Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, May : 2024

ECG MONITORING WITH ANDROID SMARTPHONE

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***Abstract*— Electrocardiogram (ECG) monitoring plays a crucial role in the early detection and management of cardiac abnormalities. Traditional ECG monitoring systems are often bulky, expensive, and require specialized equipment, limiting their accessibility and convenience for personal use. With the widespread availability of smartphones and advancements in mobile health technology, there is a growing interest in developing ECG monitoring solutions that leverage the capabilities of smartphones to provide convenient and cost-effective monitoring options. This paper presents a novel ECG monitoring system that utilizes an Android smartphone to capture, analyze, and display real-time ECG data, body temperature and to get oxygen level also. The system consists of a compact ECG sensor that connects to the smartphone via Bluetooth, allowing users to perform ECG measurements anytime, anywhere. The accompanying smartphone application provides a user-friendly interface for recording ECG readings, viewing historical data, and setting up personalized monitoring schedules. Key features of the proposed ECG monitoring system include high-quality ECG signal acquisition, real-time data analysis for detecting arrhythmias or abnormalities, and secure data storage on the smartphone or cloud-based servers. In addition to personal use, the proposed ECG monitoring system has the potential for clinical applications, enabling healthcare providers to remotely monitor patients' cardiac health and track their progress over time. By integrating with electronic health record systems , the system could streamline communication between patients and healthcare providers, improving the overall quality of care for individuals with cardiac conditions.**

Overall, the ECG monitoring system presented in this paper offers a convenient, cost-effective, and accurate solution for monitoring cardiac health using an Android smartphone. With its user-friendly interface, real-time data analysis capabilities, and potential for remote monitoring, this system has the potential to revolutionize the way individuals manage their cardiac health and receive personalized care. Further research and validation studies are needed to assess the system's performance, reliability, and clinical utility in real-world settings.

Keywords: ECG Monitoring, cardiac Abnormalities, real time data Analysis

Introduction

In recent years, advancements in technology have transformed the way we monitor and manage our health. One such breakthrough is the integration of ECG monitoring with Android smartphones, a revolutionary development that has the potential to revolutionize cardiac care. ECG, or electrocardiography, is a vital tool in diagnosing and monitoring heart conditions by recording the electrical activity of the heart. Traditionally, ECG monitoring required specialized equipment and trained professionals, limiting its accessibility and convenience for individuals.

However, with the integration of ECG monitoring with Android smartphones , this essential tool is now available at our fingertips. By utilizing the sensors and capabilities of modern smartphones, individuals can easily perform ECG measurements anytime, anywhere, without the need for bulky equipment or frequent visits to healthcare facilities. This innovation not only empowers individuals to take control of their heart health but also enables remote monitoring and timely detection of cardiac abnormalities.

The ability to monitor one's ECG using an Android smartphone opens up a world of possibilities for proactive health management. With real-time ECG measurements, individuals can track their heart health on a daily basis, gaining valuable insights into their cardiac function and identifying any irregularities promptly. This proactive approach to monitoring can help prevent serious heart conditions by allowing for early intervention and treatment.

Moreover, the convenience of ECG monitoring with an Android smartphone makes it easier for individuals to incorporate heart health tracking into their daily routines. Whether at home, at work, or on the go, individuals can simply use their smartphone to perform an ECG measurement, providing them with immediate feedback on their heart health status. This ease of use encourages regular monitoring and empowers individuals to stay proactive about their cardiac well-being.

Furthermore, the integration of ECG monitoring with Android smartphones enables seamless data sharing with healthcare providers, allowing for remote monitoring and consultation. By transmitting ECG data to healthcare professionals in real-time, individuals can receive timely feedback and recommendations, ensuring optimal management of their heart health. This connectivity

between individuals and healthcare providers fosters a collaborative approach to cardiac care, enhancing communication and support for better outcomes.

Overall, ECG monitoring with Android Smart phones represents a significant advancement in the field of cardiac care, offering individuals a convenient, accessible, and proactive way to monitor their heart health. By leveraging the capabilities of modern technology, this innovation has the potential to transform how we approach cardiac monitoring and management, empowering individuals to take charge of their heart health like never before. With ECG monitoring at our fingertips, the future of heart health looks brighter and more promising than ever.

Benefits and Limitations

Benefits:

1. Accessibility: ECG monitoring with Android Smartphone makes this essential tool readily available to individuals, allowing them to perform measurements anytime, anywhere.

2. Convenience: The integration of ECG monitoring with Android Smartphone eliminates the need for specialized equipment and frequent visits to healthcare facilities, making it easier for individuals to monitor their heart health.

3. Proactive Health Management: Real-time ECG measurements enable individuals to track their heart health on a daily basis, leading to early detection of cardiac abnormalities and proactive intervention.

