AN ENHANCED FALL DETECTION SYSTEM FOR ELDERLY PERSON MONITORING USING CONSUMING HOME NETWORKS

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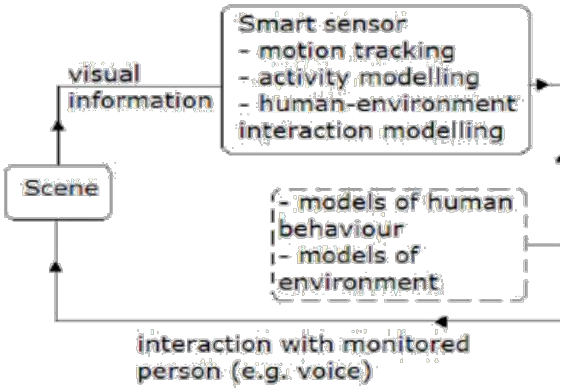
ABSTRACT

The population of 65-and over aged people in the developed countries will approach 20% of total population in the next 20 years and will obviously become a serious healthcare issue in the near future. Among the elderly, the fall events can be an unpredictable and dangerous event. Various fall detection solutions have been previously proposed to create a reliable surveillance system for elderly people with high requirements on accuracy, sensitivity and specificity. An enhanced fall detection system is proposed for elderly person monitoring that is based on smart sensors worn on the body and operating through consumer home networks. With treble thresholds, accidental falls can be detected in the home healthcare environment. By utilizing information gathered from an accelerometer, B.P. Machine and smart sensors, the impacts of falls can be logged and distinguished from normal daily activities. Furthermore, the cost of healthcare is highly related to the response and rescue time, and can be greatly reduced by fast detection and delivering signals to the specified operator for immediate consideration

I INTRODUCTION

Consumer home network usually contains various types of electronic devices, e.g. sensors and actuators, so that home users can control them in an intelligent and automatic way to improve their quality of life. Some representative technologies to implement a home network include: Ultra Wide Band (UWB), Bluetooth and ZigBee, etc. ZigBee is suitable for consumer home networks because various sensors can be deployed to collect home data information in distributed, self-organizing manner with relatively low power. Some typical applications include home automation, home activity detection (like fall detection) and home healthcare, etc.

The population of 65-andover aged people in the developed countries will approach 20% of total population in the next 20 years and will obviously become a serious healthcare issue in the near future. In China alone, the population over the age of 60 years old is 133.9 Million. Among the elderly, the fall events can be an unpredictable and dangerous event. Statistics show that one among three 65-and-over aged person falls every year. Among these fall events, 55% occur at home and 23% occur near the home. In 2003, the global number of deaths caused by fall events was approximately 391,000 and specifically 40% of the falls were from people over 70 years of age. Thus, reliable consumer based fall detection systems need to be designed, tested and commercially deployed to countries all around the world. Furthermore, the cost of healthcare is highly related to the response and rescue time, and can be greatly reduced by fast detection and delivering signals to the specified operator for immediate consideration.



II EXISITING SYSTEM

Many previous and current research projects use medical sensor networks to identify and track human activities in daily life. In order to monitor, detect and report time-critical events such the urgency of the situation can be evaluated, and co-ordinated in a number of ways and in a timely manner. The reason is that it is very expensive for the base station or the sink node to accumulate information from every sensor node and identify them in a centralized manner.

WEARABLE BASED METHOD:

Wearable based methods often rely on smart sensors with embedded processing. They can be attached to the human body or worn in their garments, clothing or jewellery a three-step detection scheme which consisted of an accelerometer, audio, image and video clips. Its innovation was to detect falls by leveraging a tri axial accelerometer, speech recognition, and on-demand video. In HONEY, once the fall event was detected, an alert email was immediately sent and the fall video was uploaded to the network storage for further investigation. They found that the sensitivity and specificity on real falls are much lower than that in an experiment environment. This inspires researchers to take more real world scenarios into consideration.

VISION BASED METHOD

Vision based methods are always related to spatiotemporal features, change of shape, and posture.

A vision based fall detection method by applying background subtraction to extract the foreground human body and post processing to improve the result. To detect a fall, information was fed into a directed acyclic graph support vector machine for posture recognition. This system reported a high fall detection rate and low false detection rate. Rougier et al Analysed human shape deformation during a video sequence which is used to track the person's silhouette.

