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Wireless ECG Telemetry

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Abstract: Wireless ECG telemetry system is used to design and fabricate a wireless bio-monitor to eliminate the restrictions caused by lead wires in conventional systems used in hospitals by permitting the acquisition and wireless transmission of a signal from sensor to recorder .This wireless Telemetry works at frequency 434 MHZ radio frequency. To view ECG waveform on computer we require Microsoft Visual Basics 6.0 software .Waveform peak is control by the variable resistance. It is a microcontroller based device which is easily controllable and operatable for the ECG monitoring of the heart patient wirelessly at remote location. This Wireless ECG telemetry device facilitates the observer to monitor the ECG of the patient from 100-150 meters distance away from him.

Keyword: ECG, TELEMETRY, Wireless ECG, Acquisition.

I .INTRODUCTION

The Electrocardiogram (ECG) is essential diagnostic tool that measure and graphical recording of the electrical activity of the heart [1]. A wide range of heart conditions can be detected when interpreting the recorded ECG signals. These qualities make the ECG a perfect instrument for patient monitoring and supervision. The commonly used ECG machine used for diagnosis and supervision at the present is expensive and stationary. The monitoring of vital physiological signals has proven to be one of the most efficient ways for continuous and remote tracking of the health status of patient. An ECG is a non-invasive monitor, which can be utilized to evaluate the heart electrical activity, measure the rate and regularity of heartbeats, the position of the chambers, identify any damage to the heart and investigate the effect of drugs and devices used to regulate the heart. This procedure is very useful for monitoring people with (or susceptible to) impairments in their cardiac activity. In addition, during surgical procedures, the electroencephalogram (EEG) is measured along with his/her ECG to track the consciousness level of a patient during anesthesia. Other physiological parameters such as oxygen saturation in heomoglobin, electromyography and blood pressure similarly provide vital information about the health of a given person when continuously monitored. The goal of our paper is to design and fabricate a wireless bio-monitor to help eliminate the restrictions caused by lead wires in conventional system used in hospitals by permitting the acquisition and wireless transmission of a signal from sensor to recorder. In hospitals, our device would readily be adaptable to any system used to monitor physiological parameters, notably bedside ECG monitors, wireless capable computers and portable ECG monitors, thus allowing a patient's vital signs to be kept track of at all times despite his/her proximity to a bedside monitor. This allows the continuous monitoring of the patient's vital signs despite his/her proximity to a bedside monitor. With the help of microcontroller auto response can be generated using decision making algorithm [2].

II. LITERATURE REVIEW

This paper focuses on the development of a portable real-time system for analysis of ECG signals of a patient and also provides algorithms and techniques for buffering and analyzing the digitized signals. These methods are used for detecting sections of the ECG waveform like the P-wave and QRS complex, for primary diagnosis of heart disease of home-cared patients or for helpful for the staff of hospital to monitor the patient. The use of monitoring and analyzing ECG signals system at home can provide preliminary informative details of home-cared patients by using PDA/PC and this system simultaneously alert the doctor of any emergencies. This paper mainly focused on a development platform for real-time analysis of ECG signals and also provides a capability for real time software to analysis of ECG signal. this paper, we present a new A Reconfigurable, Wearable, Wireless ECG System for Electrocardiogram (ECG) acquisition as well as its processing, and wireless transmission provides less noise in ECG signals like Power line interference, Electrode contact noise, Baseline wandering and ECG amplitude due to respiration Instrumentation noise generated by electronic devices used in signal processing, and other less significant noise resource. This model provides less Size and power consumption, which provides mobility and comfort to the patient. A microcontroller ATMEGA8 used to execute the signal which is received by the RF receiver. Various algorithms to detect arrhythmia of ECG waveform that are available for telemetry application like, Turning Point algorithm, AZTEC algorithm, Fan algorithm, QRS Detection algorithm [3].When we increase transmission rate of ECG data the channel impulse response length increases so the requirement of the order

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of the filter increases which makes the real time operation of biotelemetry system more complex [1]. ECG monitoring can be done through android device with high precision using socket connection between android device and detecting module [4].Tele-health is a area in which information is delivered through communication technology over large and small distance [5].Wireless monitoring system promises further improvement patient mobility and improving patient compliances with frequent and better quality measurements [6].Patient with heart arrhythmia usually need to be monitored and controlled in hospital for one to several days [7]

III. WORKING OF ECG TELEMETRY

Pulse of the ECG signal taken by thumb through the IR LEDs which are work as photo sensor .When the pulse flow into the blood then the time of diastole/systole the photo sensor senses that diastole/systole and signal is amplify through the LM324. A maximum frequency of ECG signal is up to 160 Hz, so frequency of sampling for ADC should be twice than the frequency of ECG signal [8]. This circuit utilizes the RF module (Tx/Rx) for making a wireless transmit and receive the data, RF module, as the name suggests, uses radio frequency to send signals. These signals are transmitted at a particular frequency and a baud rate.

