# Application of Biosensor in Tele ECG using Wireless Technology

Debasmita Hazra Vallabhaneni Manasa

**Abstract:** Electrocardiography measures activity of heart by measuring electric potentials over the surface of a tissue. This is accomplished using bio-potential electrode. Bio-potential electrode is a transducer that senses ion distribution on the surface of the tissue; it converts the ion current into electron current. An electrolyte solution/jelly is placed on the side of the electrode that comes into contact with tissue; the other side of the electrode consists of conductive metal attached to a lead wire connected to the modem. A chemical reaction occurs at the interface between the electrolyte and the electrode. Proposed design of Tele ECG is supported with a Bluetooth subsystem which would transfer the obtained ECG output to a cellular device and can be easily sent to expert for medical advice using the MMS service.

**Index Terms:** Telemetry, Bio-potential electrode, Tele-ECG, Bluetooth system, DSP, RS232 , UART, MMS service

## 1 INTRODUCTION

Telemetry is a remote measuring technique of collecting information from a distant location to a convenient location via different transmission channels, to be recorded and examined. However this application is limited to communication between fixed locations equipped with conventional ha lsets. Currently in the proposed design a biosensor is embedded with a miniaturized modem consisting of ADC, DSP, microcontroller and a Bluetooth subsystem.

The design aims at amplifying the ECG data obtained using biosensors, processing it, compressing the data and transferring it to the Bluetooth subsystem using a null modem cable. The signal would then be decoded in the cellular device to give the ECG of the subject.

## 2 SYSTEM MODEL

### 2.1 DESIGN:

1. The proposed module can be fabricated and the modem would be around 15 cm
2. Electronic output signal is obtained from a biosensor, which may consist of electrochemical, electro-optical or biochemical blocks.
3. Bio potential electrodes are selectively placed and is interfaced with an ADC (ADS 1258), DSP on a common board using DB connectors.
4. Data after processing is given to UART port to transfer it to the BLUETOOTH system
5. The image obtained here is sent to the cellular device which would have an inbuilt java application to decode the obtained data.

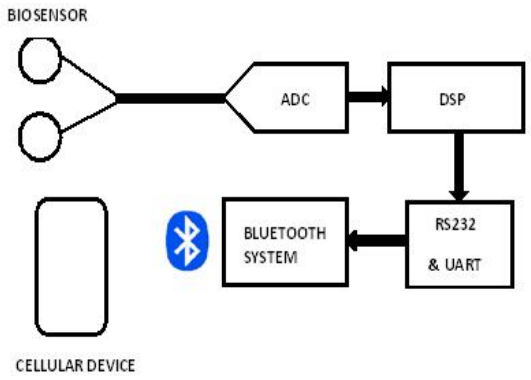


**Fig 1:System model**

### 2.2 WORKING:

1. Bio potential electrode is placed on the subject selectively, where they pick up ECG signal and send them to the DB connector on the board
2. The filter is a combination of high and low pass filter such that a band pass filter can be created whose frequency band is the frequency range of the measured signal.

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3. Analog signals are converted to digital before sending them to the DSP sub-system. LPF output is connected as input to the ADC
4. The eight ECG lead outputs from the LPF are connected to eight channels of the ADS1258. Using SPI interface, the ADC is connected to the C5505 DSP
5. DSP would process the data and transferred to the Bluetooth system from where the image is compressed and sent to the cellular device.
6. The Bluetooth UART RS232 serial Converter Module can easily transfer the UART data through the wireless Bluetooth.This bluetooth module has an UART interface and can be connected to various kinds of systems like ARM or DSP systems.

## 3 BLUETOOTH SYSTEM

Bluetooth is a specification for the use of low-power radio communications to wirelessly link phones, computers and other network devices and wireless headsets over short distances,typically up to 30 feet (10 meters).

Advantage of using Bluetooth is that the individual devices do not need to "see" each other directly and several devices can be connected in a network with a maximum data rate of 720 Kbps.

A PIN number provides basic protection against unwanted connections when setting up a device contact on the phone.

The operability of Bluetooth depends on the interaction of various services. At least

two background daemons are needed: hcid (host controller interface), which serves as an interface for the Bluetooth device and controls it, and sdpd (service discovery protocol), by means of which a device can find out which services the host makes available.

i) hcitool can be used to determine whether local and remote devices are detected. . The output generates a line in the form <interface_name> <device_address> for every detected local device.

ii) sdptool can be used to check which services are made available by a specific device. The command sdptool browse <device_address>returns all services of a device. The command sdptool search<service_code> can be used to search for a specific service. This command scans all accessible devices for the requested service. If one of the devices offers the service, the program prints the (full) service name returned by the device together with a brief description. A list of all possible service codes can be viewed by entering sdptool without any parameters.

