their own phone numbers and the phone number of the elderly. Every time they wish to view the location of the elderly they need to enter that common password.

4. Methodology

4.1 Front-end

The front-end of the application is about the user interface. In case of this application the user interface will be very important. As mentioned in Section 2.2, the elderly may not be able to use smartphones as well as people who have grown up with such technology. There are also additional factors like possibly weaker eyesights etc. that need to be considered. Therefore, before designing the UI of the app there needs to be a better understanding of how the elderly use smartphones and mobile apps, what they feel comfortable with and what they don’t like. To do this I will be making use of the plethora of articles and papers written on this subject, available on the internet. I will also be observing the Smartphone workshops held for the elderly living in Kwun Lung Lau, Kennedy Town, Hong Kong, by Chi Sun College, Jockey Club Student Village III, HKU. The way they will react in this workshop will give me an insight into their comfort level with smartphones. While I agree that this is an extremely small sample size to be observing, I hope that this experience plus all the information I get online will help me get a more comprehensive idea about the things I need to keep in mind while designing and developing the user interface.

4.2 Back-end

The database and server of the application will be equally important components of the app. For setting them up I have two major options - first is use the physical servers provided by the CS department at HKU. Second is using a virtual cloud server system like Google App Engine. While this decision has yet to be finalised, the inclination is towards Google App Engine for multiple reasons.

- It will save a lot of the set up time that will be needed if a physical server is used.
- It provides modules that help set up and manage databases easily. It also helps you easily connect the Android app to the database in a convenient manner.
- It takes care of all the maintenance and scalability issues related to the server and database.
- Lastly, it helps maintain security of the database.

All in all it will save a lot of time that can instead be used to improve existing features as well as add new features to the app. The source code of the app will be maintained on Git to allow easy version control.

5. Schedule and Milestones



The order of development of features will be decided during the course of the semester depending their perceived level of difficulty and importance to the application.

Works Cited

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