

# An Intelligent Wearable E-Belt for Continuous Monitoring of Sinus Rhythm

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**Abstract** - This paper proposes a Global System for Mobile Communication(GSM) based non-invasive wearable physiological parameters monitoring system. The system can be used to monitor parameters such as temperature and heart rate of a person. The intelligent e- belt is worn on the waist of the patient to be monitored. If the sensed parameters temperature and heart beat are within the limit, then the person is said to be in normal condition ,otherwise the patient is in abnormal condition .So actually the patient monitoring system detects if a person is medically distressed and sends message to the hospital, ambulance and relatives using GSM module . The position (longitude and latitude) determined by the Global Positioning System(GPS)also specified in the message . This intelligent e-belt is helpful for physically challenged and elderly people.

**Key Words:** Physiological Parameters ,Heartbeat Rate Measurement ,Body Temperature Measurement ,GSM Module, GPS Module.

## 1.INTRODUCTION

The proposed work describes the design of a simple, intelligent, low cost Arduino-Mega based heartbeat monitoring system integrated with GPS and GSM technology .It sends a message to the relatives at the time of heart attack. The National Heart, Lungs and Blood Institute states that “more than 3 million people in India have a heart attack and about half of them die in each year. About one-half of those who die do so within 1 hour of the start of symptoms and before reaching the hospital”. A heart attack happens to a person when the blood flow and oxygen supply to heart muscle is blocked and it is mostly caused by the Coronary Artery Disease (CAD).CAD occurs when the arteries that supply blood to the heart muscle (coronary arteries) become hardened and narrowed .It often causes irregular heart beat or rhythm by blocking blood stream .The National Heart, Lung, and Blood Institute suggest that “everyone should know the warning signs of a heart attack and how to get emergency help”. With the help of the proposed system we can locate the patient when the patient has heart attack.

In the case of any medical emergency for elderly or physically challenged people suffering from heart diseases ,continuous monitoring of the patient is unavoidable. The proposed system is useful to measure the temperature and heart rate of the person and the measured parameters are transmitted to the hospital under any emergency conditions

.It also informs the relatives and ambulance driver and locates the patient using GPS and GSM technology.

This system consists of two sensors: The temperature sensor, heartbeat sensor. Using these sensors and associated components, the patient is continuously being monitored. The outputs from the sensors are processed by the AT-mega micro controller unit. The controller is programmed with temperature and heartbeat rate within a range. If the sensed parameters are not within the range, then the patient is said to be abnormal.

The temperature sensor measures the skin temperature and it gives an analog voltage corresponding to the measured temperature. A heart rate sensor is designed to measure beats per minute. The heart rate measure is based on Near-Infrared Spectroscopy (NIS). It involves light of wavelength 700 to 900 nm to measure blood volume. Heart rate sensor consists of an Infrared Light Emitting Diode(IR LED) transmitter phototransistor, and filter circuit. The light detected by the phototransistor is amplified ,filtered and send to the controller.

Through GSM module messages are send to the doctor, ambulance driver and the relatives under any medical emergency conditions. Using GPS modems location of the patient can be monitored.

### 1.1 Block Diagram of the Entire System

Fig.1 shows the block diagram of the entire proposed system. The patient observing and monitoring system includes the sensors and the micro controller which are used for patient monitoring. The system consists of subsystems such as ambulance, hospital and relatives to which alert messages are sent if any medical distress happens to the patient. The outputs from the sensors are processed by the patient monitoring system and the results are sent to the corresponding subsystems using GSM and GPS systems.

