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GPS BASED SAFETY WEARABLE DEVICE

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ABSTRACT

There is always an urgent need to enhance the safety of people especially elderly people, women and children. This is necessary for the old people who live alone and people who travel alone at late hours like call center employees or other people in job. This project proposes a system of alerting people in case of emergencies by using most advanced technologies. The features included in the project are monitoring a fall whether its a sudden fall or not with the help of sensors, tracking the location by using GPS, alert in case of emergencies, knowing the status of person by sending message with the help of GSM to the person whose number is registered. Thus the user can be tracked in case of emergencies by the location received in the message and major disasters can be avoided.

Keywords: Accelerometer, GPS, GSM, MEMS, SMS, URL

I. INTRODUCTION

The accidental falls among elderly people has massive social and economic impacts. In elderly people falls are the main cause of admission and extended period of stay in a hospital. It is the most common cause of death for people over the age of 70, the second for people between 70 and 80, and the first for people over 80. Among people affected by Alzheimer's disease, the probability of a fall increases by more factor . Elderly care can be improved by using sensors that monitor the vital signs and activities of patients, and remotely communicate this information to their doctors and relatives. For example, sensors installed in homes can alert relatives when a patient falls. Technological advancements in the fields of electrical, mechanical and computer engineering, particularly involving microelectromechnical systems (MEMS) have resulted in smaller and cheaper sensors that operate in a wireless manner. Most systems available commercially, or which are the subject of current research, are enclosed in small cases that can be attached to the body using bands or belts. Rescue operations may keep track of an emergency crew location by using sensor-based wearable systems including global positioning systems. Individuals executing tasks that require high levels of alertness, such as truck drivers or heavy machinery operators, may be monitored to ensure their consciousness. It is therefore evident that the field of wearable sensors for telehealth is both broad and rapidly emerging. This project focuses on sensor-based wearable systems in relation to ambulatory monitoring and presents an overview of recent developments in the field. Movement monitoring and classification are examined, along with a range of clinical applications of these ambulatory sensor technologies, with particular emphasis on falls detection and falls risk assessment.

II ALGORITHM USED

The software design of the system can be divided into two parts. One of them is the software design in wearable device, and the other is in the handset. After initialization of the system, gb would be taken from acceleration

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measurements by using a low pass filter when the elderly is standing and is compared with the threshold value, that is, the fall detection algorithm will be applied. If a fall has been detected, the wearable device will locate the user and send alarm short message to relatives immediately. Then the device will remind the elderly through buzzer. If the user withdraws the alarm by pressing a button manually, the device will get back to fall detection state and a short message will be sent to inform the relatives. The fall location information will be highlighted on a web map when the relative opens URL link.

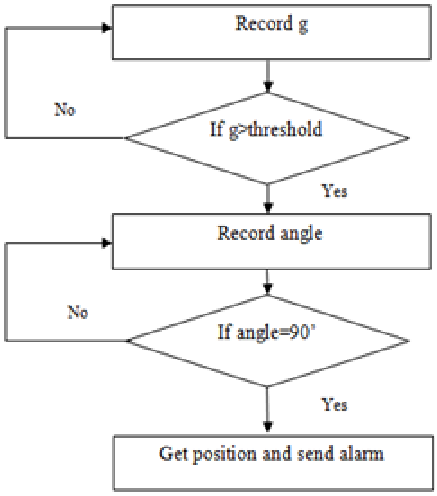

Fig .1: Project Flow Algorithm

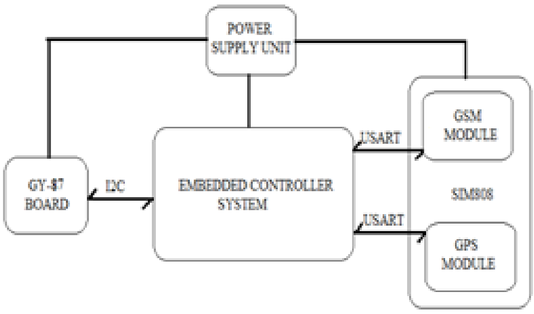

Fig.2: Block Diagram

III METHODOLOGY ADOPTED

GY-87 DOF 10 module having digital tri axial accelerometer ADXL345 is the motion sensor used in this system. The GPS service and GSM communication function are integrated in SIMCOMS SIM808 module. Arduino Uno microcontroller is used to control the whole system and imply the detection algorithm. The measurement range of accelerometer could be set at 2g; 4g; 8g; or16g; and the maximal sampling rate is 3.2 kHz. As humans activities are normally at low frequency bands, 100 Hz is a proper sampling rate for human fall detection. There is an inner digital

