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New Generations Smart Health Care System

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Abstract: This paper describes portable Bio-medical kit for monitoring health parameters such as Electrocardiogram signal, Blood Pressure and heart rate of the person. Bio-medical is the area which detects the harmful substances present in human body. From last few years this type of system has gaining more popularity because of its ease of use and accuracy. This paper presents such type of system which consists of wrist type sensor and electrodes for measurement of blood pressure and Electrocardiogram signal. Smart electronic unit is used for signal processing. This unit stores the data in the memory and makes the necessary conversions. Then measured data is transmitted wirelessly to smart phone or pc. We can see the output on Laptop or Pc with the help of MATLAB software.

Keywords: Electrocardiogram, Bio-Medical, Blood Pressure, Heart Rate.

I. INTRODUCTION

In this modern age, due to busy lifestyle people don't give attention on their health. Due to changing lifestyle, pollution, stress number of health related problems occurs. So it is better to detect the health issues earlier before the problems get severe. Most of the diseases can have more series effects if not detected earlier. For healthier life regular health check up is important. One of the simple methods to test the health condition is to check blood pressure, electrocardiogram and heart rate. Due to busy schedule it is not possible for every person to visit the hospital regularly. Also, the conventional system which is used in hospital for such purpose is bulky. It also has number of wires from sensors which is inconvenient and uneasy. A person feels irritating while longer monitoring period.

The key solution for this problem is to use the portable system which measures these parameters at home. This paper presents such type of bio-medical based portable system. Bio-medical plays an important role in human society. Numbers of bio-monitoring systems were invented for checking the health related problems. Number of wearable systems also invented for such purpose. There are some drawbacks of using conventional wearable system. In such system sensors are mounted into shirt or fabric of wearer using wires which are further connected to hardware. It easily picks up noise. Due to which distorted signal is obtained. The location of sensors cannot change easily. The cables from sensors get damaged easily while the person is performing its daily activities. Also the t-shirt used for such purpose is of tight fitting which is not comfortable for heart patients. To overcome above problems portable bio-medical system is useful.

Recently, technology is growing rapidly and new inventions are made in the area of bio-medical. Due to this number of miniature sensors are developed which consumes less power during monitoring. Use of such sensors in medical system gives most accurate results.
This paper presents such type of portable system which measures health parameters from which we can understand the early signs of diseases. The system which we developed is comfortable and continuous. The operation of the system is also very easy so that it can be use by elder person also.

Advantages of using such system are

- It provides real time feedback to the user.
- The system is portable so it is not necessary for the person to stay at home or hospital all the time for check up.
- Simple and handy i.e. no special skills required for handling the system
- Requires minimum maintenance.
- Low power consumption.
- Safe and comfortable during continuous monitoring.

Buzzer indicates the position of electrodes.

II. LITERATURE REVIEW

Biomedical field is becomes most popular these days. Numbers of researches are made in this field which determines useful data about human body. In [1] Authors Developed Bio-medical system for patient monitoring. In this system they develop light weight medical sensors which can be placed on human body. Such type of arrangement makes wireless bio-medical sensor network using this network they monitor different health parameters like temperature, sweat rate. All this information is send to physician which detects abnormal conditions of patient. In [2] authors proposed a Wireless sensor network for wearable physiological monitoring system. In this system they developed sensors which are

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integrated into fabric of wearer. These sensors continuously monitor different health parameters and transmit the information to remote monitoring station wirelessly. At remote monitoring station the data is correlated to study the health condition of wearer. The authors also described the drawbacks of conventional wearable physiological monitoring system.

In [3] respiration rate extraction from ECG signal via discrete wavelet transform is described. In this system they derive respiratory waveform from single lead ECG signal. For such extraction they use signal processing techniques. In this system they use peak detection algorithm for determining respiration rate from ECG signal. This system is used for patient monitoring.

In [4] Wearable wireless cardiovascular monitoring using textile based nano sensor system is developed. In this system bio-nano sensors are used which are inwrought into the fabrics of wearer. The system is used for cardiovascular monitoring of patient.

In [5] authors developed a system which can monitor the ECG signal b using the conventional Ag/AgCl electrodes. The authors also described the drawbacks of using these types of electrodes. There are number of new technologies are invented which overcomes most of the drawbacks of conventional system.