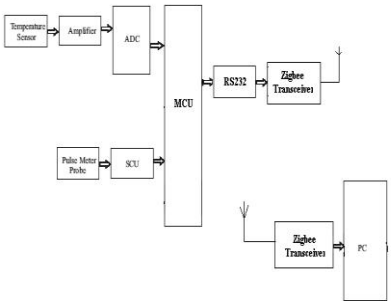
AMBIENT BASED METHOD

Ambient based methods usually rely on pressure sensors, acoustic sensors or even passive infrared motion sensors, which are usually implemented around caretakers' houses

The fall detection sensors are linear arrays of electret condensers placed on a pre-amplifier board. In order to capture the information of the sound height, the sensor array was placed in the z-axis. Experiments verified that the proposed classifier outperforms the conventional classifiers in its one-pass training and with higher distinguishing capability. Yan et al. addressed the perceived invasive nature of these wearable devices by developing a system that did not necessarily require the user to be wearing a sensor, yet was able to detect the user's location based on observations of interaction with the home-installed sensor network. Video based methods are usually more accurate than wearable based and ambient based methods. However, these systems often suffer from high risk of privacy and the prohibitive cost implementing the

cameras. Thus, wearable sensor based methods are considered in this research.

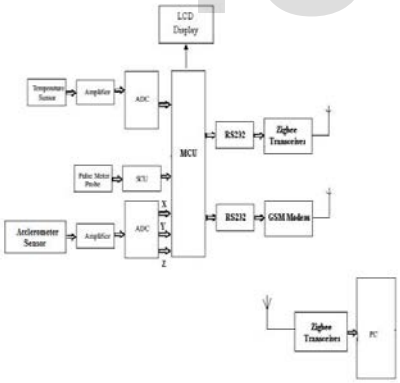
EXISTING SYSTEM WITHOUT GSM



III PROPOSED SYSTEM

Wireless-sensor-network-based home monitoring system for elderly activity behavior involves functional assessment of daily activities. An enhanced fall detection system is proposed for elderly person monitoring that is based on smart sensors worn on the body and operating through consumer home networks.

