IOT BASED REMOTE ECG MONITORING SYSTEM

Sneha S, Shweta Srikanth, Vibish Kashyap B, Vishnu K Krishnan*, R. Hemalatha, S. Radha
*Department of ECE, *Department of CSE,*
Sri Siva Subramaniya Nadar College of Engineering, Chennai, India
sneha18157@ece.ssn.edu.in, shweta18154@ece.ssn.edu.in, vibish18179@ece.ssn.edu.in,
vishnukrishnan18200@cse.ssn.edu.in, hemalathar@ssn.edu.in, radhas@ssn.edu.in

Abstract - This paper is aimed to present a system that aids in monitoring a patient"s heart health condition through the Internet of Things (IoT) technology. The proposed system screens the patient"s heart health condition by extracting ECG signals using an ECG sensor. The acquired data is transmitted to the ThingSpeak database by ESP8266. A server periodically extracts data from the database and classifies it using a CNN model, as a situation of emergency or not. The results of the classification are sent back to ThingSpeak. Based on the results, a notification is sent to the doctor and the patient"s relatives with the help of IFTTT App in case of any emergency.

Keywords - Healthcare, Continuous Heart Health Monitoring, Internet of Things, ESP8266, ThingSpeak.

I. INTRODUCTION

Internet of Things (IoT) is extensively used across various spaces and has gained immense attraction for its ability to transfer data over a network without requiring human-to-human or human-to-computer interaction and all the communication happening through the internet. A large portion of IoT devices is created for consumer use, ranging from wearable technologies to smart homes. Internet of Things (IoT) has been increasingly applied to interconnect the available medical resources and provide reliable, efficient and smart healthcare service to the elderly and patients with chronic illnesses. The application of IoT in Healthcare diminishes the challenges faced by doctors and patients by providing round the clock, remote monitoring. IoT has also allowed patients to effectively engage with their health care providers and has also increased satisfaction as interactions with doctors have become more efficient and easier. Additionally, remote monitoring of a patient's health helps in reducing the length of hospital stay and prevents readmissions. IoT also has a significant impact on reducing healthcare costs and enhancing treatment outcomes.

Traditional healthcare systems lack the ability to constantly monitor the patient's health. This leads to the untimely detection of several heart conditions. This is tackled by using IoT. ECG AD8232 sensor connected to the patient"s body collects data and the storing of the patient"s details in the Thingspeak database is mediated through the ESP8266 [1]. This makes it an efficient system with less complexity. With the help of a CNN model, the received ECG signal is classified into different classes of arrhythmia. A notification feature is in place to alleviate the problem of helplessness during an emergency, making it a reliable and cost-effective product for patients. The proposed paper presents a dependable solution for continuous monitoring of heart health by doctors, for patients using an IoT based remote ECG monitoring system.

The rest of the paper is organized as follows. In Section II, related work is discussed. Section III provides the proposed system. Section IV deals with the implementation and results. Finally, Section V concludes the paper.

II . LITERATURE SURVEY

In [2], Zhe Yang et al. proposed an IoT-based method for monitoring ECG. Using a wearable device, ECG data are gathered and with the help of Wi-Fi, it is transmitted directly to the IoT cloud. For providing visual and timely ECG data to users, HTTP and MQTT protocols are employed.

In [3], Uttam Deshpande et al. proposed a Cypress Wireless Internet Connectivity for Embedded Devices (WICED) Internet of Things (IoT) platform-based ECG monitoring system. A wearable monitoring device collects the data from the user and is updated to an IoT cloud by means of Wifi. Data communication and device management by IoT is done with protocols such as CoAP/HTTP, MQTT, TLS/TCP, DTLS/UDP, and OMA LW M2M.

In [4], Pamveer Singh et al. proposed an ECG monitoring system for a distant patient. In the proposed system an ECG sensor collects the Biosignals from the patient, which undergoes processing using development boards, and is sent to a distant IBM owned cloud, Bluemix for further analysis by a doctor or authorized personnel. The Bluemix cloud uses the MQTT protocol.

