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Health Monitoring System with Real Time Tracking

Ms. P Sravani, Dr.B.K.Madhavi, Ms. Giligittha Swetha

***Abstract*--With the advancement of technology in every walk of life the importance of safety of people has been increased. In this paper main priority is given to human's health condition when the accident occurs, so the injured people could be attended in lesser time by rescue team. This paper is designed and implemented to detect the health status of persons along with the tracking of persons from any location at any time. This is a system that utilizes sensing devices to detect fall events, heartbeat rate and vibration. It uses ARM7 microcontroller, GPS, GSM, MEMS sensor, heartbeat sensor and vibration sensors. The current system can be able to provide monitoring process from anywhere. The purpose of this system is to design and integrate a new system which is integrated with sensors, GPS- GSM to provide Fall detection, Heartbeat rate, Vibration and Real time tracking. Therefore we can receive running report quickly. It is completely integrated, and can be worn on wrist so that once it is implemented to people, then it is easy to track persons and condition of a person is known at any time.**

Key words: GPS, GSM, MEMS.

1. INTRODUCTION

Human health condition recognition is very important technology for some patients to monitor them in a secure way. A number of motion-tracking or movement recognition technologies and health monitoring system have been developed for human motion capture in virtual reality and biomedical applications including mechanical trackers and health monitoring using smart sensors[1].

Due to the technological and medical progress, the population of seniors keeps growing in human society [2]. Several researches indicated that when a fall accident occurs, many of them are incapable of moving their bodies or, even worse, in an unconscious state, and thus they can only lie on the ground and wait for help. As researchers also note, the longer they wait, the longer the recovery time is. Thus, it is very important that the medical treatment be provided in time.

A wide range of tracking systems have been developed so far which display their position on a map. Now a day's tracking a person's mobility has become a crucial issue . This system, is cost effective and can be used for tracking a human being using a GPS equipped mobile phone which reduces the cost rather than using a handheld GPS receiver.

2. OBJECTIVES

The main purpose of this system is to transmit the health status of a person when they are outside; by using the sensors the status of a person will be well known and to reduce the overall cost of tracking based on GPS system which is a satellite based service which is available 24X7 everywhere in the whole world. GPS system can be used to get location which includes details like latitude and longitude values[3].

This system uses low cost sensors to sense fall detection, heartbeat rate and vibration . In order to track the movement of the person we have used Google Maps for mapping and GSM to send the sms to the receiver. Here receiver is a mobile which has been installed with the google maps. Mobile phones equipped with GPS receiver are easily available in the market these days and is a booming technology these days. This cell phone technology has enabled us to communicate with almost every part of the world across the boundaries. The GSM is one of the best and cheapest modes of communication at present and in future[4].

3. PROPOSED SYSTEM

The proposed work of this project is to develop a system that can be supplemented with real-time wireless monitoring systems, which are designed and implemented through GPS network and are able to record and transmit bio-signals of persons. The aim of this project is to provide medical monitoring for a person at any time and at any place and to design a tracking system using GSM and GPS, to provide wireless system for monitoring the parameters of persons such as – Fall detection, heart beat and vibration.

A. Requirements

This system uses software modules and hardware modules to implement. It uses hardware modules such as ARM7 microcontroller to control the operations, MEMS sensor for fall detection, Heartbeat sensor to detect pulse rate of a person , vibration sensor to detect the vibration of

a person , GPS to get the locations from satellite and GSM to transmit the message to the receiver.

The softwares which can be used to implement this system are Keil µ vision and flash magic.

B. System Architecture

It is composed of two parts : Transmitter unit & Receiver unit.

a) Transmitter unit:

The transmitter unit is equipped with the sensors, microcontroller, GPS , GSM and 2 switches. Sensors such as MEMS sensor, heart beat sensor and vibration sensors are used. These sensors are used to measure the signals from the human body such as fall events , heart rate and vibration. After measurement, these analog signals are converted into digital signals and compared with the actual signals. If any discrepancy occurs between the measured signals and the actual signals, then it is considered as an emergency. The ARM7 LPC2148 processor plays an important role in controlling all the devices. It has an inbuilt A\D convertor. GSM transmitter is used to transmit the signals from the sensors which are controlled by the ARM7 microprocessor. GPS system is used to locate the position of the person.

