



MediFi; An IoT based Wireless and Portable System for Patient's Healthcare Monitoring

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Abstract

This paper represents an IoT based wireless portable healthcare system which can continuously monitor patient's heart rate, body temperature, SpO2 and keep track of the steps without visiting the hospital at the emergency hour. These sensors are connected to a NodeMCU development board to read the vitals of the patient and the output displayed on the OLED display.

All Data is synced from the device to the cloud using Wi-fi or SIM Card IoT module (in case Wi-Fi is not available). The data is stored in cloud storage for future references. It enables the medical records or anamnesis for the family members to monitor the real-time data 24/7 using mobile. The system allows physicians to immediate precautions and autogenerate prescription.

Keywords: NodeMCU, Health-Monitoring System, WSN, IoT Module, etc.

1 Introduction

The Internet of Things (IoT) is the outcome of the combination of two major scientific fields which are Computer Science and Electronics. IoT describes how the objects we use in our day-to-day life will interact and communicate with other devices over the Internet. The cost of employment of humans for performing routine jobs is becoming expensive every passing day. It is observed that even after employing a person for performing the assigned task, only a limited number of readings can be observed, as the human brain is exhausted and fatigued after working on the same task repeatedly.

With the advent of several fatal diseases, the branch **medical Internet of Things (mIoT)** has helped us to connect with patients, remote doctors, and hospitals via medical devices. This branch of IoT has paved the way of medical science to a greater extent. The human being's health is tremendously benefited from the mIoTs. Medical IoT devices are believed to be the fruitful outcome of Medical Science and Technology combined.

Keeping in mind the outbreak of several deadly diseases, an IoT based wrist band which can monitor a patient 24*7 would be very handy.

Our health monitoring device "**MediFi**" was originally framed during the outbreak of deadly virus "SARS-CoV-2". Our IoT device helps oneself to check body temperature, heart rate, track steps, and provides continuous monitoring of the patients, without visiting the hospitals or consulting any doctor at the late hours.

As we know, the more data we have, the more accurately we can find a cure. The device uses a sensor to check the patient's condition uploads the data to the cloud and the results can be easily accessed through a IoT application.

2 Problem Statement

The techniques used in the past have failed miserably while treating communicable diseases. As a result, a lot of frontline health workers are losing their lives worldwide daily.

It becomes the foremost duty to take adequate measures to protect our workforce amid this health crisis as they are the only weapons all

through this fight. For enabling life towards getting near to normal, the first thing that must be made sustainable is the healthcare system.

Patients with symptoms of influenza or with other pre-existing conditions like cardiac ailments and respiratory issues, are facing a lot of trouble in getting routine management as well as emergency management due to COVID-19 related guidelines. Collapse of the health care system in terms of providing adequate health services and revenue to sustain hospitals viability is evident.

In short, our health care system including both public and corporate sector are facing issue at everystep whether it is:

1. Containment of disease
2. Proper handling to emergencies due to non-COVID-19 Chronic illness
3. Protection of HCWs (Health Care Workers)
4. Sustainability

3 Literature Survey

M. Sathya et. al, [1] made a device that can either be worn or be embedded into the body of the patients, so at continuously monitor their health. The information that are being collected can be analyzed, aggregated, and mined to do the early prediction of diseases. The processing algorithms assist the physicians for the personalization of treatment, and it makes the healthcare economical with improved outcomes.

Sudha Senthilkumar et.al, [2] proposed a system that can monitor the patient's body condition like reading the body parameters like temperature, humidity, pulse, and body movements uninterruptedly from anywhere in the world. Analysis of patients' health data is done against the normal situation to track abnormal physiological parameters and in emergency situations notifications will be sent to doctors immediately.

D.Shiva Rama Krishnan et. al, [3] proposed a system that uses temperature and heartbeat sensor for tracking patient's health. Both sensors are connected with Arduino-Uno. The results are displayed in a LCD display and the readings are sent to the cloud server by the help of Wi-Fi to track the real-time data using internet and in case of any abrupt changes in patient heart rate or body temperature alert is sent about the patient

using IoT.

Md. Raseduzzaman et. al, [4] made a system that is responsible for collecting pulse, body temperature and heartbeat from the patient's body and send data into the IoT Cloud platform by using Wi-Fi and those health data of patient's stored in the cloud server. It allows the medical representatives and authorized persons to monitor the data anywhere.

4 "MediFi"-The Wearable Device

IoT has transformed every aspect of our everyday lifestyle. IoT has a good match for healthcare solutions. The advantages of IoT in healthcare are endless. Also, the popularity of wearable IoT devices is increasing day by day. Hospitals and other healthcare organizations are using wearable IoT devices to increase the comfort of patients, reducing the chances of technical errors, decreased costs, better healthcare management and safe environment both for healthcare workers and patients.

We have designed a Health Monitoring device – "MediFi" which continuously monitor the patients 24*7 and uploads the data to the cloud and the hospital or family can easily access the data using the MediFi App. The device is motivated by the fitness devices that are trending in the market nowadays. Thanks to our IoT based device "MediFi" that measures patient's body temperature, heart rate, SpO2 and keeps track of steps. The patient's essentials uploaded to the cloud can be viewed from anywhere, anytime without coming in direct contact with the patients. The doctors can recommend the accurate measures that can be taken at that point of time.

