

# Efficient Health Monitoring System using Sensor Networks

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**Abstract**— A special purpose sensor network designed to operate autonomously to connect various medical sensors placed on the human body. Introduction of effective medical monitoring & other applications will offer flexibilities and cost saving options to both health care professionals and patients. In this system, we effectively monitors the patients physiological status such as ECG, Temperature, systole, diastole, Heartbeat, flex, Accelerometer and successfully processed in the transmitter kit, which is attached in the patients body. In this system, describes how effective transmission of data from the transmitter kit to the receiver which is located in the hospital server. In addition to that we are tracking the patient's location continuously and make emergency rescue operation.

**Index Terms**—Accelerometer, Blood Pressure, Electrocardiogram, Flex, Heart Beat, Temperature, Weight.

## 1 INTRODUCTION

PATIENTS who have survived cardiac attack or other physiological problems are at a higher risk of sudden cardiac death. Many of these patients are living at home without any kind of cardiac monitoring systems. By using a wearable monitoring system for detection of ECG [1] it is possible to alert healthcare professional to the patient's condition so that the necessary action for an emergency rescue can occur. With the rapid advancements of wireless communication and semiconductor technologies the area of sensor networks has grown significantly supporting a range of applications including medical and healthcare systems. Recent developments in wearable biomedical sensors have opened up possibilities for continuous wireless ECG [1] monitoring systems. This section looks at the design of a wireless ECG [1] system that can be worn continuously for the monitoring of cardiac arrhythmias. The systems available today are either based on standard ECG[1] electrodes and a wired connection to a recording device or by pressing a recording device directly onto a patient's chest when a symptom arises. Real-time medical data about patient's physiological status can be collected simply by using wearable medical sensors based on sensor network. However, we lack an efficient, reliable, and secure platform that can

meet increasing needs in e-healthcare applications. Many such applications require to support multiple data rates with reliable and energy efficient data transmission.

## 2 PARAMETERS TO BE MEASURED

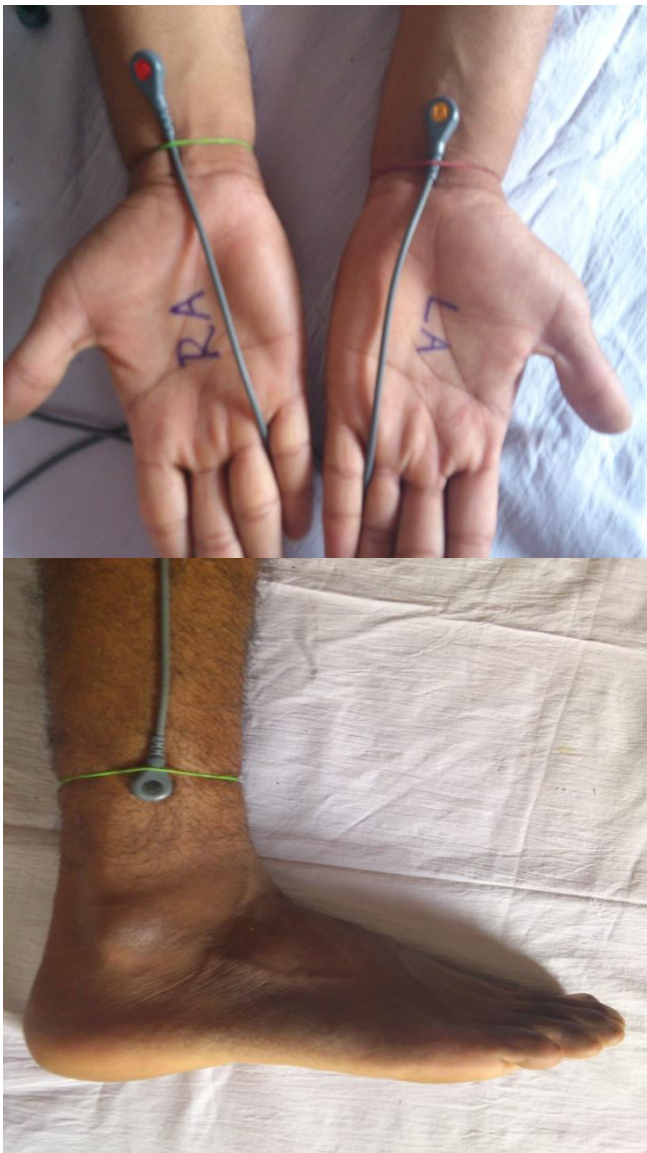
Electrocardiogram[1]	Detect heart rate and rhythm (e.g., ischemic heart disease)
Blood Pressure[3]	Hypotension, emergent hypertension, and pathophysiology
Heart Beat[3]	R-R interval in ECG signal measures the period of heart beat
Temperature[2]	Medical diagnosis
Weight[2]	A health factor related to diagnosis
Accelerometer[2]	Movement pattern analysis; measures the depth of chest compressions during cardiopulmonary resuscitation
Flex[2]	Monitoring knee movement

