



## ANDROID BASED APPLICATION DEVELOPMENT FOR HEALTH MONITORING

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### Abstract

**In medical treatment, diagnosis plays very important role. Here we are proposing a reliable, affordable wireless patient monitoring system. We have designed a system that will measure the physiological parameters - body temperature, oxygen saturation in blood (SPO2), heart rate, glucose measure in blood, as well as two bioelectrical signals electrocardiogram (ECG) signals and electroencephalogram (EEG). The recorded parameters and signals will then be transferred via bluetooth communication protocol to an android based smartphone. We also intended to generate an SMS alert in case of emergency situation with location information.**

**Keywords: health monitoring; android application; bluetooth; ECG signal; EEG signal Body Area Network(BAN);**

- Shortage of medical professionals and hospitals
- Time consuming test and lack of equipment

To overcome above issues we designed an advance wireless health monitoring system based on android. That uses Bluetooth low energy (BLE) technology as the medium for transferring data between the portable data acquisition unit and android device. That will be utilized for continuously measuring of physiological parameters EEG, ECG, body temperature, oxygen saturation of blood (SPO2), heart rate .etc. Also an Android application that will provide the advanced features like transferring of data and view in different format, direct assistant of physician in case of emergency and alert in case of abnormal conditions. The market has been dominated by the Android operating system since 2010. Android's market share (measured by units' shipment) rose from 33.2% in Q4 2011 to 82.8% of the market in Q2 2015 this shows the reach of android device to the locality.

System contains mainly two parts one is for the hardware which contains all necessary circuitry of sensor modules and controller and second part is android application which consists of user interface (UI) for controlling the graph view and graphical parameters and communication options.

Rest of the paper is organized as follows. Section II provides an overview of previous work done by researchers in the field of

### I. INTRODUCTION

Nearly 27% of the total deaths in India happen with no medical attention at the time of death, according to the 2013 civil registration data released by the Census directorate data based on 27 states and Union territories also indicated that only 43% of the total deaths happen in institutions and only 3.9% of the rest under the care of a qualified allopathic doctor.

#### *Issues of traditional system*

- Patients must travel long distances to gain access to healthcare
- Patients fail to receive continuous care

wireless health monitoring. Section III describes physiological parameter and there acquisition. Section IV Android application and there features and section V concludes this contribution.

## II. RELATED WORK

In [1] this paper authors have design an android application which communicates over bluetooth with the hardware module which consists of ECG module and respiration module for displaying data in graphical form. Some authors have designed app for ECG recording [2]some also designed for disease verification[3]. In [4] this paper authors have proposed web based health monitoring system that uses sensor modules connected to bluetooth for transmitting data to computer and form there this data is uploaded on the server and form there it can be retrieve to mobile by physician or by patient. In this paper[5] authors have utilized the PPG (Photoplethysmography) technique for hart rate calculation a microprocessor is used to covert biosignal from analog to digital format, suitably for feeding into an RF module (nRF24L01 for RF transmission). The same technique can be utilized to measure the oxygen saturation in blood [6].

Blood pressure can be indirectly obtained by measuring pulse wave velocity (PWV), which is related to both electrocardiograph (ECG) and Photoplethysmography (PPG). But it is very difficult to measure PWV. Another physiological parameter-pulse transit time (PTT), is used to describe the relationship between PWV and BP [7]. EEG is the recording of the electrical activity on the scalp. Capturing a seizure with EEG is a necessary prerequisite for making a definitive diagnosis, tailoring therapy, moving toward certain kinds of solutions such as surgery, or even affixing the true rate of events [8][9]. Watch based designs are also implemented[10]. some disease specific applications also present[11].

## III. SYSTEM DESIGN

System has mainly two components:

1. Data / signal acquisition module with a bluetooth transmitter
2. Android based smartphone for display and monitoring

Our aim is to design a cost-effective and optimal system that can last longer time on battery supply. Blow is the user module architecture. Which is contains the all sub module for measuring the physiological parameter with the RF transmitter in our case it is a (BLE) bluetooth low energy and microcontroller with separately designed power manager.

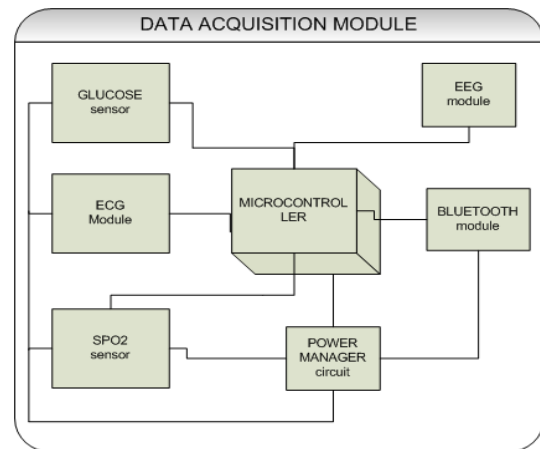


Figure 1: Data acquisition module

This module senses the physiological parameters and after signal processing and conditioning transmit it to the android phone connected to the bluetooth. Following section describes these steps in detail.