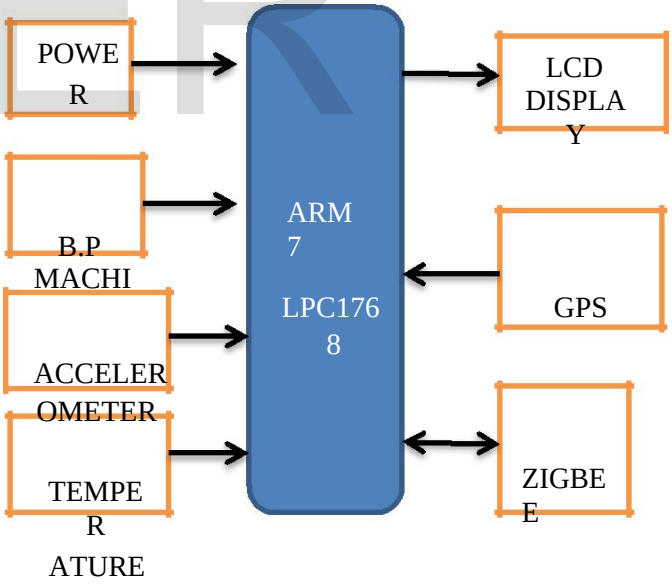
PROPOSE SYSTEM WITH GSM



IV ARCHITECTURE DIAGRAM

SENSOR SECTION

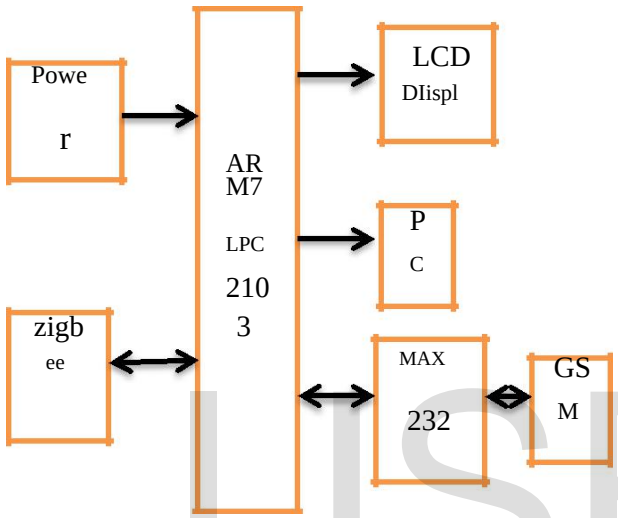
The structure of proposed fall detection system is shown in whose core structure is based on a Micro programmed Controller Unit (MCU).The Accelerometer sensor, BP machine and other smart sensors including temperature sensor all integrated on one single board, recording real time acceleration and Temperature of the body is measures and send to the Microcontroller. The MMA7660FC is a ±1.5 g 3-Axis Accelerometer with Digital Output (I2C) is used to find the fall of the elder person. The DS1621 Digital Thermometer is used to detect the body temperature of the elder person. These digital outputs are continuously monitored and send to the LPC 1768 microcontroller. If the threshold value of the Accelerometer is exceeded then it checks for the Blood pressure of the person. And these values are displayed on the LCD. Whenever the fall is occurred to differentiate the accidental fall from the Normal daily activities Blood pressure of the person is measured. These data is transmitted to the data storage section wirelessly by using Zigbee technology



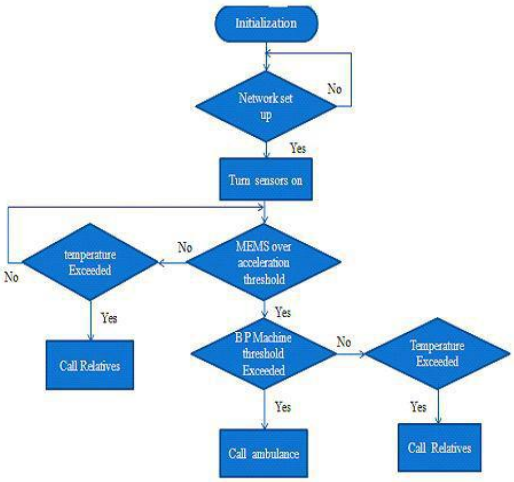
DATA STORAGE SECTION

If the fall of the person is conformed as accidental then the message is send to the either to relatives or to the Ambulance by using GSM. If the BP of the person is exceeds the threshold value then the message is send to the Ambulance along

with the GPS location. So that, they can find the location of the elderly person easily and can give the treatment at the early stage only. And the data is stored in the Personnel computer to identify the patient condition for the complete day, which is useful for the personnel doctor to give the right treatment. The data is transferred from the microcontroller LPC 2103 to the PC by using Ethernet and its architecture



DATA FLOW DIAGRAM:



Steps to Implement the Proposed System:

- ☐ Give the power supply to the hardware board.
- ☐ Set up the Network and make sure that both Zigbee modules are in the network range.
- ☐ Turn on all the sensors.
- ☐ Collect the data from the MEMS accelerometer.
- ☐ Find whether it exceeded the threshold value of the MEMS accelerometer.
- ☐ If it not Exceeded then check for the temperature threshold value.
- ☐ If the temperature threshold value is exceeded then send message to the relatives. If not go to the step-4.
- ☐ Once MEMS threshold is crossed then check for the Blood pressure threshold.
- ☐ If Blood pressure Threshold is exceeded then send the message to the Ambulance along with the GPS location of the elder person.
- ☐ If Blood pressure is not exceeded then check for the Temperature of the person, if it exceeded then send message to the Relative.
- ☐ If temperature is not exceeded the threshold then go to step-4.

V MODULES

HEART RATE

Heart rate is a term used to describe the frequency of the cardiac cycle. It is considered one of the four vital signs. Usually it is calculated as the number of contractions (heart beats) of the heart in one minute and expressed as "beats per minute". See "Heart" for information on embryo fetal heart rates. The heart beats up to 120 times per minute in childhood. When resting, the adult human heart beats at about 70 bpm (males) and 75 bpm (females), but this rate varies among people. However, the reference range is normally between

60 bpm (if less termed brady cardia) and 100 bpm (if greater, termed tachycardia). Resting heart rates can be significantly lower in athletes. The infant/neonatal rate of heartbeat is around 130-150 bpm, the toddler's about 100–130 bpm, the older child's about 90–110 bpm, and the adolescent's about 80–100 bpm.