## 3 ELECTRO CARDIO GRAM

The leads are described by convention as follows:

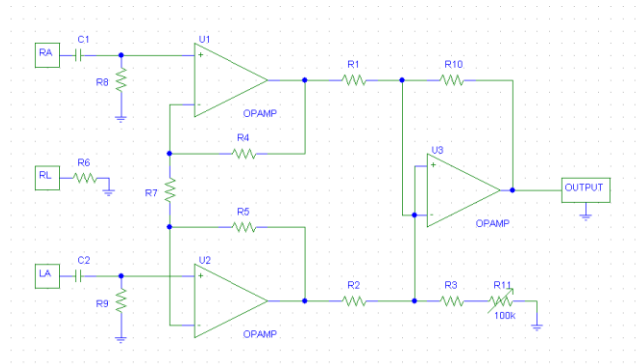
- **Lead I** - measures the potential difference between the right arm electrode and the left arm electrode. The third electrode (left leg) acts as neutral.
- **Lead II** - measures the potential difference between the right arm and left leg electrode.
- **Lead III** - measures the potential difference between the left arm and left leg electrode.

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**Figure 1:** Placement of ECG Electrodes

The typical ECG[1] amplifier has differential inputs because the more useful ECG[1] signal are differential in nature, and in order to suppress 60 Hz hum picked up on the leads and the patient's body. In the simplest case, the right arm (RA) and left arm (LA) electrodes form the inputs to the amplifier, with the right leg (RL) defined as the common. The basic configuration of the amplifier in fig is the AC-coupled instrumentation amplifier discussed earlier. The gain for this amplifier is set to slightly more than X1000, so a 1 mV ECG[1] peak signal will produce a 1 V output from this amplifier. Because of the high gain it is essential that the amplifier be well balanced.



**Figure 2:** Instrumentation amplifier for ECG signals

#### 4 MEASUREMENTS OF SYSTOLE, DIASTOLE & HEART BEAT

The wrist model is smaller and the entire unit wraps around the wrist—this is a much more space-critical design.



**Figure 3:** Blood Pressure Measurement

Measurements of Systolic, Diastolic [3] pressures and Heart Rate [3] are continuously displayed and updated with every heartbeat. Mean Pressure is computed over 10 heartbeats. Heart rate is derived from the blood pressure [3] by the detection of crossings of the instantaneous pressure with Mean Pressure. The Blood Pressure [3] Transducers or any 350 ohm bridge type transducer equipped with and Electronics for Medicine' connector. An analog output proportional to heart rate is available as an extra cost option.

## 5 TEMPERATURE MEASUREMENT

A thermistor [2] is a ceramic semiconductor which exhibits a large change in resistance with a change in its body temperature. Although there are both positive coefficient (PTC) and negative coefficient (NTC) are available, for our application we use negative coefficient (NTC) type thermistor. These NTC thermistors are composing of oxides such as the oxides of the MANGANESE, NICKEL, COBALT, COPPER, IRON and TITANIUM. The thermistors have much better sensitivity than RTD's and are therefore better suited for precision temperature measurements.



**Figure 4:** Body temperature measurement

In Hospital Automation we have to maintain the room temperature below 20°C to safe guard the electronic from thermal runaway failures.