Limitations:

1. Interpretation: While individuals can perform ECG measurements with an Android Smartphone, interpreting the results accurately may require expertise or consultation with a healthcare professional, especially in cases of complex heart conditions.

2. Data Security: Transmitting ECG data from an Android Smartphone to healthcare providers raises concerns about data security and privacy, necessitating robust measures to safeguard sensitive information.

3.Cost: While ECG monitoring with Android Smartphone offers convenience and accessibility, there may be costs associated with purchasing compatible devices or apps, which could be a barrier for some individuals.

Applications in Real-World Scenarios

The applications of ECG monitoring with Android Smartphone offers real-time heart health data for optimizing workouts and remote tracking for patients with heart conditions.

I. LITERATURE REVIEW

Ahmed J.Obaid, Azmi Shawat (1967):Assesing and Diagnosing cardio vascular problem. The article deal with IOMT(Internet of Medical Things).

L. S. Kalkonde, Anita Bhatia (2010): A circuit connected to an Android phone via Bluetooth detects and sends amplified heart signals or real time ECG monitoring on the THINGSPEAK app, aiding in early heart attack detection and enabling prompt medical intervention. The user-friendly system continuously processes ECG data, computes heart rate and sends information to healthcare providers for timely medical decision.

Woub Shet Behutiye (2015): The vitalsens VS100 devices is also explained n this part of the thesis. Emphasis was given on implementing Bluetooth API to communicate vitalsens device.

Samuel E. Delucena (2019): The methodology described in this thesis involves the development and testing of circuitry and software to enable android mobile equipped with Bluetooth to receive in coming ECG from a user and display them in real time on phone screen.

Xiao-quiang GUO, Xiaohi Daun (2011): Our ECG monitoring System utilizes android smartphone to receive and transmit ECG signal from a device . Alarm detected by the phone trigger image capture and alarm details sent to a cloud server. The alarm server then notifies doctors via their phones for immediate review of ECG images and alarm.

Swati Chandankere, S.D.Markende (1965): It is low cost ECG monitoring solution based on a low power MSP430 microcontroller which is fully integrating with sensing electrodes on the transmitter side. The controller controls the analog signal to a digital signal via an inbuilt 10bit ADC, conditions and filters it for transmission via Bluetooth trans-receiver compatible with the MSP430.

Harold L. Kennedy (2017): Discusses motivation behind this project puts light on ECG signal and noise which can corrupt an ECG signal .Design of analog front end of this project software which is embedded into microcontroller and finally explain the development of Android ECG app for this project.

Ayaz Akram, Rahil Javed (2007): This research focus on designing and developing a method for predicting arrythmia along with monitoring the ECG signal reduces noise and enhances image quality, making it suitable for various image communication applications

II. METHODOLOGY

The patient health monitoring system is an integration of electronic hardware, cloud-based database and software. The electronic hardware involves integrating the sensors which are used in healthcare such as ECG sensor (AD8232), body temperature sensor (DHT11), oxygen level and heart rate sensor(MAX30100) etc.) With the microcontroller

(Node MCU esp8266). The cloud based database is a firebase Real-time database which helps to store and retrieve the data in Real-time using the cloud service. And software consists of an android application which shows the Real-time patient health data using the android smart phone.

The hardware device is powered through 12v SMPS power supply adapter. When patient wear this device to his hand, the pulse oximeter sensor and temperature sensor starts taking the readings from patient's body and to take the electrocardiography readings, the electrodes (small plastic patches that sticks to the skin) must be placed at certain spots on the chest, arms, and legs. Once this done correctly the ECG sensor also starts taking the readings from patient. Now using the microcontroller esp8266 (node mcu), all the readings are calculated and collected together with the help of programming using the Arduino software. Now the collected data should be visible on the android app on the smartphone. So, to achieve this, the firebase Real time database is used. The firebase is an online cloud-based service which has this Real-time database service using which the collected sensor data is going to store on the firebase platform. Once this done an android application is needed to show the patient's health data on the smartphone.To develop the android application, android studio software is used where different user interfaces are created to visualize the sensor dataproperly. Also to retrieve the data stored in firebase, the backend for firebase integration is created. The retrieved firebase data integrated with user interface to visualize the real-time data. So, this is how the combination of hardware, software and cloud platform work together to monitor the patient's health in real-time.