In [6] such type of system is presented. The authors used small size sensors which are integrated into the t-shirt of monitored person. For measurement of oxygen level in blood they have developed Spo2 sensor. The wrist sensor is used for measurement of blood pressure. Chest belt is developed for capturing ECG signal. All the sensors collect the data and send it wirelessly to the pc or server. Such type of system is useful for patient monitoring at home or in hospitals.

III. ARCHITECTURE OF THE SYSTEM

The system is partitioned into four different parts. Figure 1 shows the architecture of whole system, which includes Sensors, electrodes, smart processing unit and pc or Smartphone. The sensors are attached to body for measurement of blood pressure, electrocardiogram and heart rate. The sensors sense these parameters and send the information to next part. The output of the sensors is in digital form which will be converted into analog form by analog to digital converter. The processing unit amplifies the signal, make necessary conversions and transfer it to smart phone or pc via wireless Bluetooth protocol.

The readings of blood pressure, heart rate and electrocardiogram signals are can be displayed on the phone by using software. The software is specially design for such purpose. The output can be displays on the pc or laptop with the help of MATLAB software. Both the results are shown in this paper. Working of each part is described below.

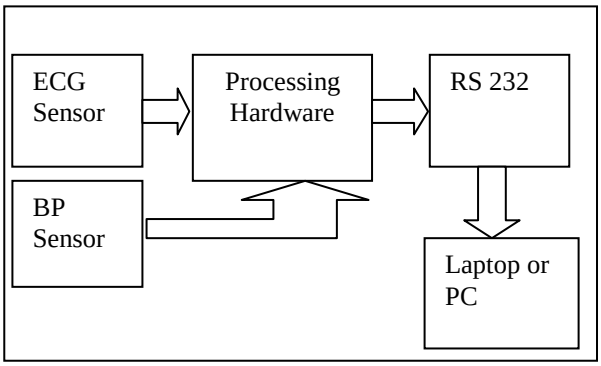

Fig.1. Block Diagram of the System

A. Electrocardiogram Sensor

ECG sensors are used for capturing the Electrocardiogram signal from human body. The sensors are attached to person's body using disposable electrodes. The placement of electrodes is as shown in figure 2. The colour code is used to indicate the proper position of electrodes. Black cable is for right arm, Blue for left arm and red for right leg.

B. Title and Author Details

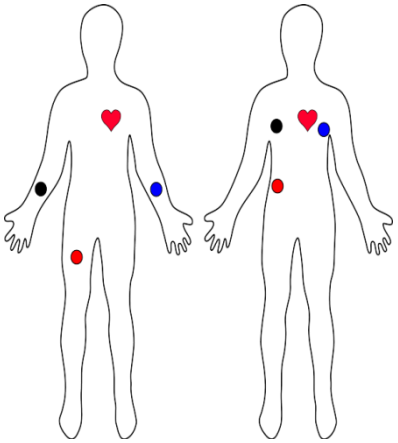

Fig.2. Placement of Electrodes

The ECG sensor used for this system is specially design as a signal processing block which is used to obtain the ECG signal. This sensor eliminates the noise and other motion artifact also amplifies the signal. For capturing the output signal easily most of the embedded microcontroller uses such type of sensors. The sensor has high pass filter, low pass filter, uncommitted amplifier, operational amplifier, fast recovery circuit. For eliminating motion artifacts it has high pass filter circuitry. This circuitry is tightly attached with the instrumentation amplifier. Such type of arrangement provides large gain and filtering in only signal stage, which saves space and cost of the hardware. The uncommitted amplifier used in this sensor creates a low pass filter which eliminates additional noise. It also has a fast restore function, which minimize the long settling time of high pass filter after abrupt signal change. Whenever the electrodes are reconnected it adjusts itself to high filter cut-off which allows it to recover quickly to take valid measurement. These electrodes are skin

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friendly. The electrode contains adhesive gel which provides good contact with skin. These sensors are small in size and performance is specified from 0° to 70°. It operates from -40° to +85°.