## 6 WEIGHT MEASUREMENT USING FOOT PRESSURE SENSOR

Here foot pressure sensor [2] is used to calculate weight of patient. Here one air bag is placed in the bottom of the foot. so weight is calculated based on foot pressure.



**Figure 5:** Foot pressure sensor for weight measurement

## 7 MEASUREMENT OF FLEX

In this project we are using a angle sensor [2] fo measuring the patient's movement whether he/she is walking in a plain surface or standing still.we can also analyze the patient's movement if he is moving in a steps upstairs or downstairs.



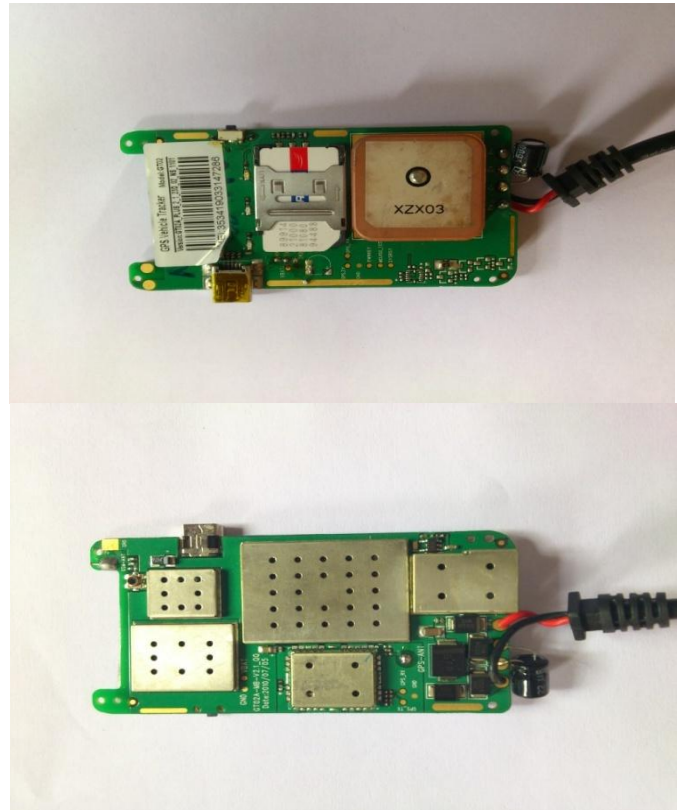




**Figure 6:** Placement of Angle Sensor for Flex Measurement

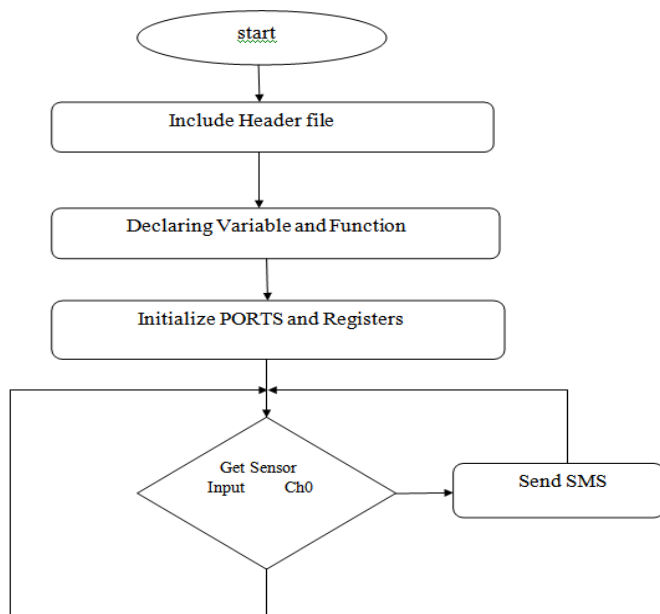
- (a) Position of sensor when patient is walking on steps.
- (b) Position of sensor when patient is moving in a plain Surface.

