

HEALTH MONITORING SYSTEM FOR COVID-19 PATIENTS USING IoT

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Abstract - Social distancing is now standard practice which is implemented worldwide since the outbreak of the corona virus (COVID-19) disease epidemic in 2019. Due to the complete acceptance of the social distancing, frequent hospital contact visits are being discouraged. However, there are some people whose physiological or mental vital needs a routine monitoring for improving their healthy living. Doctors need to monitor the patients day to day and there is a risk of doctors getting infected with the virus. To overcome this issue we designed a distant IOT based health monitor system that allows for remotely monitoring of multiple covid patients over the net. The system monitors patient heartbeat, temperature and pressure level through the help of heartbeat sensor, temperature sensor and BP Sensor respectively. With an advancement in technology day to day and miniaturization of sensors, there have been many attempts to utilize the latest technology in many areas to improve the quality of human life. Till now a remote smart home healthcare support system is proposed for monitoring patient's health status while staying at home and receiving doctor's prescriptions. Besides this, doctors also can perform the diagnosis of ailments using the info collected remotely from the patient. The main objectives are remote monitoring and guidance awareness by sharing information in an authenticated manner.

Key Words: Health Monitoring, Micro-controller, IoT, COVID-19.

1. INTRODUCTION

A Remote health monitoring system is an extension of a hospital medical system where a patient's vital body state is often monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and sophisticated circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost. The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. Internet of Things (IoT) development brings new opportunities in many applications, including smart cities and smart healthcare. At present, the primary usage of the IoT in medical and healthcare can be categorized as remote monitoring and real-time health systems.

Since the outbreak of the corona virus (COVID-19) disease epidemic in 2019, there are quite 14.5 million confirmed cases of COVID-19 reported in 185 countries, as of July 21,

2020, with approximately a 2 % daily increase. Among these cases there are quite 95 thousand deaths, which represent an approximate 4.2 % deathrate. This novel corona virus was characterized on March 11, 2020 as an epidemic by the planet Health Organization. Unfortunately, there's no successful treatment procedure or vaccine yet. It is expected that the event of an efficient vaccine will take quite a year, especially since the character of the virus has not yet been completely characterized. Currently, the only way that the world can deal with this corona virus is to slow down its spread, by using measures such as social distancing, hand washing and face masks. However, technology could also help slow its spread, through early identification and monitoring of new cases. Such technologies include big data, as well as cloud and fog capabilities, the use of data gathered through remote monitoring, such as mHealth, teleHealth, and real-time patient status follow-up. This paper proposes COVID-19 detection and monitoring system that might collect real-time symptom data from wearable sensor technologies. To identify potential corona viruses cases from this data, this present paper proposes for using eight of the machine learning algorithms, namely Support Vector Machine, Neural Network, Naïve Bayes, Decision Stump, OneR, K-Nearest Neighbor (K-NN), Decision Table and ZeroR. This detection and monitoring system might be implemented with an IoT infrastructure that might monitor both potential and confirmed cases, also because the treatment responses of patients who recover from the virus. In addition to real-time monitoring, this technique could contribute to the understanding of the character of the virus by collecting, analysing and archiving relevant data.

2. LITERATURE REVIEW

There is considerable amount of work in the literature regarding the usage of the Internet of Things to deliver health services. Usak et al conducted a systematic literature review on the usage of Internet of Things in health care systems. The work also included a detailed discussion of the main challenges of using IoT to provide health services, and a classification of the reviewed work in the literature.

Wu et al. proposed a hybrid IoT safety and health monitoring system. The goal was to improve outdoor safety. The system consists of two layers: one is employed to gather user data, and therefore the other to aggregate the collected data over the web. Wearable devices were accustomed to collect safety indicators from the encircling environment, and health signs from the user.