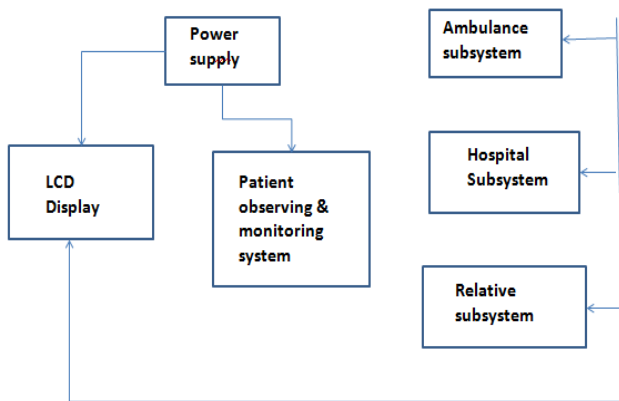


Fig-1: Block Diagram of the Entire System

### 1.2 Block Diagram of the Patient Monitoring System

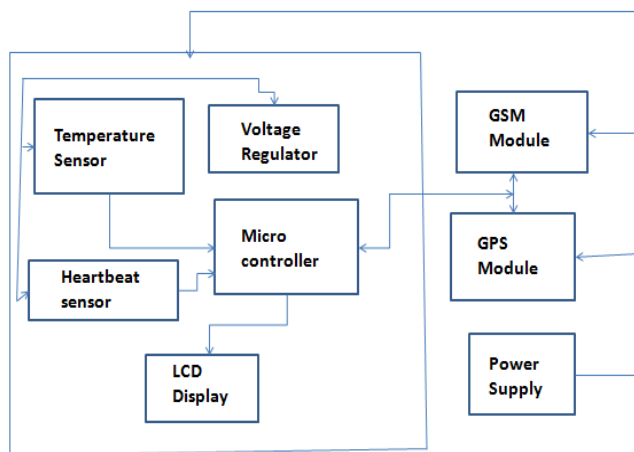
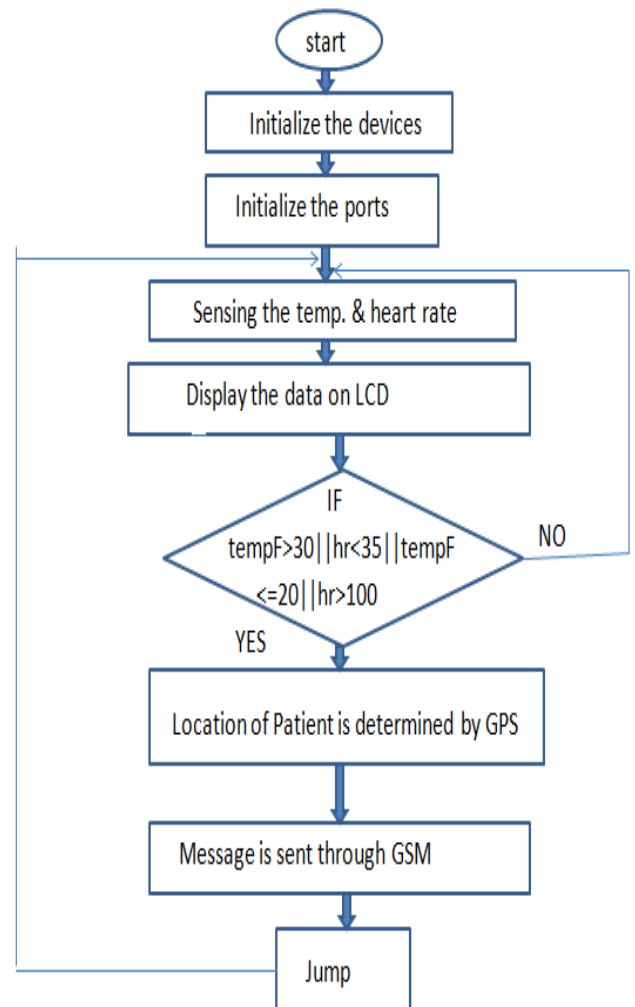


Fig-2: Block Diagram of the Patient Monitoring System

Fig.2 shows the block diagram of the patient monitoring system which consists of temperature sensor, heart beat sensor, micro controller, GPS and GSM module. Temperature sensor is used to measure the temperature while heart beat sensor is used to measure the pulse rate. The outputs of the sensors are given to the micro controller. Normally the pulse rate is 72 bpm and if any imbalance occurs to either temperature or heart rate, a message is sent using GSM module. In this system GSM is used to send message to the hospital, ambulance driver and the relatives to make aware that a patient is in distressed condition and an immediate medical assistance is needed. GPS system is used to locate the patient. The latitude and longitude regarding the location of the patient is also mentioned in the message. It helps the ambulance driver to reach the exact place and to take the patient to the hospital. The measured values are displayed through 16x2 LCD. The entire system works on a regulated 5V DC supply except for GPS, GSM modems and microcontroller.

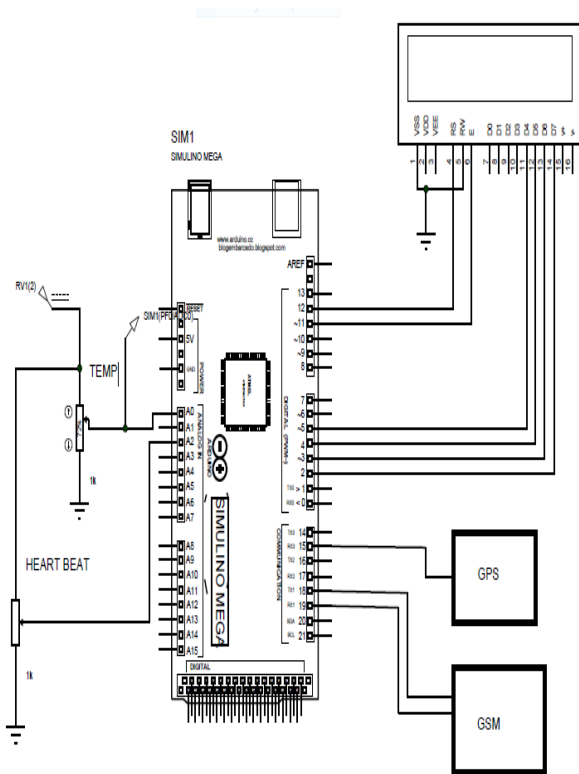
## 2. SIMULATION AND CIRCUIT DIAGRAM OF PATIENT MONITORING SYSTEM

### 2.1 Simulation



First supply is given to the system and then initialize all ports in the controller. Initially the LCD will display "PATIENT ANALYSIS "on the screen. Then the temperature and heartbeat sensor in the health monitoring system will sense the temperature and heartbeat of the patient and the corresponding data is displayed on the LCD. Then the controller will check the condition of the patient. If the temperature is within the limit 20-30 degree celcius and heartbeat within the limit 35-100 bpm , the condition is true the patient is said to be normal. Otherwise the patient is in abnormal condition and the position of the patient is located by GPS and the corresponding location ie, the longitude and altitude is send to the relatives, ambulance and doctors by using GSM module , along with the message "Plz help I am under trouble".

