Review on Fall-Detection and Miscellaneous Functionalities Strategies for Senior Citizen Mobile Application

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Abstract

With the ever-growing demand and use of smartphones, the industry has found senior citizens as a prime demographic for their products. However, many of the applications developed for smartphones are not very intuitive for the elderly. Most applications have complex functionalities that the elderly does not understand, and so they abstain from using such useful applications, or seek help of others for it. The growing stack of technology, and the advances in mobile phones can help solve this problem. However, very few applications exist that focus for aid of the elderly. We aim to create an application that can help senior citizens in their day-to-day activities and also provide emergency services, such as sending location information when fall is detected. This paper discusses the present state of application development for senior citizens, as well as some fall detection algorithms. The papers we studied focus on the points that need to be kept in mind while developing applications for such demographic. With the help of fall detection algorithms, we aim to provide a safety feature, which would inform the user's emergency contacts when a fall is detected. We also aim to provide miscellaneous functionalities, such as medicine reminder, notebook, to-do lists and emergency SOS button within the application.

1. INTRODUCTION

In this day and age, senior citizens form a healthy proportion of the world population. This demographic is arguably the fastest growing segment of the population. Because of this, a lot of investment is made by the government and well as the family members for their health and safety services. Considering the ever-growing number of senior citizens, it must be pointed out that they, as well as the next-generation, are fluent and regular mobile phone users.[1] Various innovations in IT sector have aided in making our lives much more comfortable and convenient, however very few of these solutions address the needs of senior citizens effectively. Such solutions that are currently available have sophisticated features and some also need third-party software to be installed. Even the mobile applications are not very intuitive and focus on solving only one problem.

This led us to come up with a solution that uses smartphone technology to address the various needs of the senior citizens. Our project aims to develop a smartphone application that can aid in preventive measures while also providing emergency health care to the senior citizen.

2. LITERATURE REVIEW

2.1. "Mobile Application Development for Senior Citizens"[1]

Authors: Jing Gao, Andy Koronios

This paper discusses the various types of mobile applications that can be developed in order to help the senior citizens in one way or another, thereby improving their quality of life. The authors tell us about the present options available to senior citizens, such as dedicated hardware devices, various mobile applications which provide a certain functionality, and in the end, they tell us about the various applications developed on different platforms, such as Apple, Windows and Android.

2.2. "Design for Elderly Friendly: Mobile Phone Application and Design that Suitable for Elderly"[2]

Authors: Faisal Mohamed Yusof, Mohamad & Romli, Nurhanani & Mohamed Yusof,

This research gives insights on how the design of an application makes a big impact on its usability. Concentrating mainly on senior citizens, the authors talk about the various design aspects that affect the usability of an application by the target audience. They talk about factors such as visual design, cognitive design, audio design, etc. and tell us how each of these factors need to be kept in mind while developing an application specifically for the elderly.

2.3. "Remind Myschedule –Android Application"[3]

Authors: Vineeta Bhagbole
In this research paper, the author walks us through the

development of an application for keeping track of day-to-day activities and tasks of the user. Using this application, the users were sent dynamic notifications, based on their location, and importance of the scheduled task. The application was developed using Android and its corresponding services at the front end.

2.4. "An Efficient Android Aided Free Fall Detection and Rescue System"[4]

Authors: Rini Kp., R. Gowthamani, L. Nit
In this paper, the authors talk about the design process of a system for the elderly, which helps in real time emergency communication between them and their family members. Using accelerometer and gyroscope sensors present in the smartphone, the authors were able to develop an algorithm for fall detection analysis, and when fall was detected, the real-time information could then be forwarded to the respective family members, such as location as status.

2.5. "Mobile Phone Sensors in Health Applications"[5]

Authors: Evgeny Stankevich, Ilya Paramonov, Ivan Timofeev

This paper discusses the ways in which mobile phone sensors can prove to be useful in the field of healthcare. They discuss the various types of sensors that are generally present in a smartphone, and how these easily available sensors can be used to develop healthcare applications. The authors talk about how microphones, camera, accelerometer, geolocation, and other sensors can be used for development of healthcare-related applications.

