Accident Detection System

Aswathy James[1] Nimmy Rose Sam [2] Neena K Pius[3] Jito Tomy Joseph [4]
[1, 2, 3, 4] Amal Jyothi College of Engg. (Mahatma Gandhi University) Kerala, India

Abstract---Accidents like falls in people can happen due to reasons like old age, unconscious mind and poor motor control. Such accidents may result in broken or fractured bones, cuts, and even death. Living with the fear of falling leads to isolation, worsening of mental health, and general degradation of quality of living. If the accidents cannot be prevented, the next best option is detecting them accurately, and alerting the required authorities for medical help. This paper introduces an accident detection mechanism with the help of the Smartphone. Smartphone's gather the information using the Built-in tri-accelerometer and the data obtained from the accelerometer are analyzed using the displacement based algorithm. On detecting an accident, the user is prompted to respond and can use touch or voice recognition to reduce the false positives. If the user is not responding within a period of time, the application generates alerts like emails and text messages and alerts the predefined contacts. If any unconscious situations occur, the user can press the panic button and the appropriate message/audio/video/image will be sent to the predefined contacts.The system also provides the hospitality facility.That is by providing the details of the nearest hospital.

Keywords : Android, Fall detection, Displacement based algorithm

I. INTRODUCTION

Accidents Falls are defined as an unexpected event in which the participant comes to rest on the ground, floor, or lower level. A variety of reasons like poor motor control, old age, dementia, learning disabilities etc contribute to falls in people. So the accident falls represent a serious problem among the people. According to WHO, one out of three adults age 65 and older falls each year. Falls are the leading cause of injury-related death among this population. Falls are also the cause of nonfatal injuries like broken or fractured bones, cuts and abrasions, and soft tissue damage, and hospital.

Accident detection system is a mechanism which provides a way for the user in case a free fall occurs. Free fall includes falling from stairs , accidents etc. In case where a free fall occurs the user gets an alert and if the user is not responded then the condition called free fall occurred. Then a message is sent to the predefined contacts which can be a phone number or an email id is sent from the victims android phone .The message contains the location using the GPS facility of the smart phone.The system also provides hospitality facility .That is by providing the details of the nearby hospital so that the victim will get the medical help by reducing the time and effort.

II. EXISTING SYSTEM AND DRAWBACKS

Current Methods for Automatic Fall Detection includes the following.

Falls that occur in isolation, immediate help by detecting it quickly and accurately is an important factor.

For this purpose Personal Emergency Response Systems which will detect the fall by generating alerts. It will also reduce the time between the fall and the arrival of the medical attention. PERS uses pendant for the alert generation but it will not work if the person is unconscious.

In order to classify the fall automated fall detecting systems use one of the three methods which include Vibration recognition,image recognition,worn devices.

- *Vibration recognition:* It contains a device which is inplanted on the groundor floor in order to monitor sound or the vibration.By comparing the vibration frequency it is easier to identify the fall.
- *Image recognition:* This is done by placing a camera in a fixed location and the movement patterns are recorded.The system adapts to the locations in which a single human enters/exits the room and remains inactive (lying/sitting on bed/chair). Common paths from entry points to inactive areas are then traced and remembered. It suspects a fall if a person becomes inactive in the middle of a common path. It have the disadvantages such as if the person is outside the monitored area the system become ineffective.
- *Worn Devices:* In this the user need to wear external sensors and it will uses a tri-axial accelerometer. If a specific pattern or threshold is broken, the device alerts a wireless receiver, which then alerts emergency contacts. It also faces some problems such as inconvenience and affects the daily activities of the life.
- *Recognition by acceleration threshold:* This system detects fall condition by analyzing acceleration data from an accelerometer. If the amplitude of the acceleration crosses the lower and upper thresholds and if there is a change in position then fall condition is detected.

III. PROPOSED SYSTEM AND ADVANTAGES

With advancements in mobile technology smart phone prices have reduced significantly resulting in smart phones becoming easily affordable for all. Most of these smart phones have an in-built accelerometer which is generally used for user interaction and orientation detection. Same accelerometer can be re-used for fall detection, eliminating the need of any additional hardware or sensors and thereby reducing the cost involved. Smartphone also have the necessary capabilities for alerting in case of such emergency conditions of fall, by SMS, GPRS, call etc. GPS capabilities in smart phone can also be utilized to append the geographic location to the ongoing alert message making the alert more effective and precise.

The main objectives of our project can be listed as follows:

1) Eliminating the need of any additional hardware or sensors.
2) Cost effective fall detection mechanism.
3) Avoid the false positives: By analyzing data obtained from accelerometer with displacement based algorithm and prompting the user for touch or voice.
4) Provides effectiveness, accuracy, ease of use, consistency, simplicity, attractiveness.
5) Easy to handle.

