

Ambulance Tracking with Patient Health Monitoring by the use of GPS and GSM

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Abstract: This project work mainly sheds light on three fundamentally basic functions. First being the Patient Health Monitoring, through various biomedical sensors; second being the tracking of the Ambulance which is carrying the patient and, third being the sending of these details to the nearest Hospital or Doctor, or any authorized person in the hospital, using the GSM technology. This project work will help in finding out the location of ambulance and at the same time, monitoring the various health parameters of a patient such as temperature, humidity, heartbeat rate, blood pressure, electro cardiogram, sugar, etc. A text SMS containing location and values of all the sensors is sent to a Doctor's mobile. Or we can send this text SMS to any authorized person in the hospital. Then that person can intimate Doctor about ambulance location and patient health. By using these parameters, doctor can do the necessary preparation for treatment of the patient.

Index Terms: Microcontroller, Temperature Sensor, Heartbeat Sensor, GPS Modem, GSM Modem etc.

1. Introduction

The evolution of ambulance dates back to 14th century where carts were used to take the needed patients to the hospital, manually. As centuries rolled on, four-wheeler life saver vehicle came into existence in the form of "Ambulance" to save patients precious life which 'God and Nature' has bestowed to all man-kind.

Death rates are declining nowadays with the advent of ambulance system prevailing in modern society. Some of the death rates are due to delayed service of ambulance and delayed intimation to the hospital for the needed help. This time lag between the occurrence of any accident or unforeseen circumstance and intimation to the nearby hospital has to be reduced to save more precious life of victims. In this novel solution to save patient's life by harvesting necessary details about the victim during the onward safe journey to the hospital in ambulance.

Multiple existing concepts and some booming technologies are blended in this project work, to frame the safe and secure system for patient's ambulance service. Global System for Mobile Communication (GSM), uses Time Division Multiplexing Access (TDMA) for sending short information i.e. Short

Message Service (SMS) in mobile telephony network. GSM is the most widely used wireless telephony technology in the present world for enabling mobile communication. Global Positioning System (GPS) uses satellite for tracking the mobile enabled with GPS module. Orbiting satellites are used to send the latitude and altitude of the tracking targeted GPS enabled device, using the process of Trilateration. At least three satellites are used to track the target device and the distance is calculated using trilateration, an advanced triangulation method. The harvested information from the patient is intimated to the doctor. This novel project highlights the needed advancement and solution, to save patient's life by adding intelligence to the existing ambulance system.

1. 2. Overview

'A minute can mean everything, it can either save a life or end it.' This has been our motivation for taking up this project, which may help many people in serious or life-threatening conditions, as this will find a prominent place in hospitals for the tracking of the ambulance as well as to understand the health parameter values of the patient in real-time. Our project aims at performing three main functions. The first being, generating an SMS periodically to monitor the patient's health. The second being GSM and GPS based Ambulance Tracker which is carrying the patient, and the third one is to send the above two details to the nearest hospital. The SMS that will be forwarded to the the concerned authorities will contain the 'longitude and latitude' of the vehicle location, including health parameters i.e., temperature, humidity and heartbeat. This SMS will be sent at a periodic interval of 2 minutes.

Once the doctor or any authorized person has received the text message, then he/she can use the information provided therein to ascertain the location on the map.

The working and the applications of the technology used in this project work will be quite simple yet effective in its own manner.

The GPS modem, as it receives data from satellite, gives this bunch of data to microcontroller through serial communication. As the ambulance moves along

the way from the patient's home or address to the hospital, the co-ordinates of the ambulance's location will change and fed to the attached microcontroller. Likewise, the GSM modem will send all the details (i.e. the parameters) to the user or doctor through a text message. For sending SMS, microcontroller needs to give various AT commands to GSM modem using a serial communication port.

The objective of this project work is to help the hospital authorities to predict the arrival time of emergency cases and to do prior preparations, to improve the response time (potentially saving lives) to provide greater accuracy for allocating resources and strategic planning.

This novel project will be a boon to medical patient assistance domain to save precious patient's life.

2.1. Block Diagram of System

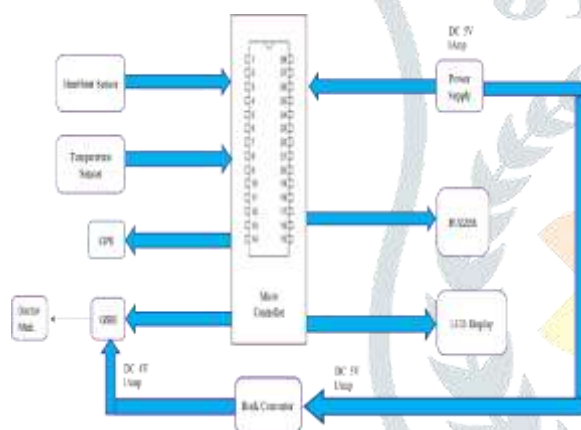


Fig. 1. Block Diagram of Ambulance Tracking and Patient Health Monitoring System

The above figure, contains the block diagram of Ambulance tracking and patient health monitoring system. This system performs three main functions. First one is Patient health monitoring; second one is tracking the Ambulance which is carrying the Patient and third one is to send above two details to the Hospital or Doctor using a GSM technology. With the help of this project, we can find out the location of ambulance and at the same time we can monitor various health parameters of a patient. These parameters are temperature, humidity and heartbeat rate. A text SMS containing location and values of all the sensors is sent to a Doctor's mobile.