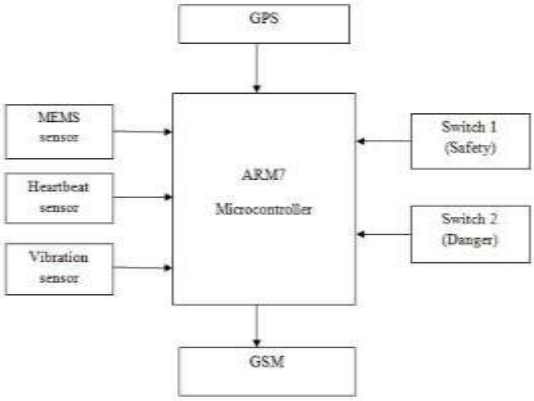

Fig 1: Transmitter unit of the system

If sensors sense the signal then that signal is collected by the microcontroller. The Microcontroller gets the coordinates from GPS and gives to the GSM. GSM transmits the corresponding message to the receiver. It uses 2 switches one is for safety purpose and another for danger. Whenever person is in danger, then person has to press danger button when there is no danger person has to press safety button.

b) Receiver unit:

In this system receiver is a phone which has in built GPS. Upon receiving the SMS, the visual basic software sorts the person's location based on the GPS coordinates also the health status is displayed. In this way any person can be tracked along with the health condition.

Fig 2: Receiver diagram

C. Hardware Description

The heart of system is microcontroller which will access the data. In our project 'ARM' controller is used.

a) ARM 7- LPC 2148

The ARM7 is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC) [5].

This simplicity results in a high instruction throughput and impressive real time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM7TDMIS processor also employs a unique architectural strategy known as Thumb, which makes it ideally suitable to high volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super reduced instruction set. Essentially, the ARM7TDMIS processor has two instruction sets: • The standard 32-bit ARM set.

• A 16-bit Thumb set.

b) MEMS Sensor

Due to the advancement of technology and popularity of MEMS sensors such as accelerometers, gyroscopes, etc., many researchers have developed detection systems by utilizing the sensors to detect fall events. When a fall is detected, medical treatment can then

be provided in time, reducing the level of injuries that might have been higher if the treatment had been delayed.

The accelerometer is one of the most popular sensors used to detect the body motion. Chen et al. placed an accelerometer on the user's waist to detect falls. The signal vector magnitude (SVM) and the change in orientation are calculated and used for detection. Although falls can be detected by their device, some human motions such as sitting down and lying down may lead to false alarms[6].

The gyroscope is another popular sensor used to detect body motions. Nyan Tay et al. used a two-axis gyroscope and attached it to the user's chest, waist, and right arm. They detected falls by analyzing the body angel speed and the thigh angel speed. Their approach produced good experimental results on detecting falls. However, they did not consider some normal motions such as sitting down and lying down, and therefore, the practicability of the approach is still uncertain.

c) Heart Beat Sensor

Heart beat sensor is designed to give digital output of heart beat when a finger is placed inside it. This digital output can be connected to ARM directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

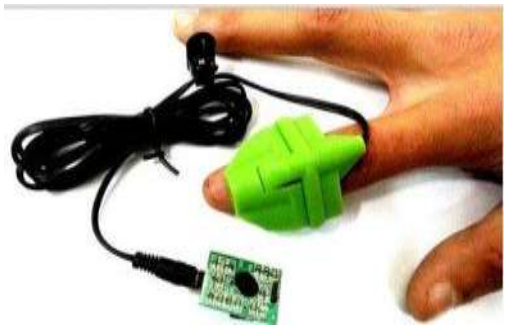

Fig 2: Heartbeat sensor

d) Vibration Sensor

Vibration sensor used to find the vibration of hands of a person when person is caused to seizures.

Vibration is a time-based (periodic/cyclic) displacement of an object around a center static position. The following contributing factors have a complex relationship with the magnitude and rate of the vibration:

The object's own natural frequencies and stiffness. The amplitude and frequencies of any external energy source(s) inducing the vibration .The coupling mechanism between vibration energy source and the object of interest.

