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Heart Rate detection using Photoplethysmography using Android Phone

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***Abstract*—** This paper includes Heart Rate Detector system implemented by some modern hardware ICs and simple sensor circuit with software executable on both PC and android platform. Very first the bio-signals are extracted via photoplethysmography concept using PPG sensor into electric signal. Now at the next stage microprocessor is used to convert the bio-signal from analog to digital format. Some application software running on Windows and Android phone have been developed to display heart rate information and time domain waveform to users for health care monitoring. Some of the applications running on the android platform few of them have been developed to display the heart rate information and some health care monitoring system. This project includes the RF modules which having the major impact and plays the predominant role in it. In future, pure wireless technology will be used instead of RF modules

Keywords- : *ECG, PPG, LDR, LED, Bio-Signal, MCU*

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I. INTRODUCTION

Because of the rapid medical development of our modern societies, the health care system becomes much more mature and professional. More than 2 millions peoples are at high risk of heart attack. It would be helpful if there was a way for these people to monitor their heartbeat. So we have a problem that is the way a project focuses on how we can utilize this problem and find a solution. By migrating that somewhat traditional clinic or hospital over the wearable or wireless monitoring system becoming more popular and where it somewhere gives more reliability and accuracy about the patient. This flow will go on in upcoming or forthcoming years as the very mean number of elderly has continued to occupy large portions worldwide. In order to migrating the existing burden of public health system and promote the popularity of routine health self-check, many technologies and methods in Biomedical engineering have been developed for making faster and more accurate pre-diagnose with ease of use. The traditional devices are too bulky and little bit inaccurate for giving the results, so patient usually need to go hospital/clinic every time whenever health checks are conducted even for slight discomfort. Also this is very much inconvenient, especially for those patients with some chronic diseases and with moving difficulty. Although some of the applications related to measuring heart rate but those are implemented with LED technologies here we are implemented this system on LDR (Light Dependent Resistor). Lately, biomedical devices using wireless techniques are developed, and their sizes become much smaller than those before.

II. LITERATURE SURVEY

The basic concept of electrocardiography is attaching electrodes to the body's surface and measuring the electric impulses of the heart. The device used for this purpose is the electrocardiogram. The transthoracic interpretation of the activity of the heart for a certain period of time that is detected with the help of electrodes attached to the skin's surface and recorded by a device that is externally attached is called electrocardiography. These days, ECG is used for both electrocardiography and electrocardiogram.

The rate and the regularity of the heart beat are recorded by means of an ECG. Many further diagnoses that can be made out of an ECG are the size and the position of the four cardiac chambers, any blockages or damages in the

heart, and the effectiveness of the drugs and devices used in cardiac treatment. Most often, ECG is employed only with humans. But for the purpose of research or even for medicinal purpose it may be employed on animals too.

Willem Einthoven struggling with his effort of designing an electrocardiogram right from the year 1889. In the year of 1902, he succeeded in publishing the first electrocardiogram which was recorded on a string galvanometer. On March 22nd 1905, Einthoven began transmitting electrocardiogram from hospital to his laboratory. That was the year when the first electrocardiogram signaling was recorded from a healthy man.

The 19th century the era of physicians technology use along the classical history of taking and physical examination for the diagnosis of heart disease.[1] he introduction of chest x-rays in 1895 and the electrocardiograph (electrocardiogram) in 1902 provided objective information about the structure and function of the heart The original electrocardiograph employed a string galvanometer to record the potential deference between the extremities resulting from the heart's electrical activation. In the first half of the 20th century, a number of innovative individuals set in motion a fascinating sequence of discoveries and inventions that led to the 12-lead electrocardiogram. Electrocardiography today is an essential part of the initial evaluation for patients presenting with cardiac complaints. Specifically, it plays an important role as a non-invasive, cost-effective tool to evaluate arrhythmias and ischemic heart disease.[2]. As a first line diagnostic tool, health care providers at different levels of training and expertise frequently find it imperative to have the ability to interpret electrocardiograms; however, a high rate of misinterpretation has been noted among non-specialized physicians especially among trainees [3]. It is likely that an understanding of the electrical basis of electrocardiograms would reduce the likelihood of error. An understanding of the disorders behind electrocardiographic phenomena could reduce the need for memorizing what may seem to be an endless list of patterns. During the first three decades of the 20th century ,the three-lead electrocardiogram usage expanded especially after improvements were made to make it more portable. Electrocardiography has played an important role in our understanding of heart disease. It was among the first bits of technology to supplement physicians' clinical skills by providing objectives data on the function and structure of human body

Figure 1. Old string galvanometer electrocardiograph showing the big machine with the patient rinsing his extremities in cylindrical electrodes filled with electrolyte solution..