The pulse is the most straightforward way of measuring the heart rate, but it can be deceptive when some heart beats do not have much cardiac output. In these cases (as happens in some arrhythmias), the heart rate may be considerably higher than the pulse rate.

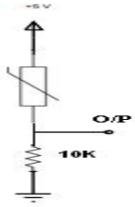
MEASURING OF HEART RATE:

- The pulse rate (which in most people is identical to the heart rate) can be measured at any point on the body where an artery is close to the surface. Such places are wrist (radial artery), neck (carotid artery), elbow (brachial artery), and groin (femoral artery). The pulse can also be felt directly over the heart.
- Producing an electrocardiogram, or ECG (also abbreviated EKG), is one of the most Precise method so heart rate measurement. Continuous electrocardiographic monitoring of the heart is routinely done in many clinical settings, especially in critical care medicine. Commercial heart rate monitors are also available, consisting of a chest strap with electrodes. The signal is transmitted to a wrist receiver for display. Heart rate monitors allow accurate measurements to be taken continuously and can be used during exercise when manual measurement would be difficult or impossible (such as when the hands are being used).

TEMPERATURE SENSOR

A **thermistor** is a type of resistor used to measure temperature changes, relying on the change in its resistance with changing temperature. Thermistor is a combination of the words thermal and resistor.

The thermistor is used to measure the temperature. Thermistor is nothing but temperature sensitive resistor. There are two type of thermistor available such as positive temperature co-efficient and negative temperature co- efficient. Here we are using negative temperature co-efficient in which the resistance value is decreased when the temperature is increased.



When the temperature is increased above the room temperature level, the thermistor resistance is decreased so variable voltage is given to ADC.

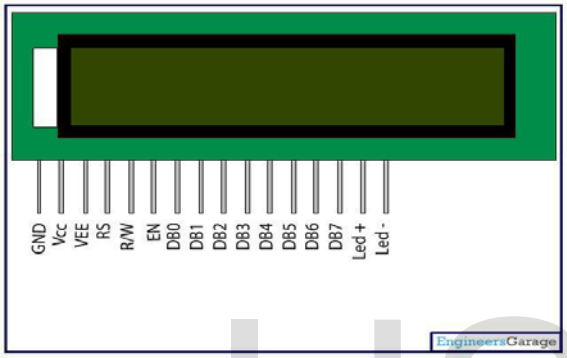
LCD (Liquid Crystal Display)

LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These

modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.

PINDIAGRAM:



GSM:

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM supports voice calls and data transfer speeds of up to 9.6 Kbit/s, together with the transmission of SMS (Short Message Service). GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. Terrestrial GSM networks now cover more than 80% of the world's population. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

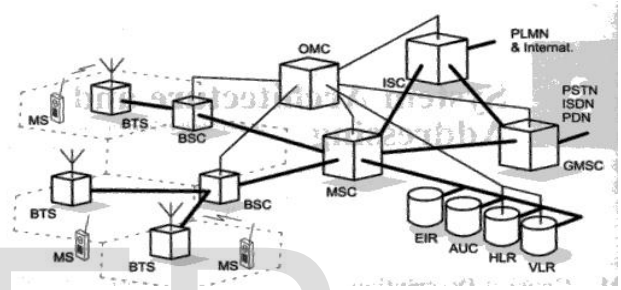
Architecture and Building Blocks:

GSM is mainly built on 3 building blocks.

GSM Radio Network – This is concerned with the signaling of the system. Hand- overs occur in the radio network. Each BTS is allocated a set of frequency channels.

GSM Mobile switching Network – This network is concerned with the storage of data required for routing and service provision.

GSM Operation and Maintenance – The task carried out by it include Administration and commercial operation, Securitymanagement, Network configuration, operation, performance management and maintenance task



VI CONCLUSION

Thus an enhanced fall detection system based on on-body smart sensors was proposed, implemented, and deployed that successfully detected accidental falls in a consumer home application. By using information from an accelerometer, smart sensor and cardiotachometer, the impacts of falls can successfully be distinguished from activities of daily lives reducing the false detection of falls.

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