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Healthcare Monitoring System Using IOT

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Abstract: ***The last ten years have seen a shift in the healthcare monitoring systems, making them one of the most major systems. Even though there are millions of medical facilities worldwide, it is challenging to attend to each and every patient, primarily those with diseases like Covid-19 and Hepatitis B. It is practically impossible to monitor the conditions of those patients due to a concern of infection.***
Without quality monitoring, it is impossible to keep track of patients' conditions. To improve patient care, the present invention discloses the design and development of a reliable and consistent patient monitoring system that allows medical professionals to monitor their patients while they are either in a hospital or at home.
Keywords: Raspberry Pi, BlueDot, Patient Monitoring System, Cloud computing.

I. INTRODUCTION

The Internet of Things (IoT) refers to connecting devices to the Internet so that they can connect to each other and send and receive data. As health of an existence is a notability amongst the most vital issues these days, IoT could be used in the good business as a ceaseless health observing framework.

IoT is a mixture of installed frameworks, sensors and programming and has the potential to transform the healthcare industry by enabling more effective and efficient patient care, as well as improving the overall management and delivery of healthcare services. Using sensors reduces the chance of human error, ensures better care and treatment, reduces healthcare costs, reduces room involved space, and improves overall performance.

In India, many people's daily lives are affected because patients are not treated properly and in a timely manner. It can be difficult for hospitals to check patient status frequently.

Continuous monitoring of intensive care patients is also not possible.

Our system is useful for dealing with such situations. Modern healthcare systems must provide better healthcare services to people anywhere, anytime, in an affordable and patient-friendly manner. Our system is designed for hospital use to measure and monitor various parameters such as temperature, pulse rate and heart rate.

Seriously injured patients and patients from certain areas may have difficulty reaching Hospital. Accordingly, they can use video conferencing to communicate with doctors and better their health while saving money and time. Patients can use this technology to record 's health status on their mobile phones.

Monitoring the availability of critical medical supplies such as blood and medical supplies is an important task for hospitals and other healthcare organizations.

Data analytics can be a valuable tool in identifying trends and patterns in demand and supply of these resources to ensure they are available when needed.

This can involve collecting data on the quantities of different commodities being used, as well as factors that may impact their availability, such as seasonal fluctuations or changes in patient populations. By using data analytics to monitor supply and demand for key medical assets, hospitals and other healthcare organizations can make informed decisions about how to allocate their resources and assure the requirements of their patients.

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II. LITRATURE SURVEY

Purnima, Neetu Rout et.al2017	Zigbee, GSM, ARM controller and sensors.	Patient Health Monitoring System	Here, a system is proposed with an approach that, by offering monitoring capability, will upgrade the health monitoring systems in medical facilities. Whenever a patient's vital signs change, the system will notify hospital staff so that immediate care can be provided to the patient and the doctor is also notified via SMS.
Saranya. E, Maheswaran 2019	GSM, Arduino, Sensors, and Cloud servers.	Disease Prediction and Diagnosis System	The disease is predicted by the disease prediction system based on the patient's pressure, heart rate, and body temperature. In order to monitor the patient's body temperature, heart rate, and blood pressure, sensors are attached to the patient's body. These sensors send data to an Arduino controller, which is utilized to detect and predict the condition of the patient. This uses a GSM module to store information in the cloud. Through the internet, it is accessible from any location at any time.
Mohammad Dawood Babakerkhell, Nitin Pandey2019	Raspberry Pi, WSN (wireless sensor network), Sensors and RFID tag.	Analysis of Different IOT Based Healthcare Monitoring Systems	The author has studied a number of systems, and the findings indicate that IOT-based designs offer greater accuracy and the ability to track patients' healthcare conditions over time from any location. The suggested framework can be installed in healthcare facilities, and a vast amount of data can be gathered and stored on the cloud. Through the use of applications, the patient record will be accessible via smartphone.
Shubham Banka 2018	Raspberry Pi, IoT severs, Sensors AND PMS.	Remote Monitoring System	The author's system uses sensors to track body temperature, pulse rate, and room humidity and temperature. Each of these observations are displayed on an LCD. The sensed data are then transmitted wirelessly to a medical server. An authorized personal smart phone with an IoT device then gets these data.

