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WIRELESS ECG MONITORING SYSTEM

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ABSTRACT

ECG is typically used by doctors to make decisions on heart health. An electrocardiogram (ECG) evaluates heart rate regularity and detects cardiac device malfunctions. It is quite helpful for keeping an eye on those who have heart activity limitations. In India nowadays, heart attacks account for almost 25% of all fatalities. The primary factor contributing to heart attack fatalities is delayed or incorrect diagnosis. A heavy device that plots the patient's ECG must be carried by the doctor making the diagnosis on the spot. The suggested effort assists in resolving this issue. It is now possible to create a portable ECG gadget that records a patient's ECG and allows them to view it on a mobile platform because to advancements in Arduino and mobile technology. In order to couple ECG via mobile board, this paper discusses low power Lilypad, mobile platform Panda board, and zigbee technology.

KEYWORDS-*ECG, Arduino, Zigbee*

I.INTRODUCTION

For many years, hospitals and other healthcare facilities have employed electrocardiograms (ECGs) to diagnose cardiac conditions and do heart disease screenings. The electrocardiogram (ECG) measures the heart rate and regularity of heartbeats, as well as the size and location of the heart's chambers, any cardiac injury, impairments in cardiac function, and the effects of medications or heart-regulating devices, such as pacemakers [1].

Many attempts have been made over the years to create clinical information systems that are dependable, reasonably priced, and available to the entire institution. Today's scenario is made possible by advancements in international standards, strong personal computer technology, and wireless technologies. The aforementioned elements have facilitated the integration of data from various medical devices, including electronic stethoscopes and ECG machines, into a unified information system setting.

The electrocardiogram (ECG) is one of the most reliable and widely used techniques for determining cardiac regularity. Since the ECG is a costly instrument, using it alone to measure heart rate is not cost-effective. There are additional heart rate measuring devices available in the shape of wrist watches. Although these instruments are capable of providing precise measurements, their price typically exceeds several hundred dollars [4,5, 6].

This work aims to provide an overview of the development of a compact wireless sensor system that can increase patient mobility without compromising the ECG sensor's dependability. The next step in the advancement of wireless patient monitoring technology is to create an ECG system that is adaptable and dependable, helping to reduce the need for cables in clinical and physiotherapy settings. The primary goal is to develop a low-cost, dependable tiny wireless ECG sensor system [9].

The goal of the proposed study is to build a portable ECG monitoring device that can communicate ECG data wirelessly. The development of mobile and Arduino technology has made it feasible to create a low-power, portable ECG monitoring device that records patient ECG data and displays it on a mobile device. The suggested method employs the mobile platform Panda board and the inexpensive, low-power Lilypad to monitor ECG.

II.ABOUT ECG WAVEFORM

Figure 1 depicts the different waves and vectors produced in the heart muscles during each heartbeat. The electrical activity linked to the depolarization of atria is represented by the "P" wave. As a result, a depolarization wave moving from the Sinoatrial node to the atrioventricular node is represented by the "P" wave vector. The region next to the sinoatrial node becomes negatively charged as the wave moves, while the area surrounding the atrioventricular becomes electrically positive. The lower body becomes positive during this process, whereas the upper body becomes negative. 'P' waves that are positive are the consequence. Arithmegaly occurs during the beginning of the 'P' wave.

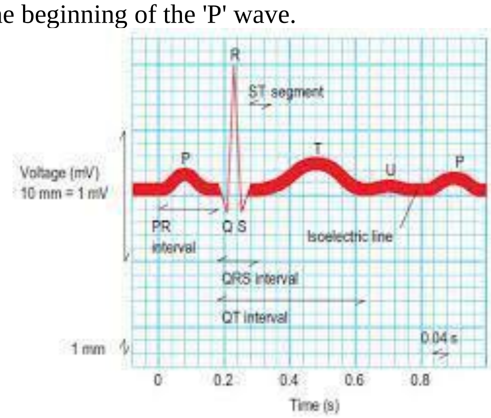

Fig.1.ECG Waveforme

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They then polarize again. There is one basic direction that atrial depolarization proceeds in. There are three routes whereby ventricles can depolarize.The ventricle depolarizes as soon as the delay period ends, starting in the septal region directly below the atrioventricular node and moving towards the right side. This is a result of the right ventricle's thinner walls than those of the left ventricle. In this instance, the depolarization wave moves from the left to the right. As a result, the body's left side turns negative and its right side becomes positive. The 'Q' wave is the recorded movement or vector.

The depolarization of the majority of the surviving ventricular muscles is represented by the 'R' Vector. The 'R' wave vector has a large amplitude or length because the ventricular muscles are larger than the atrial muscles. It appears to be moving in a positive direction, akin to the 'P' wave. The most noticeable element in the ECGs is the 'R' wave.

When measured at the body's surface, the usual amplitude of a "R" wave is roughly 1 mV, and when recorded inside the heart, it is about 40 mV.

The depolarization of the remaining ventricles is represented by the 'S' Wave vector. A 'S' wave causes the atrioventricular node area to become positive and the heart's apex region to become negative. The recorded 'S' wave hence appears negative. There is a difference in the amplitude of the 'S' and 'Q' waves. The combined effect of the ventricles' depolarization is the "QRS" complex. Prior to this period, the atrial repolarization wave has a relatively tiny amplitude and the atrium is in a state of repolarization.

