A Sovereign EBB Detection and Alerting System Based On Mobile Omnipresent Computing

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Abstract*: The Leading health problem in older community is fall. Nearly 70% of the older people are suffering from fall which may leads to death. This paper presents information about sovereign ebb detection and alerting system by utilizing a mobile Smartphone and a wearable singlet. The system mainly consists of a main board which comprises of a 3-axial accelerometer, gyro meter and a Bluetooth device which are reinforced into the singlet which is worn by the elderly people. The singlet conquers the data about the activities in daily life (ADLS) of senior citizen by use of sensor and sends this to mobile phone by using the Bluetooth device. The mobile Smartphone phone is provided with the threshold based ebb detecting algorithm founded on 3-axial accelerometer and gyroscope. Whenever a ebb has occurred the mobile phone can intimate the fall to family member and a primary healthcare centre by sending an emergent text message (ETM) and a emergent call (EC) along with location of fall by using the GPS technology so that a better intervention is provide as early as possible. The system can also be used to track the position the elderly people and intimate same whenever the crosses premises of the health care system and this system can also used to track the position of the student in the school premises.

***Keywords*: 3-axial accelerometer, Emergent Text Message (ETM), Emergent call (EC), Thresholds, wearable singlet, GPS technology.**

I. INTRODUCTION

Falls and fall related injuries are major health care issues in older people and this is increasing day by day with ageing problem of the elder people[2][3]. These fall results in increasing the disability which in turn increasing mortality rate and morbidity [1]. With increasing population of the old people the developed countries need to develop healthcare systems that should ascertain the safety of the older people not only at the home but also about the live tracking of the older people [6].In this modern world it is showing that older people are ready to accept new technologies that should accompany them and provide independence in normal activities and also safety [9]. The immediate fall detection leads to the reliable and adequate medical support [7].Research work is going on to develop system that could detect fall and intimate it to the concerned caretakers so that a better medical treatment will provided [4]. The centre for disease prevention and control forecasts that nearly one third of the people among older fall every year [1]. Different technologies have proposed to detect the fall. The technologies include locating the joint positions in the body and then by using these joints the body motion and posture can be estimated [5].

Thosiyo Tamura[2] discovered a system that detect the fall and also subsequent activities to reduce the fall related injuries. The system consists of a fall detecting algorithm based on the data obtained by the 3-axial accelerometer sensor. The system detected the fall 300 ms before the fall. In order to reduce the fall related injuries he incorporated a wearable air bag system that inflates whenever acceleration and angular velocity signals from accelerometer and gyro meter would trigger the inflation part of the airbag of capacity of 2.4L.This paper is presenting an advanced fall detection system that could detect and alert occurrence of fall by using the Smartphone and intimate the fall to the concerned persons of the older people. The system consists of 3-axial accelerometer incorporated in wearable singlet that captures the values of the daily living activities of older people. The GPS module incorporated in the system helps to capture the live tracking of the older people and intimate the location of the seniors by using ETM and Emergency phone call (EPM).

II. OBJECT AND METHODOLOY

The object of this paper is to detect the occurrence of fall and intimate it to the concerned caretakers of the seniors. To monitor the acceleration of person the system is equipped with low power consumption batteries. This system is very small and comfortable to wear. To evaluate the acceleration the system is provided with 3-axial accelerometer. This small and highly sensitive sensor would detect acceleration, inclination and also the vibration by measuring the movement in X-,Y-,Z-axis simultaneously. The 3-axial accelerometer comprises of a mass at centre of sensor which is narcotized with piezo resistive material.

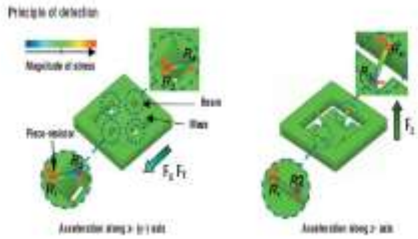

Fig1: working principle of 3-axial accelerometer.

When the MEM is subjected to acceleration in any of direction the movement of mass gets beam to deform so that there occur change in resistance in piezo material. This makes the sensor to detect the acceleration motion but in circuitry amount of deflection along each axis and translates in to data.