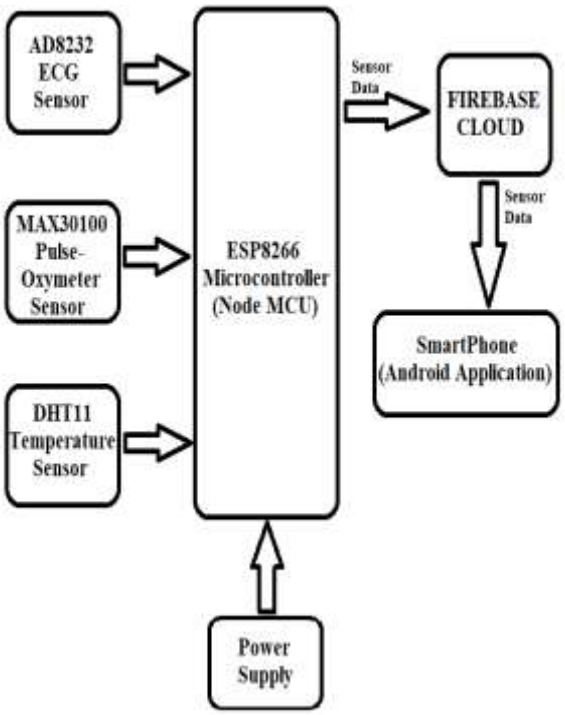
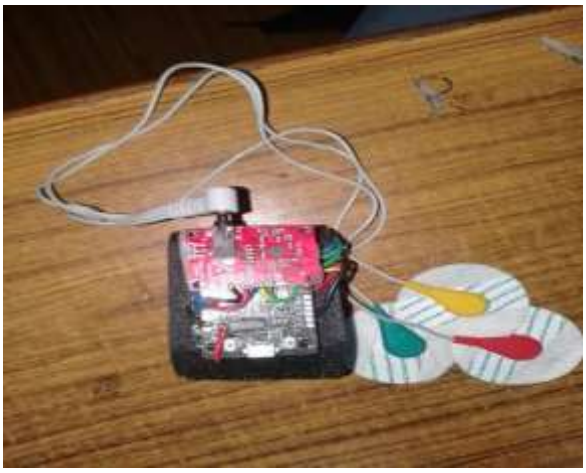


Figure 1. Block Diagram of ECG Monitoring with Android Smartphone



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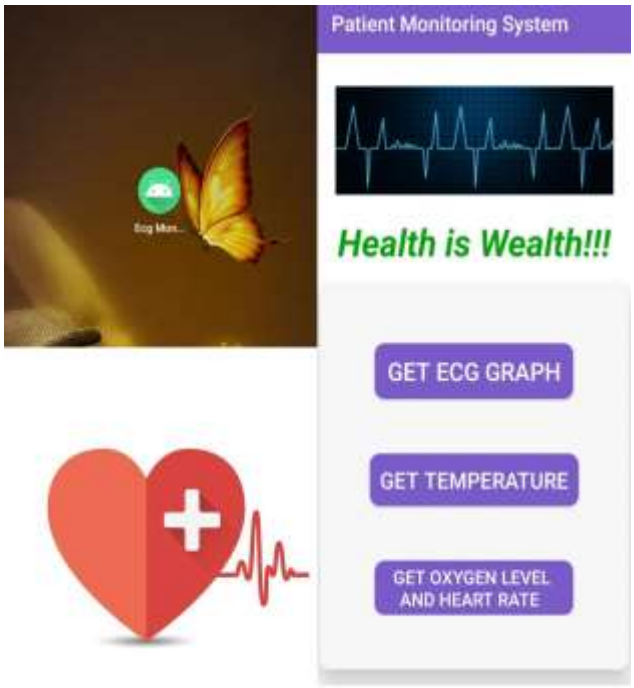

III. RESULT

Results of ECG Monitoring

IV. CONCLUSION

In conclusion, ECG monitoring with an Android smartphone offers convenience, portability, and a user-friendly interface for tracking heart health. In today's fast-paced world, where technology plays a significant role in our daily lives, the integration of ECG monitoring with Android smartphones offers a convenient and user-friendly approach to healthcare. This accessibility allows for greater flexibility in monitoring heart function, making it easier for individuals to stay on top of their cardiovascular well-being.

The ability to share ECG data with healthcare professionals seamlessly through smartphone applications enhances the collaborative aspect of healthcare. By providing doctors with real-time data, individuals can receive timely feedback and guidance on their heart health status. This direct line of communication can lead to more personalized treatment plans and interventions, ultimately improving patient outcomes and overall quality of care.

ECG monitoring with an Android smartphone is a valuable tool for proactive health management, it is essential to remember that it complements rather than replaces traditional medical care. Regular check-ups with healthcare providers remain crucial for a comprehensive assessment of heart health and the interpretation of ECG results. By combining the convenience of smartphone-based monitoring with professional medical advice, individuals can optimize their cardiovascular health and well-being for a healthier future.

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