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AUTHOR / YEAR OF PUBLICATION	METHODOLOGY/ TECHNOLOGY	APPLICATIONS	FINDINGS
Prajoona Valsalan 2020	WI-FI module, room humidity sensor, and Arduino.	framework for monitoring rooms and care recipients	Since patient information is processed and stored in the cloud, fewer patients must visit the hospital to get their documents processed, and doctors can monitor patients from a location.
R. Alekya, Neelima Devi Boddeti 2020	REST, Coap, and wireless sensor networks (6LoWPAN).	Cluster Condition health application	helps to enhance the healthcare delivery system by eliminating obstacles associated with time, geography, and other aspects, while also broadening their coverage and efficiency. The IoT health revolution is a reality, and as a matter of fact, people can obtain better care at affordable costs.
Md. Milon Islam, Ashikur Rahman 2020	ESP32, Sensors, Cloud Server.	Hospital Management System	Smart health care systems calculate the hospital room environments, for example the level of CO2, CO gases, and room humidity, along with the basic vitals of patients, like body temperature and heart rate.
Rashmika Madushan 2020	RFID tag, Wireless Sensor Network, Sensors	Medication administration and telemonitoring	Modern technology provides better solutions for advancements and supports in resolving healthcare issues.
Shah Nazir, Yasir Ali 2019	SLR protocol and GSM network.	Smart Hospital using mobile communication	Study result from mobile computing-based health monitoring provides a diverse range of applications for managing health.
R.Rubasri et.al 2018	ECC-RFID tag, Sensor network and GSM.	Healthcare monitoring System	The security protocols for authentication are a topic of discussion. In terms of both implementation and authentication, they have particularly represented ECC-based RFID authentication. Even though the that most of these falls short in the areas of implementation and security.
Ahmed Abdulkadir Ibrahim, Wang Zhuopeng 2018	Temperature, ECG, Heart rate sensors and LPWAN network.	Vitals monitoring system.	The final result puts an emphasis on utilising multiple technologies, protocols, and networking in relation to IOT. Here, the sensors used to monitor the patient's body's various parameters are the centrepiece.
Ashlesha A. Patil, Dr. S. R. Suralka2017	Raspberry Pi, WI-FI module, Cloud computing and sensors.	Smart Health care Monitoring System.	The system is intended to solve two main issues: the necessity for patients to be informed of their vital signs while doctors are not present and the presence of a doctor at that moment. The author circumvents this by making use of technology such as cloud computing and PMS.

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III. PROPOSED PROJECT

A. Methoodology

There are two sections in this methodology section that discuss the necessary hardware and software. where the components are put together to carry out the task of monitoring and assistance. According to the commands given by the person operating the system, our proposed health monitoring system is built to carry out tasks.

B. Hardware Specifications

1) Raspberry Pi 3 Model B+
2) Sensors mentioned.
3) 3-D printed parts as required
4) Smartphone
5) Video Camera

C. Software Specifications

1) *PYTHON:* A simple free open-source programming language is Python. It was preferred because of its numerous advantages over other languages. The Raspberry operating system for the Raspberry Pi effectively incorporates Python programming. Python and OpenCV perform effectively together to produce simpler end results. Python can be used to amplify the web and run OS commands. With the help of the cross-stage library known as Open CV, we can support ongoing Computer vision applications. The key emphasis is on picture preparation, video capture, and analysis, which includes details like face and article location.
2) *BLUEDOT:* Android users can download the BLUEDOT application from the Google Play store. It plays the role as a Bluetooth remote for the Raspberry Pi and a Python library, allowing us to wirelessly control our Raspberry Pi projects. This application provides wireless technology to monitor the response of the system.
3) *MIT APP Inventor:* The open-source web application MIT App Inventor allows users to develop Android OS programming applications. Anyone can undoubtedly start creating an Android application, even those who have basic programming knowledge and experience. These apps make it simple to wirelessly control the working and action to the task of the health monitoring system.