2.6. "User Interface on Smartphone for Elderly Users"[6]

Authors: Raywadee Sakdulyatham, Somjaree Preeyanont, Rajalida Lipikorn and Rewadee Watakakosol

By studying the popular application LINE, the authors talk about how it's User INterface (UI) plays a major role in its popularity in Thailand specifically. The paper tells us about how the various aspects of the UI such as font, color, brightness, etc. affect the usability of the application, and how these factors play a major role while developing applications for senior and elderly citizens.

2.7. "Dementia Patient Fall Detection Using Smartphone Technology"[7]

Authors: Bharat Ananda Shinde, Prof. Pramila M. Chavan,
In this paper, the authors discuss the research going on in the field of GPS Technology as well as various other smartphone technologies that are available for the benefit of people suffering from dementia. They also talk about how fall detection can be useful and how it can be implemented, including various techniques that are currently adopted

for this feature, such as image recognition, sensor data, vibration sensors, etc. The authors also propose a simple fall detection mechanism using sensors present in the smartphone.

2.8. "Experimental Evaluation of Mobile Phone Sensors"[8]

Authors: Zhizhong Ma, Yuansong Qiao, Brian Lee, Enda Fallon

In this paper, the authors provide results of their experiments on Google Nexus 4's in-built sensors. They conducted experiments on the accelerometer, gyroscope, magnetometer and GPS, to ascertain their accuracy, reliability, precision and other relevant metrics. Their experiments were elaborate and they concluded that the accelerometer and gyroscope present within the device are very stable with minimal deviation, GPS was fairly accurate to about 10 metres, while other sensors were less accurate.

3. EXISTING SYSTEM AND PROPOSED SYSTEM

3.1. Existing System

There are various dedicated devices that are available in the market for the aid of the elderly, and one such device is the SOS Phone. This device is specially designed keeping senior citizens in mind. It has a relatively simple design, as well as user-friendly user-interface which proves to be quite useful. Features such as task reminders and emergency contacts are available on the device. While meeting the specific requirements, the device fails to deliver any other features (such as installing additional software) that might be needed by the user. Moreover, such dedicated devices are quite expensive considering the limited functionality.

Another device available is a Medical Guardian Pendant. For using this system, you wear a device with a button around your neck or wrist. Once it is pressed, it sends a signal to a larger base system, which calls a pre-programmed number.

However, the drawback of this system is that the large console (base system) that sends an alert is not portable. In case if a user wants to do some outdoor task, it would be an inconvenience for him to carry the console with him. Thus, this system is not suitable for outdoor activities.

Lastly, a popular device – Apple Smartwatch 4, also provides fall detection and SOS functionality. However, to use this watch, the user will have to spend a lot of money. Hence, it is not a feasible solution to the people who have a limited budget.

Thus, the above discussed devices do address the needs of senior citizens to some extent, however, they do not provide a cost-efficient and effective solution to the problem.
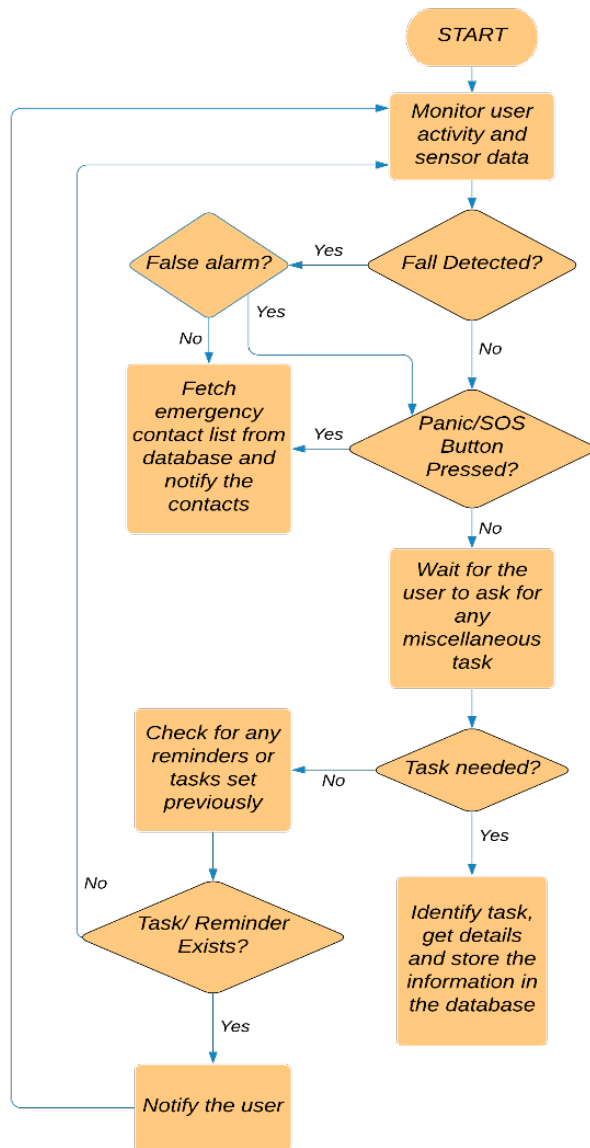
Figure 1: Flowchart of complete system