## 8 GLOBAL POSITIONING SYSTEM



**Figure 7:** Global Positioning Device

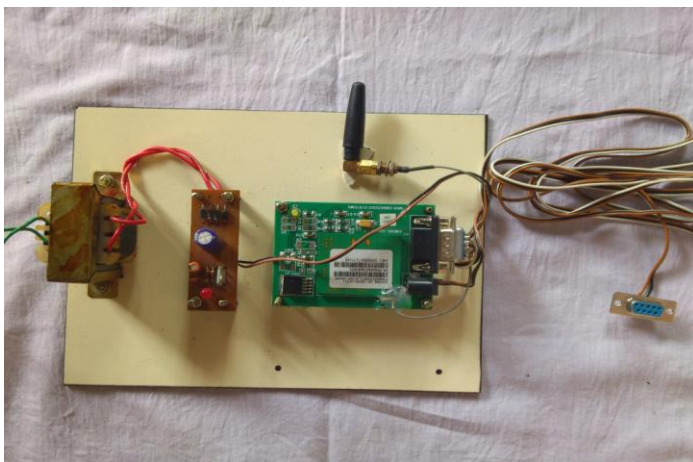
The Global Positioning System [4] uses satellite navigation, an entirely new concept in navigation. GPS [4] has become established in many areas, for example, in civilavi- ation or deep-sea shipping. It is making deep inroads in vehicle manufacturingand before long everyone of us will use it this way or another.The GPS [4] system is operated by the government of the United States of America, which also has sole responsibility for the accuracy and mainten- ance of the system.The system is constantly being im- proved and may entail modifications effecting the accuracy and performance of the GPS [4] equipment.



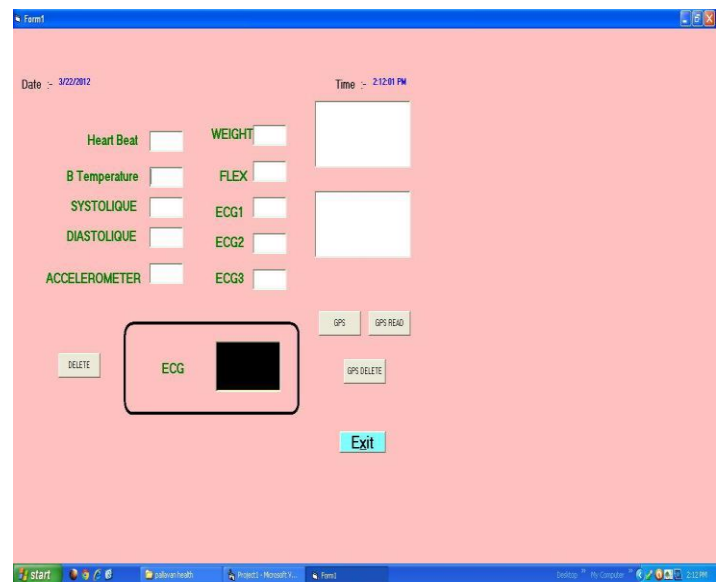
**Figure 8:** Flowchart showing process of GPS operation  
**SNAPSHOT OF TRANSMITTER IMPLEMENTATION**



**SNAPSHOT OF RECEIVER IMPLEMENTATION**



## SIMULATION OUTPUT



**Figure 9:** Before receiving the parameter values:



**Figure 10:** After receiving the parameter values

## 9 RESULTS

Values of physiological data keep on monitoring in the patient's body and transmitted through the transmitter kit attached in the body. In case of any emergency or any deviation in the normal wave or normal parameter value , alert will be taken place in the hospital server.

## 10 CONCLUSION

- Thus the integration of medical system increases ease of data measurement
- Real-time monitoring with sufficient energy
- In future it can be used for integrating/ measuring EMG, EEG and other parameters.
- We propose a secure and resource-aware BSN architecture enabling real time healthcare monitoring, especially for secure wireless electrocardiogram (ECG) data streaming and monitoring.
- In this PROJECT important information (e.g., major ECG data) is identified, and extra resources are allocated to protect its transmission.
- In particular, we present a wearable ECG sensing system consisting of small and low-powered health node sensors for wireless three-lead ECG monitoring.
- Then we introduce additional concept GPS tracking system. By using this concept we identify easily the patient's location.
- Another merit is an emergency call to 108 ambulance service from the device so they find easily the patient's location.

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