IV. Displacement Based Algorithm To Detect Free Fall

In Fig. 1, the algorithm is used to verify free fall condition as soon as close to 0 readings are recorded from the accelerometer:

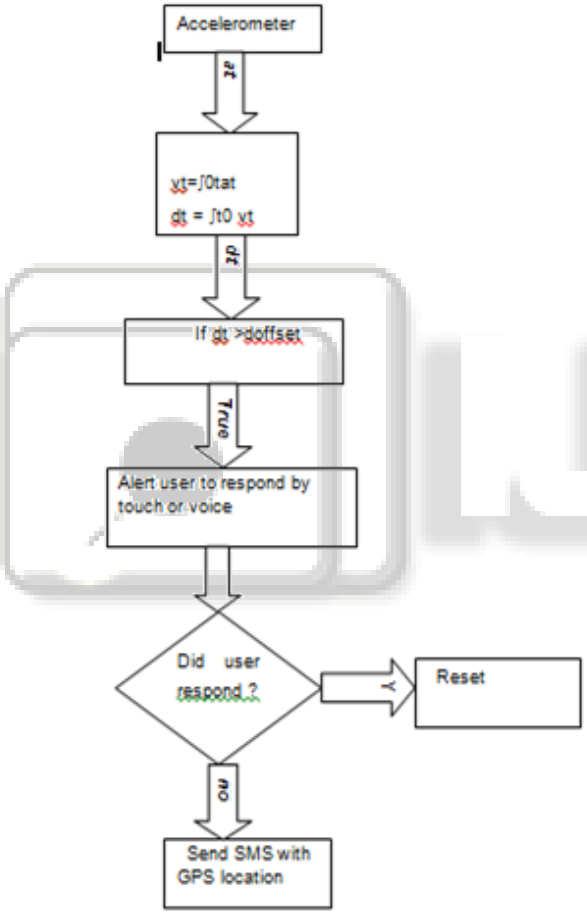

Fig. 1: Displacement based Algorithm to detect free fall

If at ~ 0

Then vt = $\int 0t$ at dt

And dt = $\int 0t$ vt dt

If dt >doffset Then return True Else return False

Here at represents the acceleration at some point of time t where close to 0 values are recorded. vt represents the velocity value obtained by integrating at over time. dt represents the displacement obtained by integrating vt over time. In this algorithm value of acceleration (at) is analyzed for the time it was close to 0. We obtain the net displacement (dt) for the time during which acceleration was close to 0. If the obtained value of displacement (dt) crosses a threshold pre- defined value (doffset) then free fall condition is confirmed. Above threshold pre-defined value (doffset) can be experimentally analyzed which will assist in eliminating the false positive conditions like running, jumping etc.

In cases of false positives like running, jumping etc. the net displacement will be close to 0 whereas in case of actual fall the net displacement will be something > 0 and hence choosing the value of doffset will eliminate most cases of false positive.

If the free fall condition is confirmed then the user is prompted to respond by touch or voice within a time period. If the desired response is obtained from the user by touch or voice then system is reset. If the user does not respond within the stipulated time by touch or voice then the fall condition is confirmed and SMS is sent to some pre-defined contact number/s with the geographical location of the event using the GPS facility of the smart phone. This will help in considerably reducing the time to get medical help as the exact location of incident of fall would be clearly known from the GPS co- ordinates. This system can be illustrated by the block diagram in fig.1.

V. Challenges

The main Challenges faced by the system are as follows:

***Challenge 1**: Performance under real-life conditions*

Fall detectors need to be as accurate and reliable as possible. A robust fall detection system should exhibit both high sensitivity and specificity. This is sometimes reached in experimental environments, but when applied to a real situation, the detection rate decreases.

***Challenge 2**: Usability*

Smartphone-based fall detectors are attractive because of the widespread use of phones, even among the older population. Studies show that the chances for carrying the smartphones by the people in pockets or handbags are large. Future smartphone-based detectors should not limit the placement of the device to a single part of the body (waist, wrist, chest, etc.). Smartphones should be used in a normal way, with no restrictions regarding their position or functionalities. This may lead to lower detection rates.

***Challenge 3**: Acceptance*

Little is published about the practicality and acceptability of the technology. Elders' acceptance poses a major problem since they may not be familiar with electronic devices. To overcome this challenge, the way the system operates is essential [59]. The detector should activate and operate automatically, without user intervention. Vision systems, like other non intrusive methods, are very good in this sense. However, some wearable devices like smartphones have other advantages that can help to improve the acceptance of fall detectors. They can operate both indoors and outdoors and integrate not only fall detection but also other healthcare applications in the same device. In this way, the traditional reluctance to carry different devices, each one targeting a specific function, would be overcome.

VI. . FUTURE WORK

In future this system could be tested on different human subjects, in different situations, to store the pattern of acceleration changes under different activities (like sitting, running, lying etc.). This stored data then can be generalized based on age, height, weight etc. Then a more complex pattern matching can be done, based on the stored data, before passing it to the displacement based algorithm. Android platform has other smart capabilities of orientation sensing and magnetic compass sensing. These additional sensing capabilities can be explored to help in minimizing the conditions of false positive. If the recipients of message does not respond then the message will be passed to care unit

VII. CONCLUSION

Free fall detection is a cost effective fall detection mechanism in common commercially available electronic device without the need of any additional hardware. The false positives are greatly reduced by analyzing data obtained from accelerometer with displacement based algorithm and prompting the user for touch. If there would be any false positive escaping out of the displacement based algorithm, it would then be filtered out by the user prompt thereby effectively yielding little or no false positives. Using cheap hardware and open source software stack, we propose a system for complete monitoring as well as response system in case of fall condition. We also introduce a panic button within the mobile phone for helping the person if any unconscious situation will happen. Also it introduces the facility of capturing the image or video or audio for the person who presses the panic button. Mobile phones have become vital part of every one's daily life and are more widely used than any sensor. Mobile phones will be accepted more widely and comfortably as the free fall detection device than any other similar hardware or sensors.

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