



New Generation's Portable Medikit for Monitoring Health Parameter using Smartphone

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ABSTRACT: A remote compact Bio-monitoring system which monitors different health parameters using devices like mobile, Smartphone is described here. Bio-monitoring is the field which measures the presence of harmful substances in the body of person. This paper presents such type of system which monitors health parameters such as Electrocardiogram signal, Blood pressure and Pulse rate throughout its day to day life. The system consists of electrodes for capturing electrocardiogram signal and sensors are used for measurement of other parameters. Signal acquirement is assured by processing hardware, which stores the record of measured parameters and then sends the data to smart phone or pc by using wireless communication. We also develop software which displays the output on mobile phone. This system is proposed for sport diagnosis and also for monitoring the patient or elder person at home.

KEYWORDS: Electrocardiogram, Pulse rate, Blood pressure, Bio-monitoring

I. INTRODUCTION

Health care can contribute an important impact on country's economy and also on lifestyle of the person. So there is a necessity of new inventions in the field of healthcare which can give the early warnings about diseases. For this purpose number of healthcare systems were developed which test the health conditions of individuals. The present medical devices used in hospitals are incursive and uneasy to wear during continuous monitoring period. Such systems are heavy and there are number of hampering wires from sensor to data acquirement system.

Nowadays due to technical advances in the field of microelectronics, nanotechnology, miniature sensors are developed. These types of sensors are small in size also require low power during monitoring. Using such type of sensors the problems with conventional system are avoided.

For measurement of health parameters a bio-monitoring system which will work automatically without any failure is required. Bio-monitoring is the field which measures the presence of toxic substances in the human body by measuring the metabolite in the blood or urine. Recently number of applications are developed which continuously monitor the health parameters using devices like mobile, Smartphone. This paper presents such type of system which is non-invasive, comfortable and continuous. This means that the person or patient may not feel uncomfortable or irritated while monitoring these parameters.

The main advantage of the system is that it offers the patient wireless communication. Also due to its simple operation the elder person is also able to handle the system. In this system different electrodes and sensors are used to measure Electrocardiogram signal, blood pressure and pulse rate of the person. The measured parameters are transfer wirelessly to smart phone. Wireless communication is most suitable for this system because in wired communication numbers of wires are lying around the body which is not convenient for the patient. The proposed system has following characteristics:

- Operation of system is simple that elder person can easily handle the system
- Buzzer gives audible warning about the position of electrodes.

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- The system work properly without failure during continuous monitoring period.
- The system has minimum bio-chemical effect.

In this way, using different electrodes and sensors for measurement of health parameters with processing hardware for storage, analysis and transmission of data the system is presented.

II. RELATED WORK

Recently numbers of bio-monitoring systems were developed for monitoring health parameters. In [1] Authors designed non-intrusive health care system. They have used wireless sensor network in order to cover wide area with minimum battery power to support RF transmission. Various devices such as wearable ubiquitous sensor network node, chest sensor belt and wrist pulse oximeter were developed for monitoring health parameters. The measures data can be transmitted wirelessly using IEEE 802.15.4 from on body sensor devices to a base-station which is connected to server pc. The result can be displayed and stored in pc continuously. Another real time monitoring system was invented by authors in [2] which uses 24 GHz frequency band for remote sensing. They have used circularly polarized electromagnetic wave with antenna to develop compact size sensors. For detection of human vital signal power spectral density with tracking algorithm was used. In [3] authors invented a wearable monitoring system which was based on E-textile bio-sensors. In this system different sensors are integrated into T-shirt for ECG measurement. The size of the sensors is so compact that they can be easily integrated into T-shirt. This type of system has same disadvantages. The T-shirt used for such purpose is having a tight fitting, which is not desirable for patients. In March 2013, a remote monitoring system was invented by Author [4]. In this system experiment was performed on animal for monitoring metabolite present in animal body. They have used bio-nano sensors which were integrated in animal body. During this experiment the sensors were integrated to detect four metabolites such as, lactate, glucose, glutamate and adenosine triphosphate. In [5] bio-medical system is presented. In this system wireless biomedical sensor network is used. They have also developed miniature sensors to detect health parameters. The sensors are attached to patient's body which forms a wireless sensor network and the sensors sense the various parameters and transmit it to physician's server. The physicians collect all the data and calculate the result based on the threshold values.