Vibration measurement is complex because of its many components – displacement, velocity, acceleration, and frequencies. Also, each of these components can be measured in different ways – peak-to-peak, peak, average, RMS; each of which can be measured in the time domain (real-time, instantaneous measurements with an oscilloscope or data acquisition system) or frequency domain (vibration magnitude at different frequencies across a frequency spectrum), or just a single number for "total vibration."

e) GPS Receiver

The GPS smart receiver features the 16 channels. Ultra low power GPS architecture. This complete enabled GPS receiver provides high position, velocity and time accuracy performances as well as high sensitivity and tracking capabilities[7].

The Method of Tracking: The tracking method is based on the process of collecting continuously the coordinate (latitude, longitude) of mobile vehicle that could get from GPS receiver. After getting the coordinate, the remote soldier unit will send it to the army unit via GSM[8]. The army unit will receive the coordinate of the soldier then displays on the screen.

Fig 3: GPS Receiver

f) GSM Hardware

The core of data communication about this system lies in wireless communication control terminals that uses GSM Modules to transfer long-distance data extensively and reliably. It Support instructions of AT commands. SIM300 can be integrated with a wide range of applications. SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz SIM300 provides GPRS multi-slot class 10 capabilities and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS- 4. With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in our application[9]. Therefore, the MCU can connect with GSM modules very expediently through serial interfaces.

Fig. 4: GSM modem

4. SOFTWARE DESIGN

This includes the coding of ARM 7 processor. This total system is programmed with the embedded c code and compilation has been done with the keil µ vision and flash magic softwares.

5. EXPERIMENTAL RESULTS

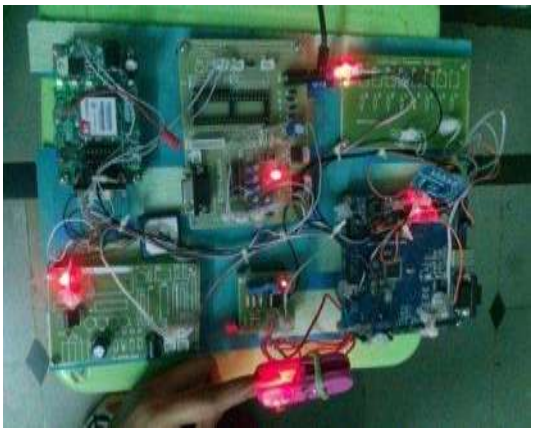

Fig 5: Transmitter unit

The above figure is a transmitter unit. The 3 sensors has been connected to the controller. Whenever these sensors senses the signal that signal is transmitted to the receiver by using GSM along with the coordinates.

Fig 6: Receiver unit

In this system receiver is a mobile phone with GPS installed. For example, if heartbeat of a person increases or decreases then that information can be received in the form of sms as shown above. For remaining sensors also the information can be received as shown above.

Here safe and danger buttons are used to transmit the information whether they are in safe or danger. Whenever the person press that button then the information can be received in the form of a sms as shown above.

4. CONCLUSION

From the above designed project it can be concluded that we are able to transmit the data which is sensed from person to the receiver by using GSM. It is completely integrated so that it is possible to track anytime from anywhere. It has real-time capability. The accuracy of system is affected by some factors such as weather, environment around GPS receiver.

5. FUTURE WORK

The future works include optimizing the hardware system, choosing a suitable GPS receiver.. A Camera can be fitted into the system so as the person's view is saved in to the database. This system has many advantages such as large capability, wide areas range, low operation costs, effective, strong expandability and easy to use. Upgrading this setup is very easy which makes it open to future a requirement which also makes it more efficient.

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ABOUT THE AUTHORS

P.Sravani is an M.Tech Student in Embedded System and Drives in Department of Electronics and communication Engineering from SWEC (Hyderabad). Earlier she has completed her Under graduation in the field of Electronics and communication Engineering from RRSCET (Medak District)

Dr.B.K.Madhavi, presently working as Professor in SWECHyderabad (Telangana).She has work experience of 23 yrs.
She has completed M.E from BITS,Pilani, Ph.D from JNTU, Hyderabad.
She has published 38 International journals and 32 national journals. She has attended national interntional conferences.

Giligittha Swetha, working as Asst. Professor in SWEC done M.Tech in G. Narayanamma Institute of Technology & Science (For Women). Published paper on Performance Evaluation of MIMO OFDM System by using Adaptive MMSE Equalizer in International journal interested area Communications and Antennas.