The MediFi App is designed in such a way that it can be accessed anytime and from any part of the world. The app is designed keeping simplicity at the top priority. Hence the app has a very user-friendly user interface. The app actively monitors the patients and synchronizes the readings or vitals into the cloud server. The doctors and the patient's family can regularly monitor the patient's condition on their fingertips. The doctors can then physically check the patients and generate a prescription via the app or in the traditional way.

5 System Architecture and Working

The methodology adapted is to read data using the sensors and then send it to the cloud servers. And the data can be seen by the doctors and can be flagged as alert if the readings are unusual.

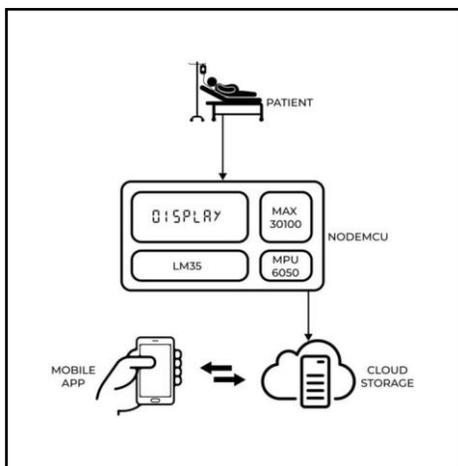


Figure 1: Architecture of the proposed system

Figure 1 shows the architecture of our proposed system for health monitoring of the patients remotely. Our MediFi wearable device can be firmly fitted onto the wrist using the belt. The MediFi device mainly works in two parts. In the first part the sensors take the vitals or readings from the patient's body. The sensor MAX-30100 reads the heart rate and the SpO2 concentration whereas the MPU-6050 record the steps of the patient. A LM-35 has been used to continuously record the body temperature of the patient. The patient's vital readings are then sent to the main processing device called NodeMCU. The NodeMCU takes those readings and does all the required calculations on the raw data that was just collected by the sensors. When the calculations are done, the NodeMCU displays the final readings on the OLED display mounted on the device. The NodeMCU also actively sends the patient's readings to the cloud server through the internet. These patient's readings are regularly sent to the cloud server in real-time for future use.

The second part comprises the synchronization of the data. The readings in the cloud server are synced in real-time from the MediFi device to the MediFi App. The prescription or the doctor's prescription is also synced from the MediFi App to the cloud server for future use.

These readings and prescriptions can be viewed by the patient's family from anywhere. This can be a great help for the family because they can instantly take measures as per the doctor's recommendation if the patient is critical.

Figure 2 below shows how the sensors are connected on the NodeMCU development board.

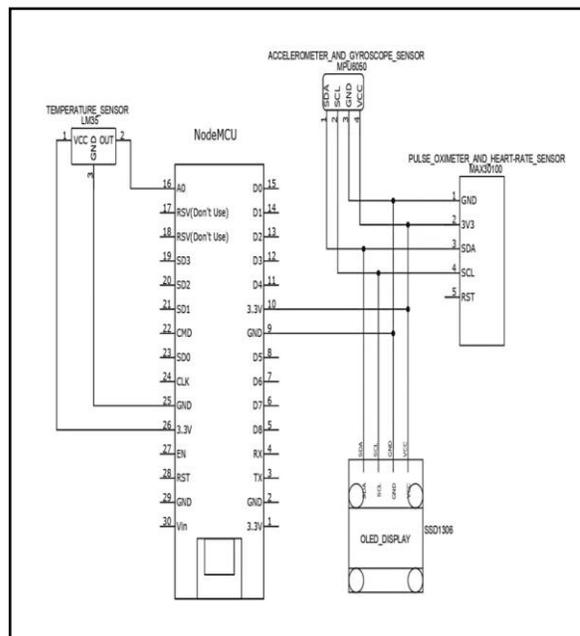


Figure 2 : Circuit Diagram of the wearable device

6 Benefits

When we decide for a product, the first thing that ever crosses one's mind is the pros and cons. Our device being an application of IoT has several benefits which can be enlisted below:

- Remote monitoring: Real-time remote monitoring via connected IoT devices and smart alerts can diagnose illness and can save lives in case of a medical emergency.
- Prevention: Smart sensors analyze health conditions, lifestyle choices and the environment and recommend preventive measures, which will reduce the occurrence of diseases and acute states.
- Reduction of healthcare costs: IoT reduces costly visits to the doctors and hospital admissions and makes testing more affordable.
- Medical data accessibility: Accessibility of

electronic medical records allow patients to receive quality care and help healthcare providers make the right medical decisions and prevent complications.

- Improved treatment management: IoT devices can help track the administration of drugs and the response to the treatment and reduce medical error.

7 Conclusion

In this paper, we have proposed a medical IoT based device that can monitor patient's health. The proposed system can track the patient's vitals like heart rate, SpO₂, body temperature and the steps with the help of various sensors mounted on the wearable device. The readings are actively uploaded to the cloud server so that it can be accessed anytime remotely via the MediFi App. This device can save a lot of time as the doctors can recommend treatment remotely. This proposed system will be a great addition to the medical world and will be hugely support the medical IoT field.

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9 References

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