III. PROPOSED SYSTEM

The proposed system for measurement of electrocardiogram signal, blood pressure can be sections into four functional parts. Each part is described separately. In the first section electrocardiogram signal and blood pressure of the person is measured. For this purpose, electrodes and sensors are used. Next section is the medium for transfer of data. Third section is processing hardware for graphical representation.

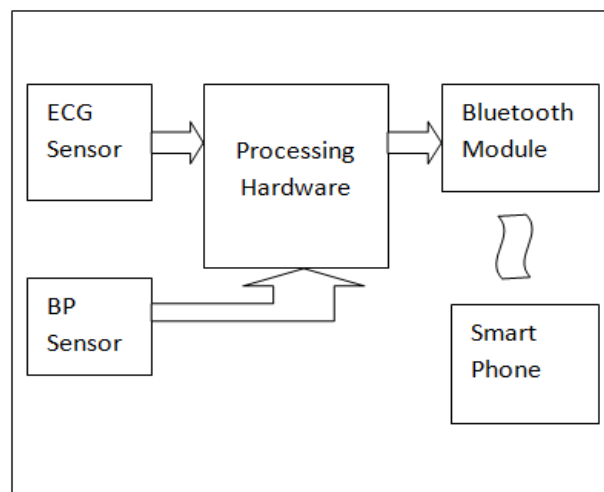


Fig.1. Block Diagram of Proposed System

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The figure 1 shows schematic of the proposed system. At the input side two sensors are used which are attached to human body. These sensors capture the electrocardiogram signal and blood pressure of the person and send the data to processing hardware. Processing hardware receives the data convert the analog signals into digital form, perform the necessary operations and transfer it to mobile using Bluetooth module. At the receiver side there is a Smartphone or pc which receives the data using wireless communication. The software is used to display the output. Working of each section is described below.

A. Electrodes for capturing Electrocardiogram:

To obtain the signal electrocardiogram signals from human skin, we used the sensor which contains conductive electrodes. These electrodes can easily stick to chest and pick the electrocardiogram signal. The electrodes contain liquid electrode gel for good contact with skin. Location of electrodes was chosen by taking reference from previous measurements.

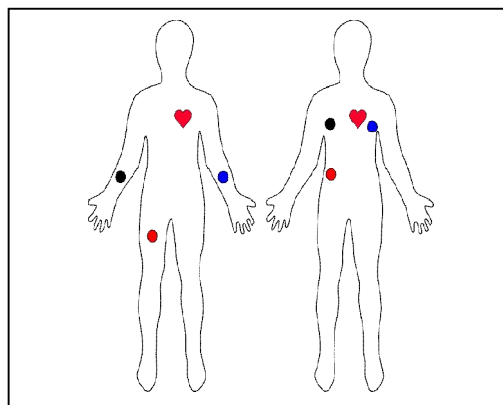


Fig. 2 Location of electrodes

There are three electrodes attached to chest at different positions. The figure 2 shows the location of electrodes. We use the colour code which indicates the correct position of electrodes. The electrodes are further connected to ECG sensor by means of probes. The ECG sensor is a signal conditioning block for measurement of ECG signal. It is specially design to remove, amplify and filter small bio-signal in the existence of noise and other motion artefacts. The design of sensor is such that it may be used by embedded microcontroller to capture the output signal easily. It has two pole high pass filter which eliminate the motion artefacts. The high pass filter is tightly attached with instrumentation architecture. This feature allows the filtering and large gain in only one stage. Such type of arrangement will save the space and also cost. It gives high signal gain ($G=10$) with dc blocking capabilities. It also have fast re-establish characteristic which improves the filter settling. Size of the sensor is $4\text{mm} \times 4\text{mm}$ and performance is specified from 0°C to 70°C and operation from -40°C to $+85^\circ\text{C}$. These electrodes are safe for skin also it is so flexible that it is comfortable during continuous monitoring.