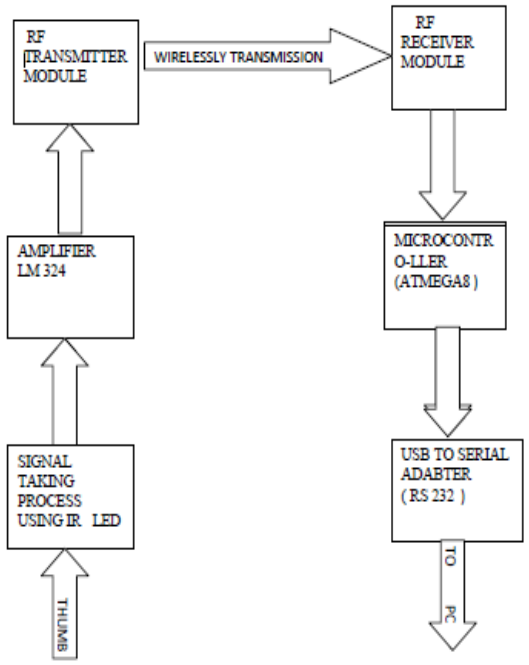

Fig. 1 Block Diagram of Wireless ECG Telemetry

Once ECG of the patient is taken it passes through RF module of the transmitter. This transmitted wave is detected by the receiver module. Received signal is then displayed on screen of the personal computer, which is placed away from the patient. A receiver can receive these signals only if it is configured for that frequency.

A. Transmitter

Transmission part contains IR LED (transmitter and receiver) in which the receiver is worked as the photo sensor, when LED is connected to the thumb then sensor senses flow of blood and signal is detected by the sensor. Second LED transmits the signal to the LM324 amplifier. Amplifier increases the strength of the signal for the transmission at fixed voltage level which is provided by voltage regulator IC7805.

B. Modulation Technique

The amplified signal is passes through RF module, where modulation is taken place. Amplitude shift keying is used to modulate the ECG signal which is to be transmitted. Amplitude shift keying uses simple architecture of transmitter as well as receiver. It is very cost effective than any other shift keying modulation techniques as bandwidth requirement is less.

C. Receiver

ECG Signal is received by the RF module of the receiver, which filter and demodulate the received signal. A Microcontroller ATMEGA8 used to execute the signal which is received by the RF module of the receiver. Microcontroller contains Rx (receiver pin) and Tx (transmitter) pin which are connected to USART (Universal Asynchronous Receiver Transmitter). PC (Personal Computer) is connected with receiver module through RS232 serial adapter. Waveform peak is control by the variable resistance.

IV. RESULT

Through wireless telemetry device ECG of a volunteer has been taken and received at 150 meter away from the transmitter. Figure 2 & Figure 3 are showing the waveform which received on computer screen. Received ECG waveform is properly observable and can be analyzed easily. Wirelessly recorded ECG waveform through the module can be digitized further for deep analysis.

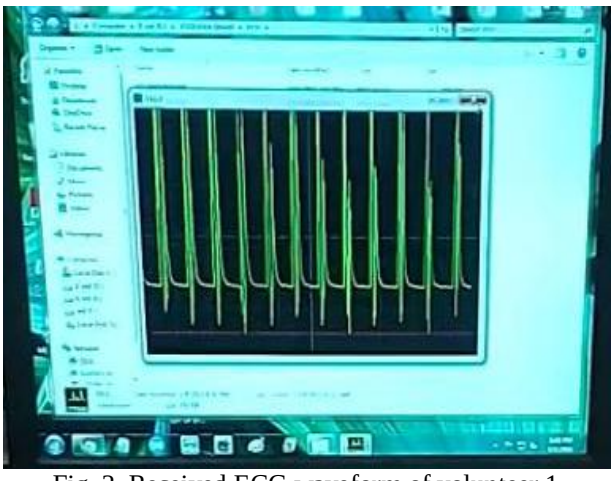

Fig. 2. Received ECG waveform of volunteer 1

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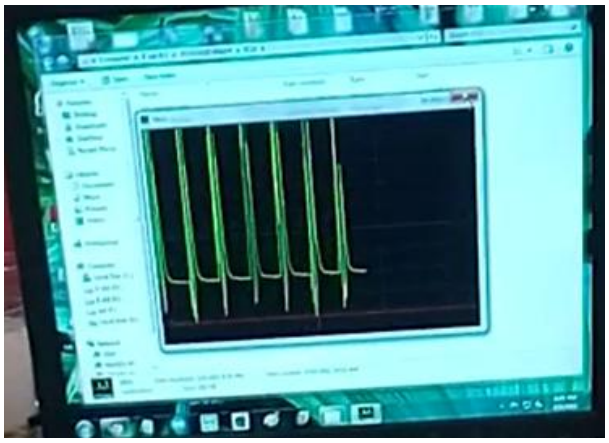

Fig. 3 Received ECG waveform of Volunteer 2

V. CONCLUSION

With technology advances in communication, now it is possible to monitor the condition and activity of heart of the patients wirelessly at some distance away from him/her. Also further processing on the received ECG waveform is possible. The main part of this system is wirelessly monitoring using RF module. So such wireless system allows remotely access of patient & also staff does not stay with one patient .they can check all the patient at one place at one time and there will be no wire system.
Current system can be developed for conventional 12-lead ECG system also in near future a device will be developed to interface the existing ECG machine with wireless monitor.

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