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filter in ADXL345 which could weaken noise and reduce the burden of digital signal processing in Arduino to some extent. The measurements will be sent through I2C(inter integrated circuit) bus communication between the sensor and the controller. SIM808 can offer GPS and GSM service on serial port communication with controller, and it can also work in low power mode. Each hardware component of the wearable device is working under low voltage and the detection algorithm does not need complex calculation resource, so the power consumption of the whole device is quite low. A 1200 mAh, 3.7 V polymer lithium battery is quite enough to provide the need of the wearable device for a couple of days.

IV SYSTEM TEST

The sampling rate of accelerometer is set at 100 Hz and the measurement range is 16 g with a maximum precision of 4 mg. Controller will read raw measurements from the mems sensors inner FIFO and apply the fall detection algorithm. The test objects are different volunteers. Based on analysis of these volunteers experiment data, athreshold and tthreshold are set as 2 g and 2 s, respectively. In order to get g when standing and lying after the fall, sum acceleration a which has magnitude between (1-0.3) g and (1+0.3) g will be considered as gb and ga. Considering that the tilt of the ground or the lying posture of the elderly may affect the rotation angle, rotation angle between (90-30) and (90+30) will inform that the elderly has fallen. System test contains five kinds of activities of daily living (i.e., walking, jumping, squatting, sitting, and resting) and four kinds of fallings (i.e., forward, backward, leftward, and rightward). Each kind of motion has been repeated 20 times on each volunteer and the detection results of the proposed algorithm and an acceleration threshold based algorithm are measured.

4.1 Location Based Service

Message is received on handset when a fall is encountered. An alarm SMS (short message service) containing a map URL has been received by the handset as shown in figure below when a fall has been detected. Clicking the URL will open a map in Web browser on which the fall location will be displayed accurately as shown in figure.

Fig.3: Alarm SMS received with URL and location

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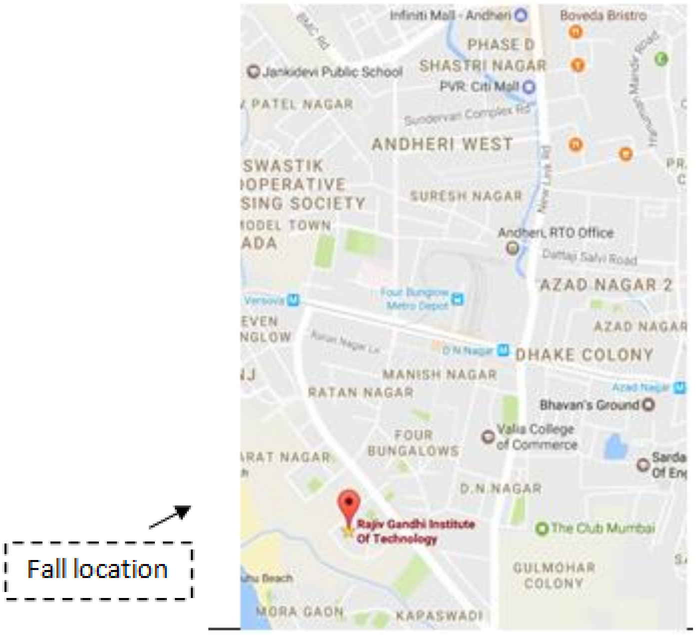

Fig -4: Location via map of URL send

V CONCLUSIONS

The proposed system will be a portable device for user, having sensors consisting of MEMS sensors and a simple algorithm using classification of fall. This system can detect type of fall from accelerometer signal using the threshold algorithm and location of the person is captured via GPS satellites . After fall is detected a message will be sent via GSM network which consists of latitudes and longitudes along with URL of location where fall has taken place. The propose system is a good alternative device to the existing approaches, and is less complex as compared to others, with high speed response it will be highly accurate and also less costly.

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