D. Detail Description of Sensors Used

1) Heart Beat Sensor

Heart rate monitoring is a challenging process as even periodic check-ups of the heart rate of a patient may not guard them in case of rapid heart rate fluctuation. As we have observed the number of patients in the pandemic situation, it is not possible for the hospital staff to check all the patients' heart rates continuously. With the use of IoT, now there are compact devices available which can be used to continuously measure the heart rate of a patient with nearly 90% or better accuracy. So, if any patient is having abnormal heart rate, then the sensor will notify the concerned department and the doctors may be able to help and save the patient in time.

a) Advantages

- One can track their heart rate at any time.
- It displays the accurate result in no time delay.

b) Disadvantages

- It may not be much accurate while the person is doing something which involves vigorous movement of hands.
- Patient may wear it incorrectly and that may cause the inaccurate result.
- After a certain period, the device needs to be recharged because of continuous power consumption by the sensor

2) Blood Pressure Sensor

As we have seen in the coronavirus pandemic situation that there were a lot of patients in hospitals and it was not possible for the staff to check the blood pressure of each and every patient after a certain period of time. With the use of devices like IoT-based blood pressure sensors, it is very much easy to check and monitor the blood pressure of patients continuously.

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So, if in case the blood pressure of a patient is changing abnormally then the concerned department can easily get a notification regarding that immediately and the patient can get help immediately.

a) Advantages
- One can check their blood pressure at any instant time with the IoT-based blood pressure sensor.
- It is very useful because of having a compact size.

b) Disadvantages
- Sometimes due to some internal error, it may display incorrect or inaccurate results.
- After a certain period, it needs to be recharged because of continuous power consumption by the sensor.

3) Pulse Oximeter

Pulse Oximeter is used to measure the Oxygen saturation (SPO2) of haemoglobin in the blood of a person by using IoT-based technology. It displays the percentage of blood loaded with oxygen. It is very helpful as it checks the SPO2 of a patient continuously in order to avoid any critical situation.

Normal SPO2 level is 95% or higher. It depends on age, in younger it is nearly 99% while in older age people it may come as down as 95%. People with chronic lung conditions may have much lower SPO2 levels as low as 89%

a) Advantages
- It is of great relief for patients having cardiovascular or respiratory diseases.
- It alerts the patient when the SPO2 level goes below a certain value.
- It is available at a cheaper/affordable price.

b) Disadvantages
- The sensor may not display accurate results in certain circumstances which include poor blood circulation, cold hands, lipids in blood plasma, etc.
- The sensor consumes energy because of continuous monitoring and thus it needs to be charged after a certain period.

4) Temperature Sensor

A body temperature sensor is used for checking the body temperature of a person in order to check whether the person is having normal body temperature or not. It has been very useful in the pandemic situation for differentiating between ill and healthy people.

We can use the MLX90614 sensor for contactless temperature measurement. It contains a thermopile detector chip which is IR sensitive and also signal conditioning ASIC and both are integrated into TO-39 can. To achieve high accuracy and resolution the thermometer contains a 17-bit ADC, low noise amplifier and Digital Signal Processor unit.

a) Advantages
- It is very useful as it has a fast response time.
- It is available at a low cost and at an affordable price in the market.
- It measures temperature accurately and continuously.

b) Disadvantages
- It is less sensitive and sometimes it may display inaccurate results due to internal issues.
- It may display a higher temperature in case the person is involved in any physical activity.

5) Respiration Sensor

A respiratory sensor is a very useful device for patients who are admitted to Intensive Care Unit (ICU). The LM35 temperature sensor is used for calculating the respiratory rate and the voltage value of inhaled and exhaled air is used for continuous monitoring of patient. We use NRF24l01 for transmitting the data of sensor to medical center and the data are stored on webserver to check patient's respiratory status which is helpful for the doctor.

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Liquid Crystal Display is used for displaying the patient's data. So whenever there is any abnormality in respiratory status then an alarm is generated as well as a message is displayed on the LCD and webpage. In such a case a doctor or any medical professional would get the alert in time and they will be able to treat patient accordingly.

a) Advantages

- It is mainly used in intensive care units and thus it is made to provide more accurate results.
- It alerts the doctors when the patient's respiration threshold value is reached and thus doctors can provide suitable help to the patient.

b) Disadvantages

- It works on electricity, so it consumes power.
- It is not compact in size; LCD is needed to see accurate results.