Darwish et al. proposed a CloudIoT-Health paradigm, which integrates cloud computing with IoT within the health area,

supported the relevant literature. The paper presented the challenges of integration, additionally as new trends in CloudIoT-Health. These challenges are divided into three levels:

1. Intelligence
2. Technology
3. Communication and networking

Amna Abdullah and et al. demonstrate a LabVIEW based patient checking framework. The framework undertaking is completed in five key advances. We think about two frameworks to execute the system. In this system, we see the sensors attached with the patient's body to a transmit unit related with a ZigBee or GSM orchestrate. The transmitter transmits the data remotely to a recipient that is additionally connected with a ZigBee or GSM engineer. The beneficiary is connected on to the USB port of a close to watching unit (which could be a Laptop with LabVIEW programming in it). The region watching unit shows the last information.

In remote health monitoring system, the patient's health parameters are recorded by a sensible phone by eliminating a further hardware and transmit data through an internet interface. It gives end to end monitoring screen through three steps. Firstly, the important time health parameters are measured through wearable sensors and transmitted to a wise phone which shows the patient health status in graphical interface. Secondly, this technique provides knowledge to friend and doctor through web interface for further monitoring. Thirdly, I provides real time alarm if the patient is at emergency situation like attack, etc.

IoT. Maghdid proposed the utilization of sensors available on smart-phones to gather health data, like temperature.

There are many challenges in using the wearable tracking devices for a long time. Firstly, the daily use of tracking devices is mainly based on small size, rough use and less energy consumption. 2nd thing is that the main challenge is of the accuracy, validity and integrity of measurement data with other devices. 3rd is that the user friendliness and therefore the experiences of the user with the device and its friendly supporting software play vital role in continuing regular and long period use of wearable tracking devices. the utilization of Internet of Things (IoT) and its e-Health applications within the Tele-medicine health system results in seamless flow of data between doctors and patients, thus making healthcare cost effective and improving the standard of patients' treatment. This technique uses the K53 Tower System platform for e-Health applications to point out the benefits of IoT in medical system. The 2 fundamental aspects in monitoring people in danger are:

- Prevention
- Effective and early intervention during medical emergency

Rao and Vazquez proposed the utilization of machine learning algorithms to spot possible COVID-19 cases. The learning is completed on collected data from the user through web survey accessed from smart-phones. Allan and Jones discussed the need to develop standard protocols to share information between smart cities in pandemics, motivated by the outbreak of COVID-19. For instance, AI methods are often applied to data collected from thermal cameras installed in smart cities, to spot possible COVID-19 cases. Fatima et al. proposed an IoT-based system to identify corona-virus cases. The approach is predicated on a fuzzy inference system.

Using the available literature, Peeri et al. conducted a comparison between SARS, MERS and COVID-19. They suggested the utilization of IoT in mapping the spread of the infection.

3. OBJECTIVES

- To reduce health care costs.
- To reducing physician office visits, hospitalizations, and diagnostic testing procedure.
- To update the server with patient data on website GSM technology is used.
- Create a valuable data system enhancing the standard of life for everybody.
- To create a user friendly IoT based system.
- Enable fast and remote healthcare monitoring.

References	Techniques/ Methodology	Advantages	Disadvantages
[1]	Wellbeing monitoring through Wireless Sensor Network and cloud computing using IoT	Cost efficient technique and ubiquitous monitoring	Not easy to deploy WSN nodes compared to wired networks.
[2]	Health monitoring through Wireless Body Area Sensor Network (WBASN)	Easy addition of new sensors to existing system.	Sensors should be low in complexity, small in size, light weight and easy configurable.
[3]	Cipher text Policy Attribute Based Encryption (CP-ABE) for data security	Access based policy towards data protection.	Difficult to implement in non-interactive group of networks
[4]	Technology Acceptance Model	Widely recognized technologies to be used for easy access	Adoption of new technologies is difficult to equip with for elders
[5]	IOT with smart devices	Real-time data access and intelligent data integration.	Constant updation and upgradation of devices is needed.

Figure 1: Comparison of Methodologies used in the survey.

Nguyen presented a survey of AI (AI) methods getting used within the research of COVID-19. This work classified these methods into several categories, including the utilization of

4. METHODOLOGY

I. COMPONENTS USED

Sl. no	Components
1	Micro-controller board
2	ESP8266 Wi-Fi Module
3	MAX30100 Pulse oximeter sensor
4	18B20 temperature sensor

Table 1: Components Used.