C. Blood Pressure Sensor

The sensor used for measurement of Blood pressure also gives the reading of heart rate. This type of sensor uses oscillometric method to measure the blood pressure and heart rate. For our project we use the wrist type sensor. The wrist cuff is wrapped around the wrist. The sensor has inbuilt air pump which allows automatic compression and decompression. In response to every heart beat there is contraction and extension is produces in the wrist. The sensor sense this small fluctuation of pressure in wrist cuff. The amplitude is then converted into millimetre of mercury column and the output is presented in digital form. The sensors can stores up to 60 sets of readings. Whenever the memory is full the last first reading is replaced by new one. The sensor works automatically and it has liquid crystal display. The output of the sensor is in digital form which is further given to processing unit.

D. Processing Unit

Processing unit consists of microcontroller and other circuitry. The microcontroller receives all the data from ECG and Blood pressure sensor then makes the analog to digital conversion by using analog to digital converter. Then the data is amplified and filtered again by processing unit. The output is then transfer to Bluetooth module via wired communication. Afterward the data is transfer wirelessly to smart phone or pc using this module. The software is developed in the mobile phone which displays the output of the system.

E. Experimental Setup

The figure 3 shows the experimental setup of the system. For measurement of ECG signal the used electrodes gives appropriate Electrocardiogram signal.

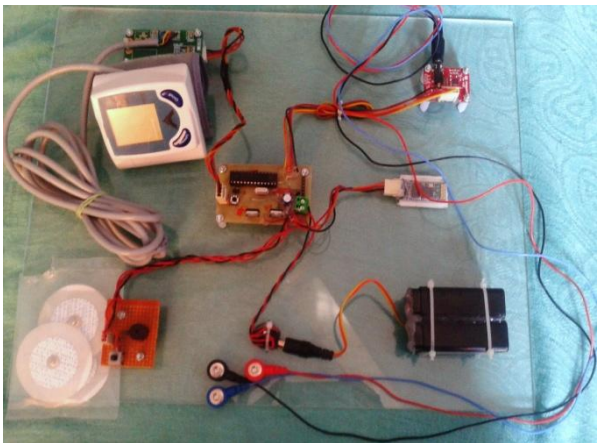

Fig.3. Experimental Setup

It is observed while performing the experiment that the most accurate Electrocardiogram signals is obtained when we place electrodes near to heart. The electrodes we use are totally different from conventional electrodes so the drawback of conventional electrodes can be minimizing using such type of electrodes. It is also observed that person may not feel uncomfortable or irritating while using these sensor electrodes for longer monitoring period. Similarly we use wrist type blood pressure sensor which also gives accurate readings of blood pressure and heart rate. The device we use is fully automatic.

It also has an adjustable wrist cuff so that it can easily fit to any size of person. It also has a protective portable case. The sensor gives appropriate reading when it is placed in the straight line of heart.

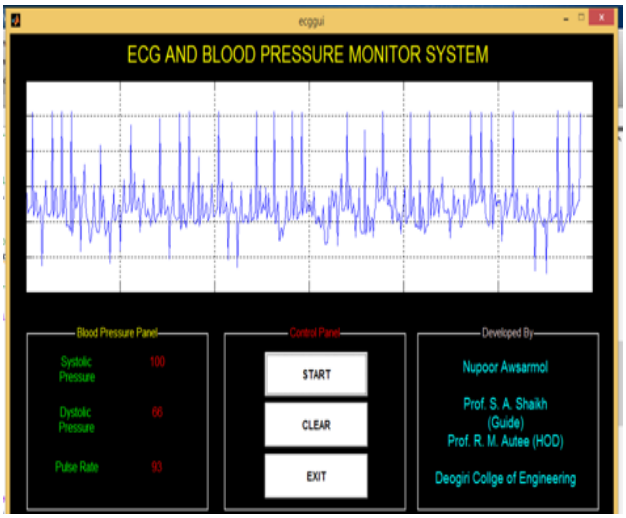

Fig.4. Result of the system

The figure 4 shows the output of the system. 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.

IV. CONCLUSION

Bio-monitoring based Smart health care system is successfully developed and presented in this paper. The system is used to monitor health parameters such as ECG signal, Blood pressure and Heart rate of observed person. The output can be observed on pc or laptop by using the MATLAB software. It is observed that we get the accurate readings when we placed the sensors near to heart. The output of system can also be viewed on Smartphone by using the appropriate software. For wireless communication we used Bluetooth module. Such type of system is small in size so it can be easily carried anywhere. Also because of is simplicity it can be handle by elder person also.

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BIOGRAPHIES

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