Allows stable transmission of both data and voice in severe noisy environment. Bluetooth uses 1/3rd the cost of Wi-Fi and 1/5th the power of Wi-Fi.

## 4 MULTIMEDIA MESSAGING SERVICE

Multimedia Messaging Service (MMS) - sometimes called Multimedia Messaging System - is a communications technology developed by 3GPP (Third Generation Partnership Project)allowing users to exchange multimedia communications between capable mobile phones and other devices .

MMS supports transmission of audio,video,text and image files and emailing messages to multiple recipients.The ECG data can be sent in 5 packets of 30 Kb each, such that every packet takes about 10 secs for transmission,giving an overall transmission time of 60 seconds for 150 Kb of data.

## 5 SOFTWARE

JAVA is the preferred software as almost all mobile phones are equipped with its various platforms.Additionally,it supports Bluetooth, camera and messaging functionality.The softwate can easily be updated over the internet with no extra cost or difficulty.

## 6 EXPERMENTAL ANALYSIS

1. RR interval: The interval between R wave and next R wave
2. PR interval: measured from beginning of P wave to the beginning of QRS complex. Time the electrical impulse takes to travel to the ventricles.
3. QRS complex: Rapid depolarization of right and left ventricles
4. T wave: repolarization of the ventricle

The display can be observed on the mobile screen.

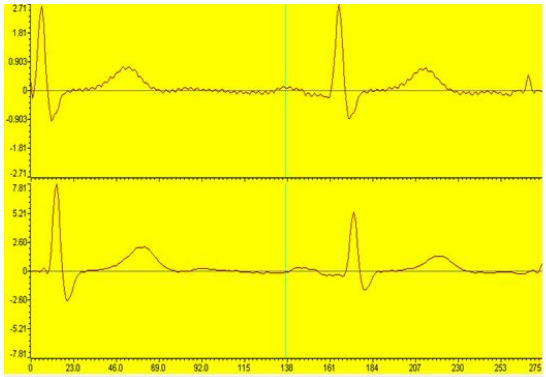

**Fig 2 (i) Input ECG signal**
**(ii)ECG signal after smoothening**

**Fig 3:CRO Monitor With ECG Display**

In Fig 2 (i),the input obtained from the biosensors is displayed.Then it is filtered and the smoothened ECG signal is obtained bothe from software (Fig 2(ii) )and hardware (Fig 3).The heart rate for signal is approximately 89 beats per minute.

## 7 ADVANTAGES of TELE-ECG:

1. Low cost, portable and compact.
2. It has an internal rechargeable battery which could be operated in the absence of external supply.
3. Mobile as well LAN[3] connectivity can be used.
4. Acquisition, processing, storing and visualization of ECG in real time
5. Using a secure GPRS connection for the transfer of ECG data[7]
6. Since it is electronic equipment, it does not require large working space
7.It does not consume lot of network bandwidth due to compression of data.
8. The software can be easily updated.

## 8 DISADVANTAGES of TELE-ECG:

1. The Biosensors have to be periodically replaced if not handled with care
1. Improper functioning of the device due to errors in the software.
2. Failure in MMS due to low connectivity from service provider.

## 9 CONCLUSION

Nanotechnology and Wireless communications play a major role in many of the application devices. In the proposed model a biopotential electrode is studied and we tried interfacing it with signal conditioning device which would process the data and ECG analysis can be obtained taking care of the time factor.

Thereby the proposed model would aid us to provide a better medical help irrespective of the fact that the medical expert is available at the moment or not.

With the recent trends in technology,the device can be very easily made user friendly and portable enough to be carried along such that continuous monitoring can be done.If implemented on a large scale,it would benefit the society by ensuring that people are atleast provided with the opportunity to get an instant cardiac diagnosis,thereby alerting them of any life threatening disease.

## 10 FOLLOW UP ACTION

1. Creating awareness about the advantages of Tele Medicine among the rural masses by conducting small camps in their areas.
2. Not necessarily a qualified doctor but skilled and authorized persons can be trained for the operation of the device efficiently.
3. Through proper channel the government can be approached and requested to allot a suitable band for the efficient functioning of telemetry devices where MMS service is involved.
4. The government should make this facility available at every government health centre for the local population

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