B. Sensor for Blood Pressure

Blood pressure is denoted by two readings namely systolic and diastolic. The sensor we used here for monitoring blood pressure gives these readings also gives the reading for pulse rate of the user. The sensor device is small in size and gives 8 bit values in ASCII format and gives fixed digits from 000 to 255. Each reading consists of 15 bytes and transmission rate is 9600 baud rate. The reading packet's last byte is usually enter key character so we can view each reading on new line. The output of the sensor is serial data for further analysis or display. The sensor is having digital liquid crystal display screen. It is having capability to store readings of 60 group members. The working voltage range is +5V and it operate in the range from -40°C to $+80^\circ\text{C}$.

C. Processing Hardware

Processing hardware is used for digitization of analog signals and for storage and analysis of measured data. All the measured data collected by sensors is given to microcontroller. Microcontroller receives the data and converts the

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analog data into digital form, makes necessary conversion and sends the data to smart phone or pc by using Bluetooth module. The software is used for graphical representation of electrocardiogram signal which also displays the reading of blood pressure and pulse rate. The sensor is designed in such a way that it can easily fits on wrist like a watch

IV. RESULTS AND DISCUSSIONS

Experiment was performed placing electrodes at different position on the chest. It is observed that we get the correct readings when the electrodes are placed near the heart. The wrist type sensor also gives the appropriate readings. This system can be used to follow up patients at home without making any disturbance in their daily routine. The developed system is portable and can easily carry at any place. The result of the system is shown in figure 3. The test measurement has proven that the electrodes which we were used are proper for capturing the electrocardiogram signal and the electrodes which were attached to skin are not harmful for skin. The wrist type sensor used for blood pressure monitoring also gives appropriate readings. Whenever the supply is on, the sensors attached on body senses ECG signal and Blood pressure and send via Bluetooth model to microcontroller. Microcontroller converts analog values into digital form and send the data via wireless Bluetooth to Smartphone. In figure the reading of blood pressure i.e. Systolic, Diastolic, pulse rate and waveform of ECG signal is shown.

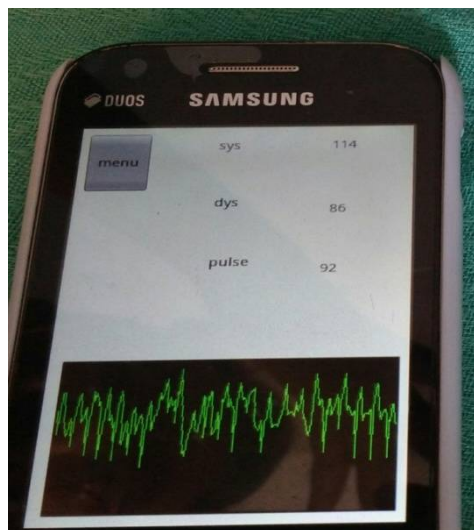


Fig. 3 Result of the system

The system which we present here holds a promise over other conventional health care system because of two main reasons. First is ease of use. Once place electrodes and sensors, there is very little extra efforts are requires for individual to capture the valuable data from body. So the elder person can easily handle the system. Second reason is we can understand the early warnings of diseases such as high blood pressure etc.

V. CONCLUSION

We successfully designed and realize the New Generation's Portable Medikit for measuring electrocardiogram signal and blood pressure. The designed system measured these parameters without making any disturbance in daily routine of the person. In our project we give special attention on use of new techniques in the field of monitoring of health parameters. Such system is composed of sensors for detection of electrocardiogram signal, blood pressure and pulse rate. All the sensors collect the data and transfer it to acquisition unit. The acquisition unit can be pc or smart phone. This unit transfers the data by using wireless communication. With the help of software which we develop, the output can be observed on the smart phone. In this way system is design and executed.



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BIOGRAPHY



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