As a result, the ECG waveform's base line typically turns flat between the beginning of the QRS complex and the conclusion of the "P" wave. The ventricles contract as they start to depolarize and then repolarize. The 'T' wave symbolizes ventricular repolarization. If the 'U' wave is seen, it is commonly thought to be the result of ventricular muscle after potentials. In the QT interval, the ventricles are inactive.

III.METHODOLOGY

Figures 2 and 3 present an overview of the proposed system. The ECG electrode is attached to a circuit that uses a Lilypad Arduino and delivers data via a Zigbee device. Pandaboard attached at the receiving end.

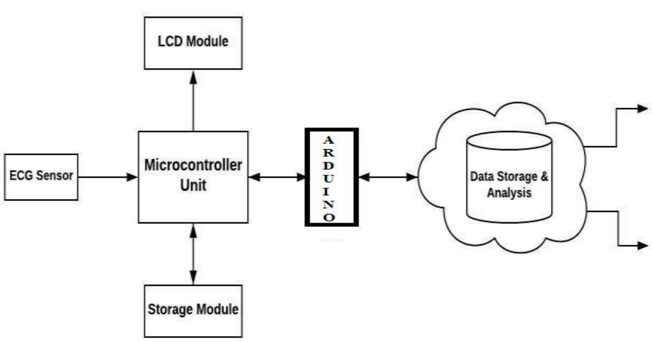

Fig.2.Sending End

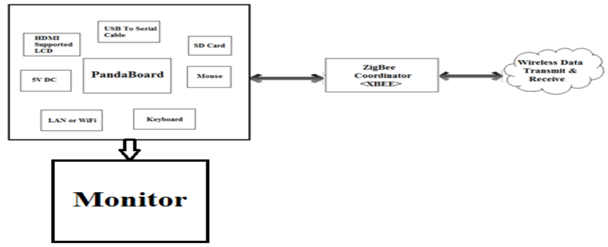

Fig.3.Reciving End

The monitoring system's data collecting component is focused on creating an ECG sensor board, which includes signal amplifier circuits and ECG electrodes. The weak electric signal produced by the heartbeat will be picked up by sensor leads. Microvolt impulses are converted to millivolts using an amplifier. The objective of this work is to obtain the human body's data and then process, filter, and amplify the signal before sending it to Lilypad Arduino. A reset switch, a 10-bit analog-to-digital converter, and an ATmega328V microcontroller are all part of the main board, which operates between 2.7 and 5.5 V.

The data is handled by the Lilypad Arduino circuit before being sent to the data monitoring component. The Zigbee breakout RX port is linked to the LilyPad TX port. The zigbee breakout operates a zigbee module and is fueled by the same power source as the LilyPad.

In Figure 2, the receiver function is displayed.The ECG is shown on the receiver's screen once it gets the data sent by the circuit via zigbee. The Zigbee has a voltage rating of 3.3V.However, the UART port's output voltage is 5 V. Therefore, a level shifter is required to lower the voltage from 5V to 3.3V. With its unique cheap cost and open nature, the Pandaboard is an open source mobile software development platform that makes development quick, simple, and extremely expandable.

Fig.4.shows the hardware prototype

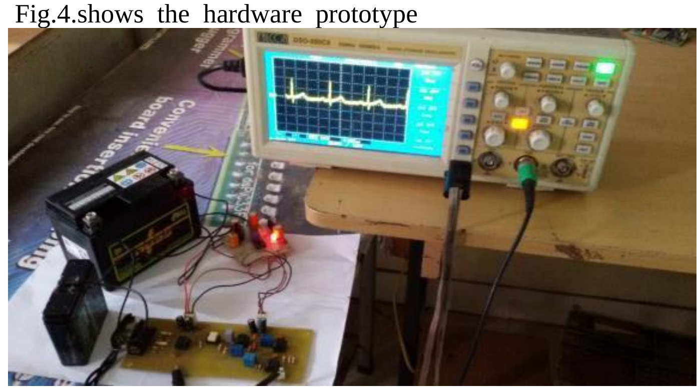

Fig.4.Hardware prototype of Proposed system

IV.COMPARISON

a.Limitations of Current Systems

1. Monitoring the reports for abnormalities is time-consuming work on the part of someone.

2. A portion of them only read when it's heart attack by the flip of a switch that won't be very beneficial for identifying a person's cardiac action.
3. A computer should be used to upload the report for moving it to the medical facility.
4. The automatically detecting ECG monitor the algorithm is expensive and large.

b. Advantages of Proposed system

The suggested prototype is a mobile platform device called Pandaboard that serves as the basis for a portable ECG monitor. The patient will wear a portable ECG monitor that wirelessly transfers heart rhythm data from Lilypad Arduino to Pandaboard for storage and monitoring. The Pandaboard's Linux foundation makes it simple to convert to other Linux-based systems, such as a PC or PDA.

1. Keeping track of a patient's heart rate and circulation
2. Lilypad Arduino is utilized to offer inexpensive a portable gadget and a solution.
3. The Zigbee protocol is utilized for transceivers. This is an improvement above Bluetooth technology.
4. The PandaBoard mobile platform is utilized to offer access to the instrument with mobility.

V.CONCLUSION

A heavy ECG device must be carried by the doctor in order to diagnose a patient on the spot. The development of Arduino and mobile technology has made it feasible to create a low-power, portable ECG monitoring device that records patient ECG data and displays it on a mobile device. This paper provides a brief introduction of a portable ECG system that employs the mobile platform Panda board and the low-cost, low-power Lilypad for ECG monitoring.

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