To obtain the acceleration a sensor is integrated with class 4 Bluetooth on a main board and it is mounted in a singlet or it can attached to belt and it is used to transmit data to smart phone. The 3-axis accelerometer has a full scale range of ±3g. It can quantify the static expedition of gravity in tilt-sensing applications, as well as dynamic expedition resulting from kineticism, shock, vibration. Phase sensitive demodulation techniques used to find out

Fig3: 3-axis accelerometer.

the magnitude and direction of the acceleration Bluetooth has a range of 10 meters and a transmission rate of 2Mbps.The sensor reads the data of the daily living activites of the older people and transmits data to the mobile smart phone. Falls are distinguished by acceleration and angular velocity. In order to differentiate the falls and daily living activities pre experiments were conducted. The normal activities of daily living were walking, sitting, standing etc., these are compared with the intentional fall values of backward fall ,forward fall, side fall of both left and right.The sensor node acquires the acceleration and angular velocity. The acceleration values for different daily activities is shown in figure below.

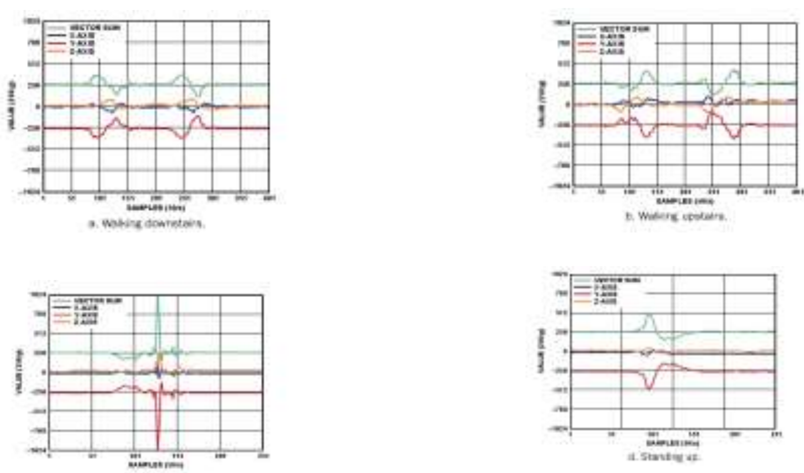

Fig2: Acceleration values for different activities of daily living

The falls are differing from the activities of daily living. These falls can be detected by considering the threshold values of intentional fall. These threshold values are taken by experimenting fall different intentional falls. These threshold values for different activities are tabulated as follows.

Type of fall	x-Axis	Y-Axis	Z-axis
WALKING	95	89	A1
	97	87	A2
	98	88	A3
ABNORMAL WALKING	96	88	A2
	95	86	A1
	94	80	A2
RIGHT SIDE FALL	A0	94	90
	A3	98	92
	A3	91	98

Table1: Sample values of daily living activities and intentional fall

III. FALL DETECTING ALGORITHM

As per the data mentioned, a fall detection will occur only if the resultant acceleration is greater than the thresholdig acceleration α_T total deflection angle is greater than Θ_T. The falls are transitory and always less than 2seconds, detection can be difficult. The algorithm for fall detection is figured as below.

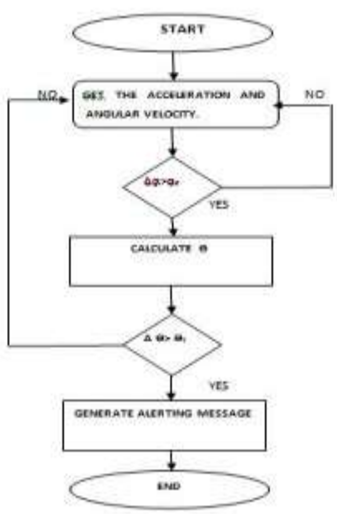

Fig4: Fall detection Algorithm

The figure shown above is the flow chart of the threshold based algorithm on the 3-axial accelerometer. The step by step procedure is as follows.