6) Glucose Monitoring System

Glucose monitoring is also an important aspect of the health monitoring system. People having diabetes need to periodically check their glucose level in order to reduce any unpleasant symptoms of high or low blood sugar but in times of surge in the number of patients, it is not possible for the doctors to check the glucose level of a patient regularly.

So, we use devices having IoT to monitor the level of glucose in the body regularly and with good accuracy.

The device consists of sensors, a microcontroller, a wireless communication block, management, and energy harvesting components.

a) Advantages

- Continuous glucose monitoring is very helpful for diabetes patients.
- It measures near to accurate glucose level and alerts the user in case the threshold value is reached.

b) Disadvantages

- It measures interstitial glucose level and not the real time glucose level and due to that there can be delay in treatment of diseases like hyperglycemia and hypoglycemia in patients.
- It also consumes energy and thus it also needs to be charged after a certain period.

E. Comprehensive Explanation of Project

The main goal of the system's initial testing was to verify that the system could perform autonomously to the patient's bedside, capture the patient's body vitals and save that information in its cloud server, and then report to the doctor with the information. The mobile health monitoring system will be given a number of upgrades, though. The system will have wireless capability so that patient data can be wirelessly transferred to the doctor's PC without the doctor having to remove the SD card in order to access the data.

When urgent health care is required, this might speed up the doctor's response time. In order to improve communication between the system and patients and to ensure accurate readings, the system will also be given some speech capabilities. System-patient interaction should be the same as that between a doctor and patient because the ultimate goal is to have a system with human abilities that can help medical staff in a hospital setting. More sensors and other devices will be added in order to gather more thorough medical data on the patient.

The mobile health monitoring system can currently only detect and measure common vitals. In order to provide a visual inspection of the patient, a video camera will also be integrated into the system. The automated health monitoring system will undergo additional testing inside of a hospital since that is where it is intended to be used.

The information and timing columns also include information about the patient and data timing. The data collected is then saved on the cloud server. Thus, a complete record of each patient's medical history is kept, which can be used for better remote healthcare and diagnosis.

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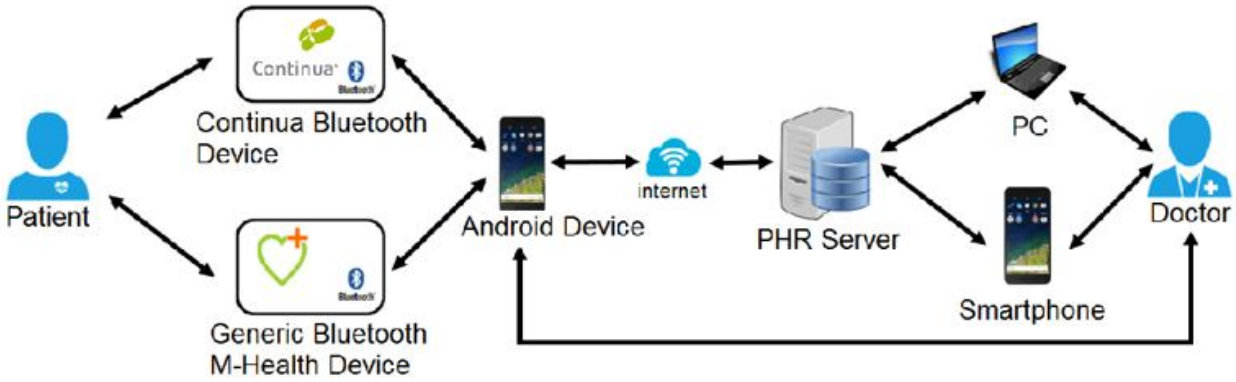

Fig 1: Algorithm of Health Monitoring System

IV. CONCLUSION

IoT has many uses in a wide range of fields. Any remote tracking system, — in particular those utilized in the field of health monitoring systems, may benefit from the use of the Internet of Things. Besides that, it gives an overview, analysis, and methods for the Health Monitoring system using IOT process, as well as numerous software and hardware components.

