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RESEARCH ARTICLE

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ENSURING PEOPLE SAFETY USING SENSOR

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ABSTRACT

Falls are a major health risk that diminishes the quality of life among the elderly people. The importance of fall detection increases as the elderly population surges, especially with aging ''baby boomers''. However, existing commercial products and academic solutions all fall short of pervasive fall detection. In this paper, we propose uti-lizing mobile phones as a platform for developing perva-sive fall detection system. To our knowledge, we are the first to do so. We propose PerFallD, a pervasive fall detection system tailored for mobile phones. We design two different detection algorithms based on the mobile phone platforms for scenarios with and without simple accessories. We implement a prototype system on the Android G1 phone and conduct extensive experiments to evaluate our system. In particular, we compare PerFallD's performance with that of existing work and a commercial product. The experimental results show that PerFallD. Devices are becoming an integrated part of every person's lives regardless of age. This paper discusses the methodology behind developing an application for mobile devices that can determine if a person has fallen. The results of the experiments demonstrate promising hands-free responses to the smart-phone user falling as compared to other systems like Life-Alert.

Key words— Pervasive fall detection _ Mobile phones _ Context information _ Accelerometer _Magnetic field sensor _ Accessory

1. INTRODUCTION

Today's smart phones or mobile phones serve as the central computing and communication device in people's lives. such a trend is inevitable in the real world due to the tremendous growth in recent years of new smart devices, such as i-phones, i-pads, and android-based platform, which is expected to continue. these phones embed various sensors, including accelerometer, digital compass, gps, and camera, enabling new applications in various domains such as healthcare, social networks, and environmental monitoring. this study focuses on healthcare domain one good example of these systems is fall detection. This is because falls are a major health risk for elderly people, diminishing the quality of life or even resulting in death. The fall detection system can be classified into four categories

- IMAGE-BASED SYSTEMS
- DATABASE-BASED APPROACH
- CONTEXT-AWARE TECHNIQUES
- ACCELERATION-BASED DETECTION

Each approach has its limitations and advantages. For example, the advantage of image-based and context-aware approaches is an accurate detection rate; the database-based approach stores various sensed user behavior into a database for various activities. The acceleration-based detection is the most widely used method, as current high level devices build in the acceleration sensors

2. EXISTING SYSTEM

A similar project, "A smart-phone based fall detection system", was completed using smart-phones to detect if the user had fallen. Using the phones accelerometer, they performed several tests to get readings from different scenarios (jumping, sitting, etc). Once the data was compiled, they created an algorithm that utilized an artificial intelligence to reduce the chance of false positives. The major problem with existing commercial products and academic research is that they have deficiencies that hinder pervasive fall detection. The base must be installed somewhere indoors and the portable sensor must be attached to a belt at the waist. Once the base receives the signal from the sensor indicating a fall, it can automatically communicate with a present emergency contact using the fixed phone. However, the maximum distance between the sensor and the base is limited. Fall detection can only be conducted within a small indoor environment and elderly people may easily forget to bring the sensor with them, as it is an extra device

DISADVANTAGES:

- It can call only to the specific person.
- The specific person is unavailable to pickup the call the situation the particular person in risk.

3. PROPOSED SYSTEM

This study proposes a low-cost fall detection system, using the existing devices and wireless technology, without the need for hardware modification, environmental setup, and wearing external sensors. The proposed system has three central components

- Sensing
- Learning
- Alerting

In the first component, we take the advantages of the data base based approach to collect realistic fall data. That is, we collect the real accelerometer data from the mobile embedded sensors and record the corresponding user behaviour to determine the required parameters. In the second component, the proposed system learns the relationship between the fall behavior and the collected data. In this step, we utilize different fall features, including vertical and total acceleration ,to design different fall detection algorithms. We also measure the performance in both sensitivity and specificity while considering their trade- off. In the third component, the mobile phone alert pre configure emergency contacts through message. We further design an interface which allows users to manually disable the alert to avoid false positive and to reduce transmission costs

ADVANTAGE

- It is possible to autonomously call for assistance without the user having to manually press a button.
- It provide a reasonable low-cost solution for non clinical environments conforming to the requirements.
- Before this app is used for the purpose of alertness. But now in this app call feature is added.

3.1 System Design

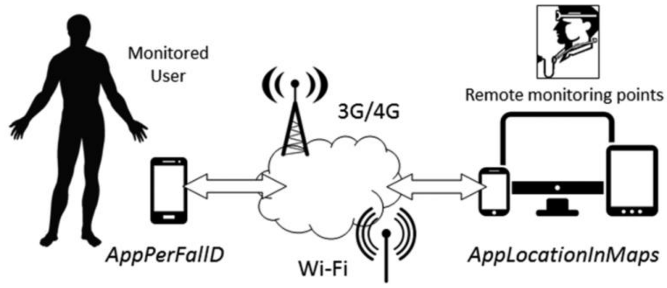

Fig:1 – system design of fall detection

3.2 System Architecture

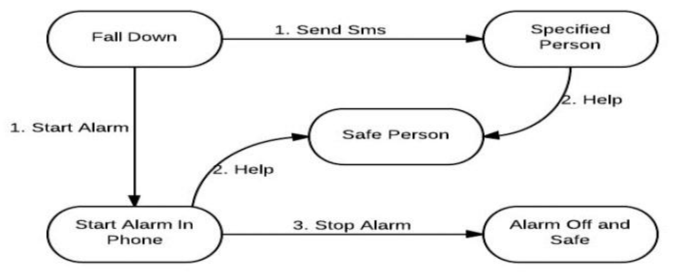

Fig2 - System Architecture

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4. SYSTEM IMPLEMENTATION

The implementation of this proposed system involves the following modules.