Step1: system initialization takes place. That means initialize the acceleration.

Step2: system continuously read the values of the 3-axis accelerometer sensor readings. The above secured data is stored in buffer for two seconds and then updated since it is circular queue. Each time new data is overwrite on the previous data.

Step3: At this stage the system checks whether the final acceleration is greater than the threshold one. If the final acceleration is greater than the threshold one then it will jump to step2. If it is greater than the threshold one then it will calculate the angular velocity. If this angular velocity is greater than threshold then it would be the fall otherwise the system will move to step2 to repeat the process.

Step 4: Alerting message would be generated at this stage.

IV. SYSTEM ARCHITECTURE

Considering the physical eccentric nature of the older people, the mobile omnipresent technology is introduced to develop the fall detection and alerting system. The system architecture for fall detection is figured as below.

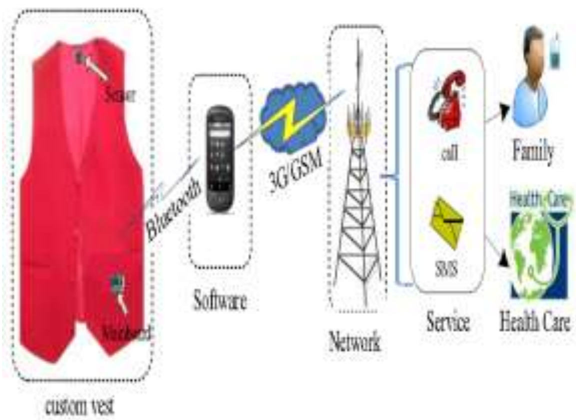

Fig5: System architecture for fall detection

The above figure shows the architecture of the system. It mainly consists of a wearable singlet and mobile Smartphone with fall detection program. The sensor reads the acceleration and angular velocities. Then it will calculate the resultant acceleration and angular velocity and sends this to mobile smart phone through Bluetooth. On receiving the data from the sensor the fall detection algorithm judges whether the people is falling or not. If it is fall then the phone can send a emergent text message[ETM] or a emergent call with location mentioning the latitude and longitude to the concerned care taker and a primary health care system..

The GPS module mounted in the system helps to track the live position of the people. The same location send as emergent text message or as a emergent call. The GPS location pictures thats attaining the position is as follows.

FIG: 6(a)

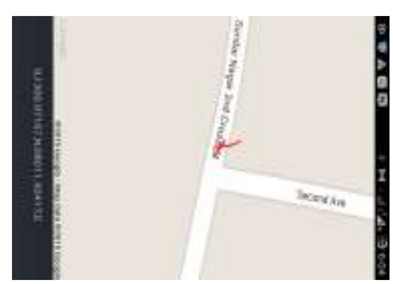

FIG: 6(b)

System showing live tracking the position of the person.

From the above figures we can observe that fig(a) showing the movement of the person as the green colour line and marks the position and movement of the person as the line. This green line marks the normal movement of the person without any fall. This normal movement may include the walking, standing, sitting. From fig(b) we can observe that there is difference in the movement of the person. This movement may be abnormal and it may be a small tilt and even a fall. The red colour line indicates the fall and even change in the tilt. The above red line indicates the right side intentional fall. At the bottom of the picture we can observe the latitude and longitude of the location.

RESULT

The final result system would send an emerging text message to the concerned caretakers and it is as shown in figure below. The system would send the same emergent text message when the school children are crossing the boundaries of the system.

FIG: **An Alarm message to caretakers with the GPS location**.

CONCLUSION

Taking this into account and results obtained, it can be concluded that this system is able to detect the fall and can provide am emergent text message to the concerned taker takers of the old age people which helps to provide the emergent medical services to the injured people. This system helps to reduce the unintentional falls that would occur in the old age people due to age problems.

Future scope

The system reduce the injuries that occured in the old people due to the unintensional fall.The future scope of the system is the size of the sysem may be reduced and it is easy to weare and carry. The system is also designed in such a way that in future the fall is detected in a few seconds before the occurance of the fall and it can be send via ETM to the concerned person

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