2.1.1 Heartbeat Sensor

Heart beats are important for the health of a patient. Heartbeat sensor works on the principle that blood in human body pumps with every heartbeat. We have used a Biometric Pulse Rate or Heart Rate detecting sensor. The working of the Pulse/Heart beat sensor is very simple. The sensor has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry. This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed over a vein in our human body. This can either be your Finger tip or you ear tips, but it should be placed directly on top of a vein. Now the LED emits light which will fall on the vein directly. The veins will have blood flow inside them only when the heart is pumping, so if we monitor the flow of blood we can monitor the heartbeats as well. It works on pure 3.3 Volt DC.



Fig. 2. The Heartbeat Sensor Used

2.1.2 Temperature Sensor

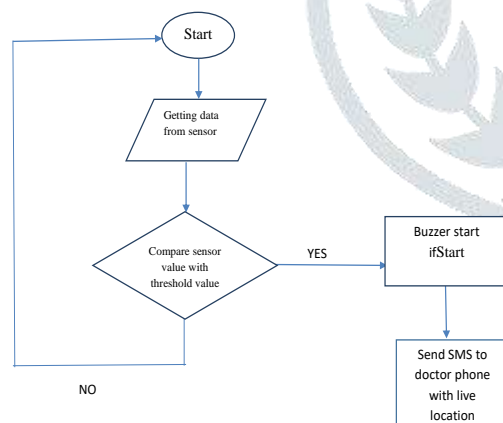
We have used a temperature sensor to measure the body temperature of the patient. This is an analog type of temperature sensor. It gives variable output voltage as per the variations in the temperature received/sensed. We have used LM35 temperature sensor in our project. The advantage of LM35 over thermistor is that, it does not require any external calibration. The coating also protects it from self-heating. Low cost and greater accuracy make it popular among hobbyists, DIY circuit makers, and students. Its operating voltage ranges from 4V to 30V.

The above figure, shows the circuit diagram of ambulance tracking and patient health monitoring system. This system is based upon GSM and GPS Technology in order to compensate for the existing health system, reduce the workload of the staff taking care of the patient, and improve the patient's mobility is specifically designed to provide better services and a better cure.

To keep the moment of the patient intact with the sensors on the body, the wireless sensors are required to be minimized and portable. These sensors are heart beat sensor, temperature sensors which are the basic requirements of a patient. Temperature sensor used here is LM35 which is a precision integrated device.

For controlling action, AVR Microcontroller is used. It is an 8-bit microcontroller with inbuilt 128 bytes of internal random access memory, 4K read only memory, timers/counters, four general purpose input/output ports. Controller will match the limit predefined in the code of the microcontroller. GSM is required in Ambulance tracking systems because GPS system can normally only receive location information from satellites but cannot communicate back with them. Hence, we need some other communication system like GSM to send this location information to central control room.

4. Flowchart



5. Advantages

The main advantage of “Ambulance tracking with patient health monitoring system” is that with the help of GSM technology, the data of patient health can be sent to a longer distance through SMS. With the help of this, doctor could have all prior information ready in hand before the patient reaches to the hospital.

With the use of GPS technology, the exact co-ordinates of ambulance can be tracked. And then distance from the hospital can be found out. Thus, we can get /

manipulate approximate time for the ambulance to reach to hospital.

As this system is fully automated, it does not require any human interaction. This system receives the health parameter values, longitude and latitude and sends SMS automatically after a period interval of time.

6. Disadvantages

We cannot implement the GPS & GSM in each and every ambulance, it will lead to be expensive.

Also, we cannot do the many more arrangements for the patient who is in a very serious condition.

7. Future Development

We can add more sensors to monitor health parameters.

Besides, we can dial an emergency call if the patient health parameters crosses a threshold value or patient co-ordinates go out of a certain/pre-decided track.

With little bit modification, this project can also be used for “Industrial purpose”. This project can be used to track industrial vehicles carrying equipment or materials like fuel tanks, fuel containers or gas container. This system can be used in vehicle of scientific labs or industries carrying chemicals, radioactive materials and explosive materials. In these cases, we can use this project to track vehicle location, however in such applications we need to modify the project. We have to replace the health parameter sensors with respective sensors like, temperature sensor, LPG gas leakage sensor and other related sensors for the security of material which is being carried.

3 8. Conclusion

As this project is based on micro-controller and, GSM and GPS technology is used to transmit data via the text messages, this field of medicine helps the doctors to keep a keen eye on the patients' health when the patient is in ambulance. Also, the physiological parameters such as body temperature, heartbeat are monitored. The patient can be analysed by doctors in any part of the hospital wherever they are. It reduces the doctor's work load and also gives accurate result. The system can help to save a few critical minutes of response times by monitoring location of ambulance from Hospital. It uses Visual basic software at PC in monitoring system to display location of ambulance by using Google earth map and displaying SMS. After receiving SMS,

hospital can prepare their staff for proper treatment of the concerned patient.

9. References

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