These applications produce a significant amount of sensor data that must be effectively monitored and handled. The distinct framework offered can be used to manage patient-specific network and cloud device data. IoT has the potential to improve the healthcare system. Regardless of the numerous obstacles to IoT in healthcare, there is always a way to navigate around them.

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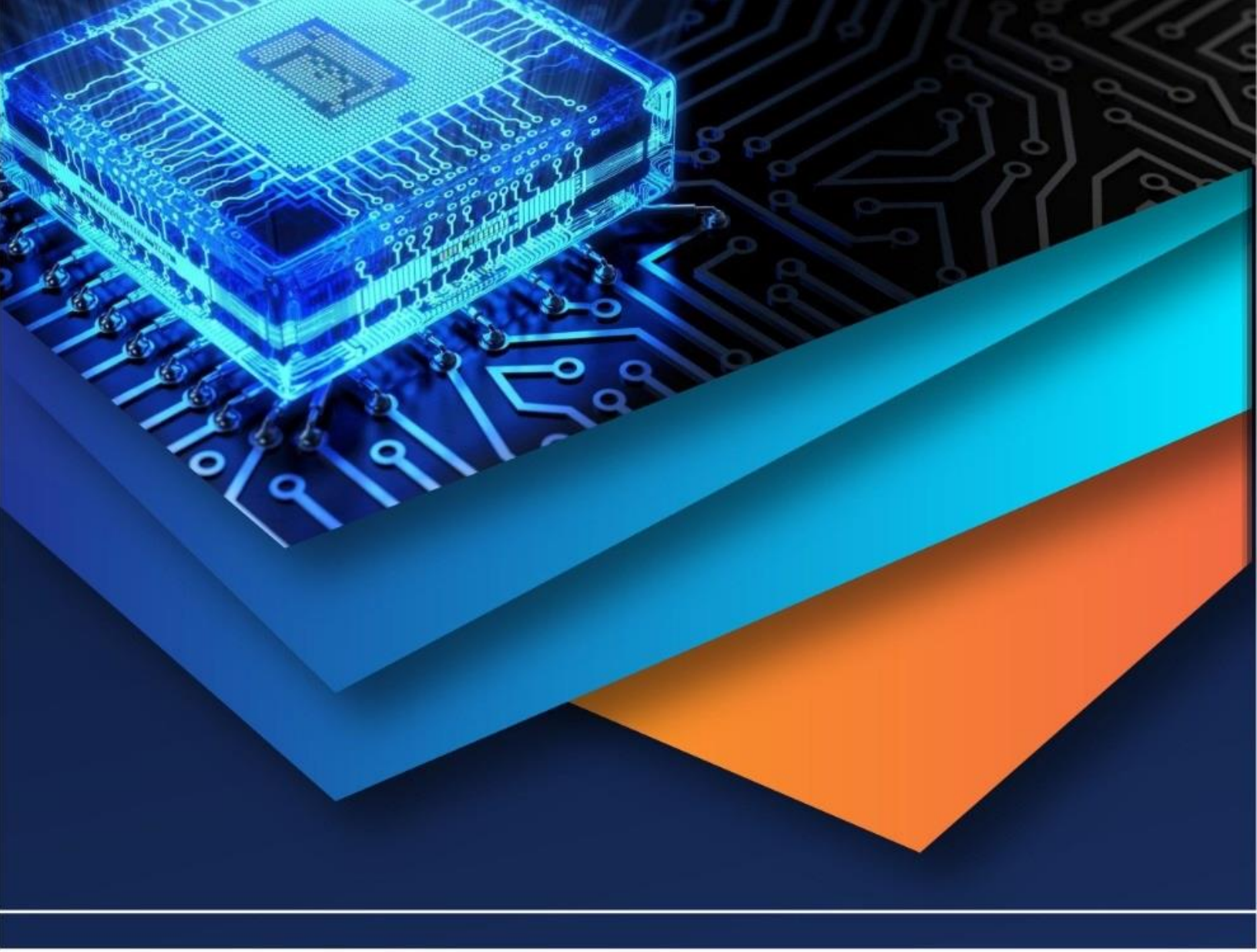

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