II. PROPOSED SYSTEM

IoT server used in this device is Blynk, which acts as cloud storage to get the data from the system and which is then displayed in Blynk mobile application. Blynk can be installed in Android and IOS mobile platforms. Programming language used is embedded C++ for programming Wi-Fi microcontroller.

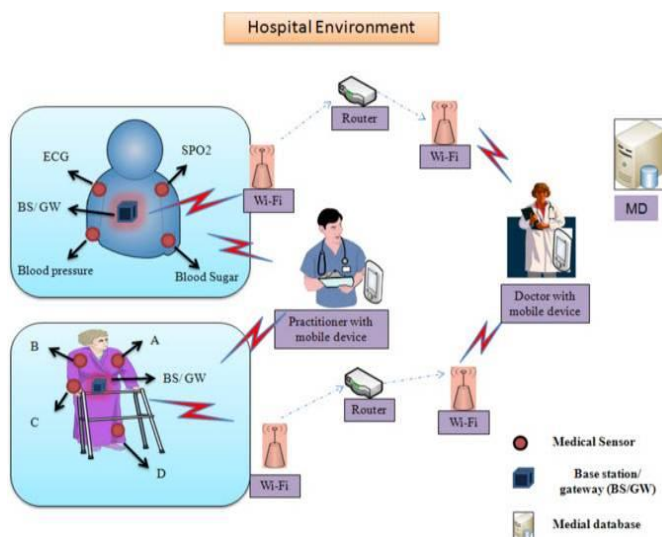


Figure 2: Proposed System.

By using the power switch, system can be turned ON, which gives power to the micro-controller board and sensor board. Then finger has to be tapped in the oximeter sensor, so that it will collect the data from the patient and send it to the internet cloud storage to displays in the doctor's mobile application. Then you can measure the body temperature by keeping the finger in temperature sensor. Based on the schedule by doctor, patients can do the test periodically. Blynk application shows the data in both numerically and graphical chart visualization. It also gives the alert notification in the doctor's mobile phone when high temperature of fever or emergency is detected.

Unprocessed information from various IoT devices is stored on the server. These devices include various sensors like temperature sensor, vibration sensor, BP sensor and pulse sensor. Since some of the sensors give analog output

which cannot be used by raspberry pi, we first convert the analog values into digital form and using converter IC. Then using the micro-controller, we write the code in which that reads the values from the sensors and updates them into the database at regular intervals.

The relevant information is obtained as a result from the information stored by filtering, classifying and categorizing it. This information is nothing but the patient's real-time health data and symptoms that the patient has. This information is going to be further utilized in subsequent level to predict if the patient is affected by any known disease. This helps to create the system smart and efficient.

The analysis/predication phase, we use data processing techniques to predict the sort and nature of the disease or the disorders that the system was designed. Using AI can further improvise the system by making it smarter. Hence we will infer the disease or disorder by using the prevailing knowledge domain and categorize the end in various categories like Ideal, Normal, and With Symptoms etc.

III. OVERVIEW OF THE SYSTEM

In Fig [3], overview of health care monitoring system is depicted. Patients' vital parameters like Heart Beat and temperature is continuously monitored via medical sensors and periodically stored in cloud service. The proposed system collects real time data from the patients and delivers an updated patients status to the medical professionals and to the caretakers using WSN. This autonomous system replaced the normal method to gather the parameters regularly by nurse. It avoids the manual errors in collecting the patient's information. MQTT is light weight protocol used for transfer the messages. The observed vital signs of the patients are analyzed and checked against the quality range to detect the abnormality of the patients.