Fall detection with Mobile Device

Testing and Data Collection

SMS Send and Alarm

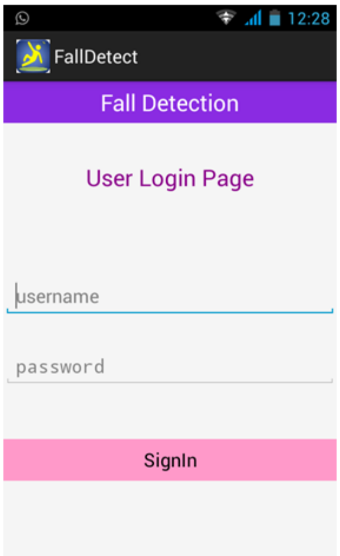
Event

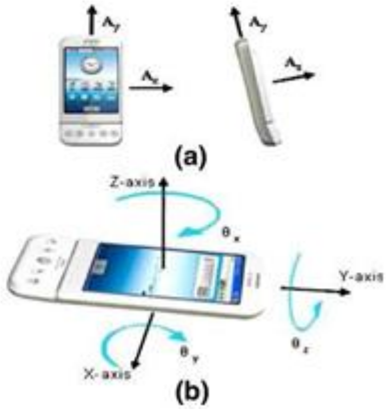
Implementing the Algorithm in a Mobile Application

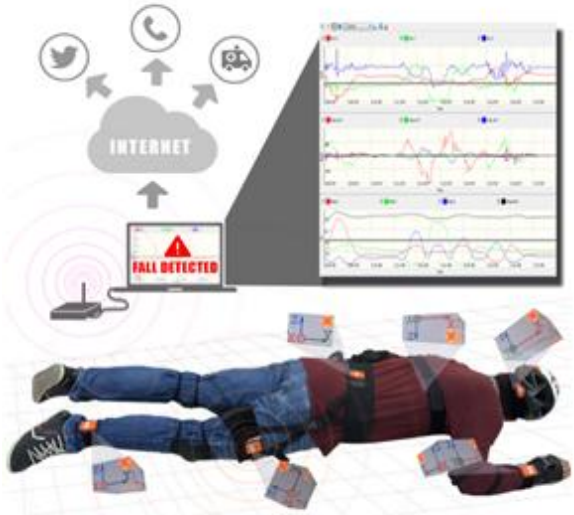
4.1 Fall detection with Mobile Device: In order to detect a fall, the application on the smart phone must be able to distinguish between what is and what is not a fall. For the purpose of this project and as suggested by the three stages of a fall were defined as:

1. The detection of a free-fall phase;
2. The collision of the person with the floor; and
3. The person entering a rest state.

Accelerometers are common in smart phones and smart devices, such as tablets and smart watches. The accelerometer in these devices read accelerations in the three-dimensions (x, y, and z). By finding the magnitude of a reading, the situation the device is in can be evaluated. For example, if a phone is dropped while its accelerometer is streaming, the magnitude of the acceleration will spike when it hits the floor, signal that a collision has occurred.







4.2 Testing and Data Collection : The first stage of this work involved designing a basic application to collect real-time accelerometer data from an Android device. Android platform offers three settings for the delay of data collection from the accelerometer: normal, game, UI, and fastest. For the purpose of the data collection, the "fastest" setting was used in order to obtain more accurate readings. Using this, the basic application collected thousands of data points from the accelerometer into a comma-delimited text document that was saved onto the mobile device

Once completed, testing began in a safe environment where a test subject fell, jumped, walked, ran, and dropped the phone. Multiple samples were taken from each of the different situations. Each situation was shown to have a unique set of conditions, as illustrated in Figures Though there were similarities in the dynamics of accelerometer readouts between a person falling and the mobile device, the person falling with the telephone in their pocket collided with the floor at a higher magnitude compared to when the phone fell to the floor on its own.

4.3. SMS Send and Alarm: In the emergency notification process, the mobile phone starts an alarm message on the screen and records the alarm time after detecting fall. When user receives the message, they can determine whether healthcare assistance is required or not. In this step, we further design an interface which allows users to manually disable the alarm to avoid false positive and to reduce transmission costs. If the user stops the alarm in time, then the algorithm backs to the monitoring stage. If not, the mobile phones alert pre configure emergency contacts through message. We assume that the mobile phones contained the SIM card and can send message through the telecommunication company

4.4 Event: The Event shows the sensitivity versus specificity in different phone-attached locations based onthe overall acceleration. For each location, we adjust the thresholds and compute the sensitivity and specificity, as indicated by the markers of each line. This is also known as receiver operating characteristic curve. This clearly shows the tradeoff between sensitivity and specificity. A higher sensitivity is always gained at the expense of a low specificity. That means that determining the threshold should consider the balance between sensitivity and specificity

4.5 Implementing the Algorithm in a Mobile Application: The basic application that collected real-time accelerometer data was further modified in order to utilize the algorithm during runtime. With the algorithm in place, a series of tests were performed to determine the thresholds, ranges, and times for each stage of the fall. The ranges and thresholds are needed to account for minor variations in the hardware of different smart phone models and manufacturers. By having a predetermine range that is acceptable for each condition, the application Can be used universally across each device

5. CONCLUSION

The result of this experimentation can be used in many ways and the produced framework for fall detection on mobile devices. Firstly, the research can be expanded into a more complex application for fall detection. The basic applications designed in the process did not include dialling for assistance. The user interface was very basic and was not subjected to any degree of usability testing. This application can also be extended to different smart devices instead of smart-phones. Ideal devices for this research would include the smart-watches. The use of a smart-watch would eliminate the possibility of the telephone falling by itself and potentially causing a false-positive fall

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