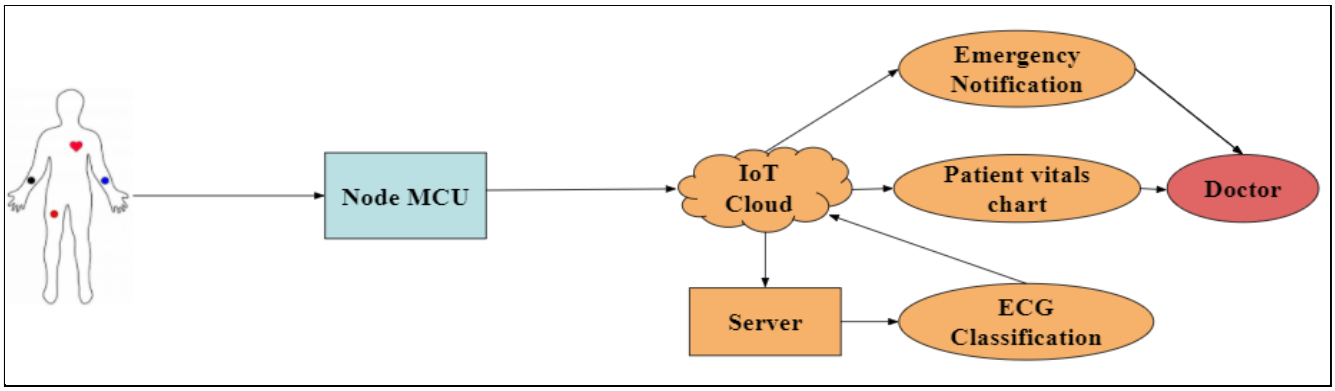

Fig 1: Block Diagram of the Proposed System

In [5], Mohammad Kachuee et al. proposed a deep convolutional neural network that is trained to detect arrhythmia in a given ECG signal. Furthermore, using the learned representation of arrhythmia, myocardial infarction classification is also performed. The proposed methods were evaluated on PhysionNet"s MIT-BIH and PTB Diagnostics datasets.

In [6], Mehak Chhabra et al. proposed an IoT based ECG monitoring system for calculating the value of a patient"s heart rate in beats per minute (bpm) and sending it to a cloud-based database. The critical parameters sent by the system can be analysed by the doctor and the real-time parameters of patients who are not admitted to the hospital can be monitored.

In [7], Auday A.H Mohamad et al. proposed a system in which a Node-MCU transmits the gathered ECG signals to the ThingSpeak platform. On the ThingSpeak-MATLAB cloud, PCA is employed which compares the received ECG signal with the various ECG signals stored in the Thingspeak channel databases. Based on this comparison, the system now classifies the signal into three groups namely, Arrhythmia-MLII, Atrial Fibrillation, and Normal-Sinus.

III. PROPOSED SYSTEM

The proposed system can be represented by the block diagram as in Fig 1. The three lead ECG pins are placed at three different locations on the patient"s body. The AD8232 ECG sensor amplifies the signal and converts the physical quantity into electrical quantity. The NodeMCU receives these signals and processes it before sending it to the cloud. The ThingSpeak platform is the chosen IoT cloud application for this purpose. Authorised personnel can view the patient"s data on the ThingSpeak channel [8]. A server is used to periodically extract the data from the ThingSpeak database and perform arrhythmia classification with the help of a CNN model. The output of the classification is sent back to the IoT cloud. Using React on Thingspeak, a request is sent to the WebSocket in case of an emergency. Then a notification is sent to the authorised personnel using the IFTTT App(If this then that) [9].

A. DESIGN METHODOLOGY

The design procedure associated with the proposed IoT system for ECG monitoring is elaborated in this section. The purpose of this system is to collect ECG signals using a single end node that sends data to the cloud.

1) PROCESS SPECIFICATION

Fig 2 shows the process diagram for the ECG monitoring system. When the ECG signal detected from the patient is classified as abnormal by the CNN model the system sends an emergency notification.

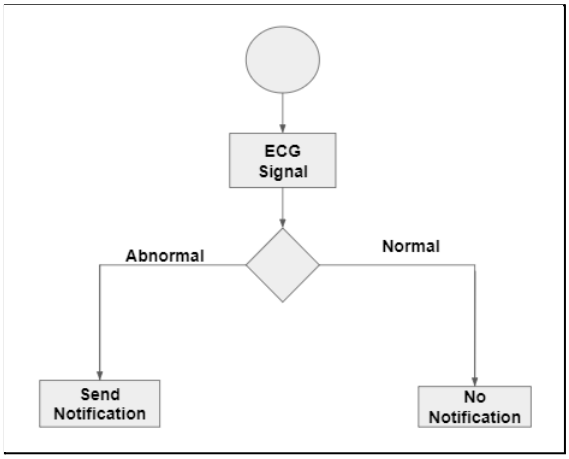

Fig 2: Process Specification for ECG Monitoring System