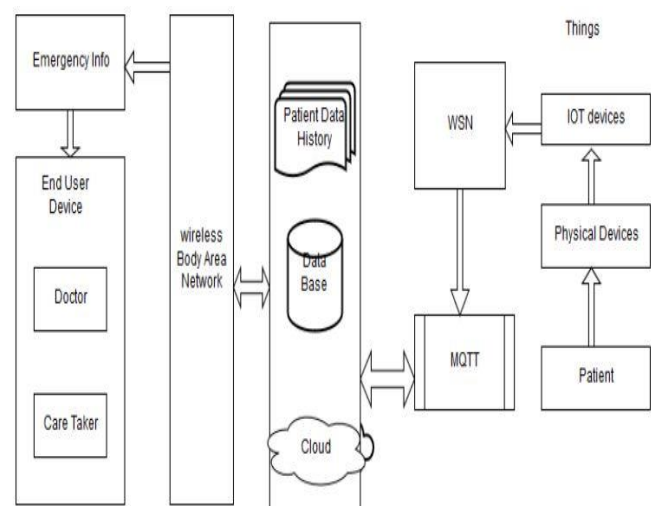


Figure 3: Overview of Health Monitoring System.

IV. IMPLEMENTATION

In this paper, we've proposed a system during which patient's body temperature, pulse, body movements and vital sign reading results that are being monitored by the system.

The varied sensors are placed on the patient's body and that they take the readings and send the corresponding signal to the raspberry pi. The Raspberry Pi may be a credit card-sized single-board computer that operates on Linux OS. Here, various sensors are accustomed to measure the patient's body temperature, pulse, vital sign and their respective results are sent to the database via Raspberry Pi and may be monitored from anywhere worldwide through the web facilitated via GSM module.

The programming in Raspberry Pi is done in python language and it sends the data related to the patients' health to the server connected via Internet. The details can be easily accessed online by proper authentication and health status of the patient can be monitored.

5. RESULT

As the title says, the results of Smart Health Monitoring system are of utmost use to patients and doctors also. The patient can check their health status anytime from the comfort of their homes and visit hospitals only when they really need to. This can be done by using our system whose result are brought online and may be seen from anywhere round the world. Since it's a prototype model, our system shows the just about real time values of varied health parameters and emulates how equivalents are often implemented within the world. The doctors can also use the log of the patient body condition to study and determine the effect of medicine or other such things. The smart prediction module predicts the disease that the patient is suffering from by asking them for various symptoms they may have and the options are based on the previous symptom. The final conclusion is made after at least 3-4 symptoms are identified. The result is most accurate if more and more symptoms are identified.

6. CONCLUSION

The system is mounted at patient side and perpetually transmits patient health information over the web in order that doctors will monitor multiple patients remotely and attend the specified patient desperately once required.

This project fulfills the aims to significantly reduce the risk of exposure in healthcare workers. It is also expected to scale back the increasing demand of PPE (personnel protection equipment) and logistics stays in quarantine period reduced for conventional routine examinations and most important that the health can be monitored and disease diagnosed by any doctor at any distance. In this paper, an IoT (Internet of Things) based health monitoring system was developed. The system monitored body temperature, pulse rate and saline level, which are also displayed on a LCD. These sensor data is sent to a medical server using wireless communication. This data is then received by an authorized personals smart phone using IoT platform. With the values received the doctor then diagnose the disease and therefore the state of health of the patient.

This System allows:

- Doctors to monitor patients remotely without risk of infection
- One doctor can monitor over 500 patients at a time.
- Doctor gets instant alert just in case of health
- Fluctuations of emergency

7. FUTURE SCOPE

As a future work, we decide to extend our application beyond Android platform to other IOS platforms for wide adaptability. With the efficient technique presented during this paper, it's believed that this research may be extended to other areas of IoT like agriculture for monitoring of livestock and consultation of farmers with veterinary doctors towards diagnosis, prescription and treatment for the diseases in livestock in farms. Also, the new system is extended to be used within the pharmaceutical sector. The doctors can send prescriptions to the pharmacist for recommendation of dosage and possible dispensing of medicines to patients. Finally, it'll be of interest to hold out an evaluation of the general performance of the proposed system using different mathematical and statistical evaluation tools. The system may be further improved further by adding AI system components to facilitate the doctors and therefore the patients. The data, consisting medical record of the many patients' parameters and corresponding results, are often explored using data processing , in search of consistent patterns and systematic relationships within the disease. For instance, if a patient's health parameters are changing within the same pattern as those of a previous patient within the database, the results also can be estimated. If the similar patterns are found repeatedly, it would be easier for the doctors and medical researchers to find a remedy for the problem.

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