3.2. Proposed System

During the previous decade, there have been immense improvements in mobile phones' computing power, memory size, and more importantly, in this case, the quality and number of sensors embedded in the device, such as GPS, accelerometer, gyroscope, etc. Nowadays, many applications use location-based services for various functionalities. Most of such applications use either GPS or network-based solution (GSM of Wi-Fi) to ascertain the user's location. For this very reason, we chose mobile device as our primary equipment to track the user's location, with the help of which we can send the detected location to the user's contact/caretaker in case of emergencies.
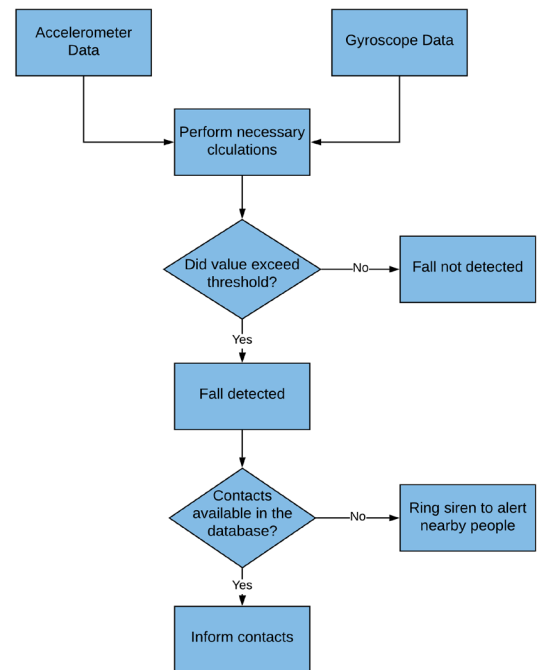

Figure 2: Fall Detection

[1][2] Opposed to the approach of cutting-edge features and making special devices, the approach of developing relatively simple mobile applications on popular Smartphone platforms, providing a well-designed and intuitive user-interface, and utilizing the features already present on the mobile phones, can be considered to be more beneficial and cost-effective in order to meet the needs of senior citizens in the long run.

The proposed system includes following functionalities:

- SOS Button - Quickly request help when needed. Clicking this option will send a text alert to multiple individuals and each alert will include the current device location.
- Fall Detection - It will use mobile's in-built accelerometer and gyroscope for fall detection and send text alert along with the user's location.
- Emergency Contact List - An address book with photos of individuals who can help in case of any emergency. List of individuals may include – family members, neighbors, friends, doctor, police, plumber, electrician, etc.
- Information Notebook - It provides a functionality to store personal, financial as well as medical information. Personal information may include Aadhaar number, pan number. Financial information may include insurance number, bank account number whereas

medical information may include name of the doctor, hospital or medical prescription.

• Scheduled Reminder - [3] It provides a customizable scheduled reminder. This is further divided into two modules: a to-do task list for day to day activities and a reminder list for daily medicines.

The main feature of our application is fall detection, which shall be done by using the data fetched from the accelerometer and gyroscope. These values will then be checked against a threshold to determine if there was a fall or not. If fall was detected, then the emergency contacts of the user will be notified, along with the location where the fall was detected. The flowchart is as follows:

4. CONCLUSION

The purpose of this project is to discuss the techniques available to track down the patient, to carry out the necessary requirements of day-to-day life without any interruptions and it also discusses the implementation of a system which will relieve stress on caretaker.

Instead of developing specific mobile hardware devices for senior citizens, with respect to the rapid advancement of smartphone devices, this project undertakes a novel perspective of research into how to develop desirable mobile applications to improve senior citizen's way of life.

5. REFERENCES

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