III. PROPOSED SYSTEM

The overall design block diagram of our PPG heart rate detector. In the current block diagram design, the system is scattered into mainly two parts: PPG detector device and actual Human Interface[4]. As shown in fig. 1 PPG detector device is at the upper portion, also consisting battery powered standalone device consisting a special Light Dependent Resistor for PPG peaks detection, a conditioning circuit is introduced for migrating noise & anti-aliasing, a MCU (Microcontroller Unit) is there for digitizing the PPG signal generated by the PPG detector device & preparing the data which will be in the form of analog form for further transmission , and RF transmitter for connection to the server computer or Mobile device. The block diagram mentioned below depicted the Human Interface, as shown in the lower part of Fig. 1, consist of RF receiver and a Android phone with quite good configuration. The Bluetooth of an Android phone communicates with the PPG detector via the RF receiver.

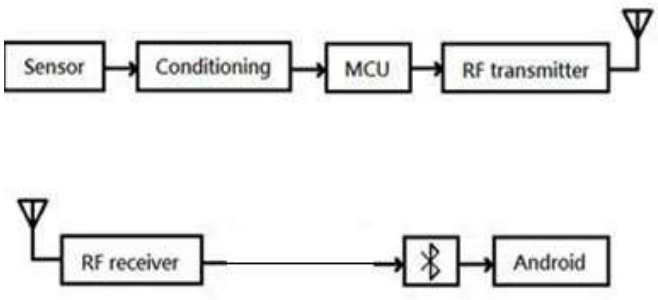

Figure 2. Block Diagram..

IV. COMPONENTS OF PROPOSED SYSTEM

A. *RF Transceiver*

nRF24l01 is used to wirelessly transmit the PPG signal to the server computer or equivalent. The only reason behind them to select this transceiver is only it is small, near about to size of 4*4 mm^2 and can be operated through a standard serial peripheral interface (SPI). The carrier frequency is ISM frequency band around 2.4 MHz and operates up to 1Mbps data rate.

B. *Microprocessor*

We have been selected C8051F930 which belongs from the family of 8051 microprocessor with surely 10 bits ADC, 90µA supply current. The purpose that we have used this kind of microprocessor is that to build PPG sensors along with its cable and all.

C. *Signal Conditioner*

When we extract the bio-signal from the human interface via PPG sensor and cable which they carried over to the MCU of the system, The signals which bought from the initiate level are in the weak form and is contaminated with noise on top of DC component.

D. *Finger House Clipping*

In this architecture we have introduced three kinds of clipping. One of them is taken by human right hand, another one is taken by left hands thumb and for the more accuracy also one of them is taken by the Right legs calves for more accurate results. When all these three clipping are being processed by well mannered i.e. once you placed on your body immediately analog signals are converted into digital one which are then displayed by the Android Phone via Bluetooth technology.

E. *Android App*

In order to display the results of peak rates that we have been taken earlier in the form of analog signals which further then converted into digital one those are at the last are represented on to one of the application named as “Blue Term”. This application is fully supported by android platform which will first creates a Hex file of the resultant further it will converted into human readable form. The Bluetooth APIs android supports the cable replacement protocol. By using the serial port emulation mode the PPG information that we caught from the human interface with also necessary information can be easily delivered to the Smartphone apps without any computing consumption. At the last, an open source pure Java API, Andoidplot was used to create dynamic PPG chart. Whatever library its having is added to Android Application, then again the plot reviews (i.e. Photoplethysmograph) can be added to the layout main file

V. CONCLUSION

We have concluded a low cost solution to enhance the remote monitoring system .It is secure, robust and low power consuming. It can be operated on multiple channels so to avoid interference with other wireless device or equipments. In future we are trying to store the heart rate in memory as well as connecting with the emails also using GPS system to send the alert message to correspondence of the patient. Including other bio-medical signals like Breathing rate along with Heartbeat rate.

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