### 2.1 Circuit Diagram of Patient Monitoring System

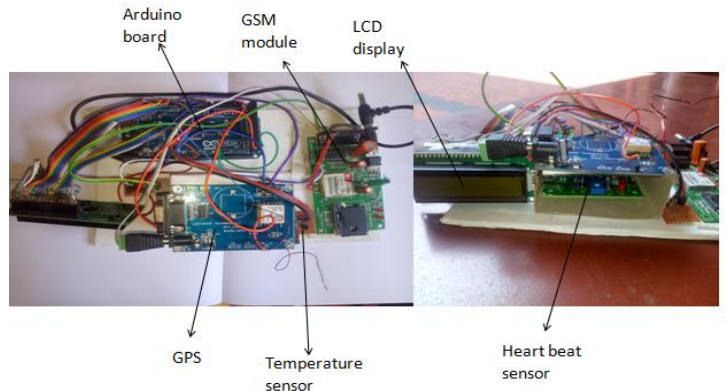


**Fig:3.1** Circuit Diagram of Patient Monitoring System

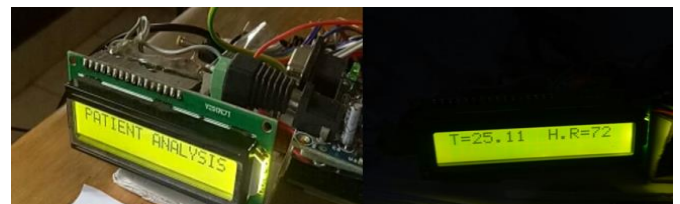
In the patient monitoring system we use the Arduino Mega development board which support ATmega2560 microcontroller .The LCD display, temperature sensor and heartbeat sensors are interfaced with the controller. The controller ,GSM and GPS requires 12V supply and the other components require 5V supply, where 7805 voltage regulator is used to regulate the supply.LM-35 senses the analog value ,it given to the arduino through the analog pin (A0).Vcc and ground are given to the respective pins of the arduino board .The reset pin of LCD is set to the pin 12,enable pin to the pin 11 and d4-d7 pins to digital ports to the 2-5 pins of arduino,5V supply and ground is also given from the board. Heartbeat sensor reads the analog value, it is given to the arduino through the analog pin (A2), Vcc (5V) and ground is also provided. If the temperature is within the limit 20-30 degree celsius and heartbeat within the limit 35-100 bpm , the condition is true and the patient is said to be normal. Otherwise the patient is in critical condition and the position of the patient is located by GPS. For that a signal has to be transmitted from controller board to the GPS, so they are connected to each other by the transmitter(Tx) and receiver(Rx) pins. The position of the patient is located by GPS and the corresponding location ie, the longitude and latitude is send to the relatives ,ambulance and doctors by using GSM module. The GSM module is interfaced with the controller and "Tx" and "Rx" pin of the GSM module is connected to the transmitter(Tx) and receiver pins(Rx) pins of the controller board.

### 3. EXPERIMENTAL SETUP

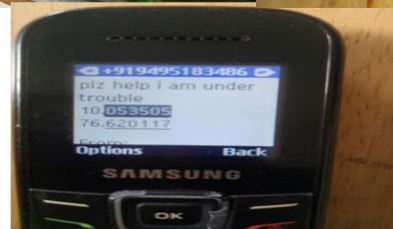
The patient monitoring system (Fig:3.1) is used to monitor temperature and heart rate of a human subject. The system consists of sensors, controller, GSM system, GPS system. During normal condition (Fig:3.2)the temperature and heartbeat rate are displayed on the screen. During abnormal condition(Fig:3.3) ,the message ("plz help I am in trouble") will be sent out along with latitude and longitude. The location of the patient is thus determined, the temperature and heart rate is also display in the LCD.



**Fig:3.1**Hardware Setup of Patient Monitoring system



**Fig:3.2** Normal Condition



**Fig:3.3**Abnormal Condition

### 4. CONCLUSION

Intelligent wearable e-belt proposes a GSM based non-invasive wearable physiological parameters monitoring system. The system monitors parameters such as temperature and heart rate of a patient.. The outputs from

the sensors were received and are processed by the micro controller. The LCD , displays the measured values. The micro controller checks whether there is any abnormality in the measured values. If there are any such problems, an immediate message is sent to relatives, hospital, ambulance driver with location of the patient, thus providing medical aid. This intelligent e-belt is hence helpful for physically challenged and elderly people.

## REFERENCES

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