TABLE 1: SYSTEM REQUIREMENTS

SYSTEM PARAMETERS	VALUES
Supply voltage range	3.3V-5V
Sampling rate	512sps
Data streaming rate	>1Mbps
ECG frequency response	(0.05-150)Hz
EEG frequency response	(0.1-100)Hz

### A. Hardware

We are using TI's ADS119x series AFE (Analog Front End) for the signal conditioning and filtering .It provides the following features that make it perfect for our application.

- Eight Low-Noise Programmable gain amplifiers (PGAs) and Eight High-Resolution ADCs,
- Low Power: 0.75 mW/channel,

- Data Rate is 250 SPS to 8 kSPS ,
- CMRR:  $-115$  dB ,
- Programmable Gain: 1, 2, 3, 4, 6, 8, or 12,
- Unipolar or Bipolar Supplies:  $- AVDD = 2.7$  V to  $5.25$  V  $- DVDD = 1.65$  V to  $3.6$  V,
- Integrated Respiration Impedance Measurement,
- SPI™-Compatible Serial Interface

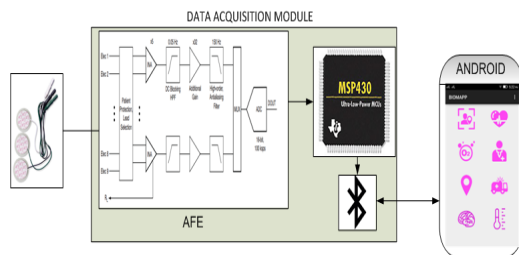


Figure 2: Proposed System

This figure shows the basic functionality of the ads119x chip. It takes signal from the ECG leads and it has instrumentation amplifiers with configurable gain and has filter for ECG range (0.05-150 Hz) and  $\Sigma\Delta$ -ADC for high precision. This is same IC can be utilized for EEG signal acquisition with change in gain. Because it has frequency range of (0.1 – 100 Hz).only the difference is the EEG input range is in microvolts while ECG has in mili-volts. Now for EEG measurement we have added instrumentation amplifier for additional gain in ECG AFE for amplification of EEG signal and then applied low pass filter for ( $f_c = 100$ Hz). Now after signal conditioning we have SPI bus for transferring data from ADS119x to MSP430 controller which is connected to the BLE module using USART which supports up to 2Mbps of data rate. Also we have designed SPO2 interface that uses the ADC channel of MSP430 controller and transfers the data to the android device using the same UART configuration.

### B. Software

Data received from the bluetooth module is utilized in android application. This application (BIOMAPP) is designed using the android studio. Based on the user preferences data is analyzed and processed in the device.

### Application features and implementation

We have used GraphView library and Google location API and SDK version 21 for design of application. It has following features

- a) Profile based data analysis and storage
- b) EEG and ECG graph (plot on the data provided by the hardware module )
- c) Temperature, SPO2 and other parameter in the TEXT format
- d) Text format for data storage and sharing on local disk
- e) Screen shot option
- f) Abnormality detection
- g) Alarm and notification trigger
- h) Emergency contact
- i) Direct assistant of doctor on emergency
- j) Rescue feature

Different physiological parameters are measured on the device and on their normal and abnormal condition different notification, alarm and rescue methods are implemented in the application, i.e. If the condition is normal then simple notification is generated saying your condition is normal and if the condition is abnormal then the emergency contact methods will be called.

Following images are from the android application showing the graph and text view format for presenting the physiological parameters.

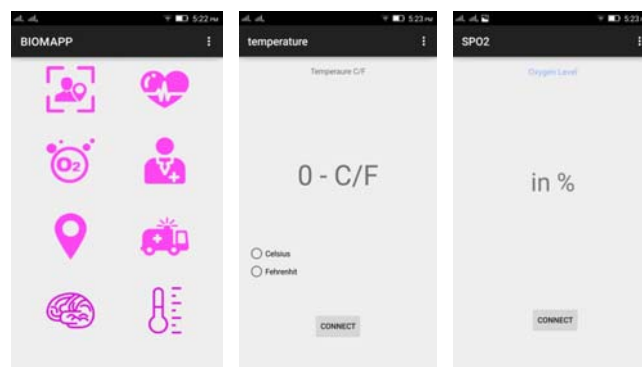




Figure 3: Application screen shots

#### IV. CONCLUSION

Till now we have defined system requirement and design parameters. Also designed the application feature based on their references and considering reviewed research work done till now in this field. We also implemented software part and results are given in the section III. Soon the hardware will be implemented and ready for testing on real subjects.

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