Automatic IoT-Based Health Care Monitoring System for Elderly Patients

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Abstract

Age-related health maintenance is a technique that is becoming increasingly important worldwide. Doctors who frequently interact with their patients and other medical professionals can benefit from IoT health monitoring devices. There are several elderly folks who need routine health examinations by medical professionals. With the help of the suggested effort, patients could receive an earlier diagnosis and treatment. This IoT-based smart fitness monitoring system was created to track a person's heart rate, temperature, blood pressure, and level of oxygen in their blood. With the use of this system, remote clinics in rural or village settings can communicate with hospitals in urban regions, which can be useful. The IoT system will notify the general practitioner or doctor if any anomalies in the patient's health occur. This patient health monitoring device can assist clinicians in gathering real-time patient health data. The system can periodically check the parameters thanks to nippy internet. The cloud stage enables information storage for near-term real-time data access. This technology would aid in the early finding of anomalies and the prompt treatment of elderly individuals, thus saving their lives.

Keywords: *Health Monitoring, Raspberry Pi, Cloud, IoT, Sensor Interfacing.*

INTRODUCTION

The global expansion of underlying disorders has significantly altered people's daily lives. The health systems of emerging and wealthy countries are under pressure due to the sluggish invention and tardy distribution of pharmaceuticals and medicines. With the help of sensor expertise combination with integrated IoT and machine culture algorithm for additional processing of patient large data, diagnoses and treatments for patients can be made. IoT and machine learning will benefit greatly from one another. IoT expertise would help out health officials in separating the patients who need urgent care from the few others who may be confined at home, averting the colossal patient

effervesce at hospitals and community health centres. The creation of an automated health monitoring system that responds or sounds an alarm when a patient is in a critical state is required. The Raspberry Pi is used to retrieve the data, and it will warn the doctors and anyone else who may be worried. It also records former diagnostic information concerning the patient's health. Through an internet portal, medical professionals are made aware of the patient's actual condition so that the right treatment can be administered to cure them. The elegant patient fitness tracking structure includes the mechanism of heart rate, humidity, temperature sensors to be positioned in the vicinity to monitor the patients' situation. Subsequently dispensation, each one of values is given to the doctor so they may assess the patient's condition. Temperature, EEG, and heart rate sensors send their signals. Some microcontroller, including an Arduino, Raspberry Pi, can be used to upload data to the cloud. The safety of the cloud is one of the complicated considerations because the internet is a vital communication pathway. The IoT-based system can nonetheless provide real-time information regarding the patient features in spite of this. Thanks to the progression of internet technology resembling cloud computing, edge computing, and wearable healthcare monitoring devices may become increasingly prevalent in the coming years. a prerequisite for developing a health monitoring system that could be applied to real-time monitoring of impaired by using the various sensors.

LITERATURE SURVEY

Monitoring the daily life of elderly patients in the wards or their houses is a tedious job for the healthcare workers. They need to be present with the patient every time whenever they are required to be monitored. A smart home, mechanized factories, schools, environment monitoring systems, smart cities, oil refineries, etc are where IoT is most frequently used. Portable biosensors and wearable smart devices can be used to record a person's on a daily basis performance, help out in managing their health, and prevent problems with life-related diseases from developing. The IoT framework enables us to create tiny gadgets with sensing, processing, and communication capabilities, enabling the development of sensors, embedding strategy, and other 'things' that will aid in the accepting of the environment. Older patients may benefit greatly from IoT-based health monitoring devices. This system may simply be linked with a mobile application for rapid access and has an LCD display that is embedded and shows the observed temperature along with oxygen saturation level and pulse rate, and. Raspberry Pi is used in the suggested IoT-based approach. While the system's results were compare to those from other commercially existing devices, they were establishing to be accurate. In order to save lives during the COVID-19 epidemic, IoT-based tools may be useful. The healthcare sector has consistently been at the forefront in the development and application of IoT for the successful management and treatment of healthcare. Recent

advancements in IoT have created new opportunities for study and investigation across many industries, including the medical and healthcare sector. Hospitals have begun utilising cell devices for Internet of Things (IoT) applications, and they have combined them with wi-fi sensor nodes that resemble RFID, NFC tags, and tiny sensor nodes. A disease's early diagnosis is crucial for a better recovery. Monitoring levels of creatinine in healthcare systems allows for both qualitative and quantitative verification of underlying illnesses. Therefore, there is a great demand for Point of-Care (PoC) devices that are quick, portable, affordable, and time-effective. An Internet of Things (IoT)-connected, rapid, accurate, and cost- and time-efficient proof-of-concept diagnostic tool for measuring serum creatinine levels is presented in the current work. the foremost target of this study is to present a simple handheld medical device for detecting diabetes through breath. The method entails creating hardware that connects to an IoT system to simplify patient diagnosis and personal monitoring. The Arduino board is utilised in this setup to read the sensor and sense the breath. Wireless communication is used to log the breath value level to the system. Web page is interfaced with data collecting. For superior user experience and service effectiveness, the suggested platform impeccably integrates IoT devices.

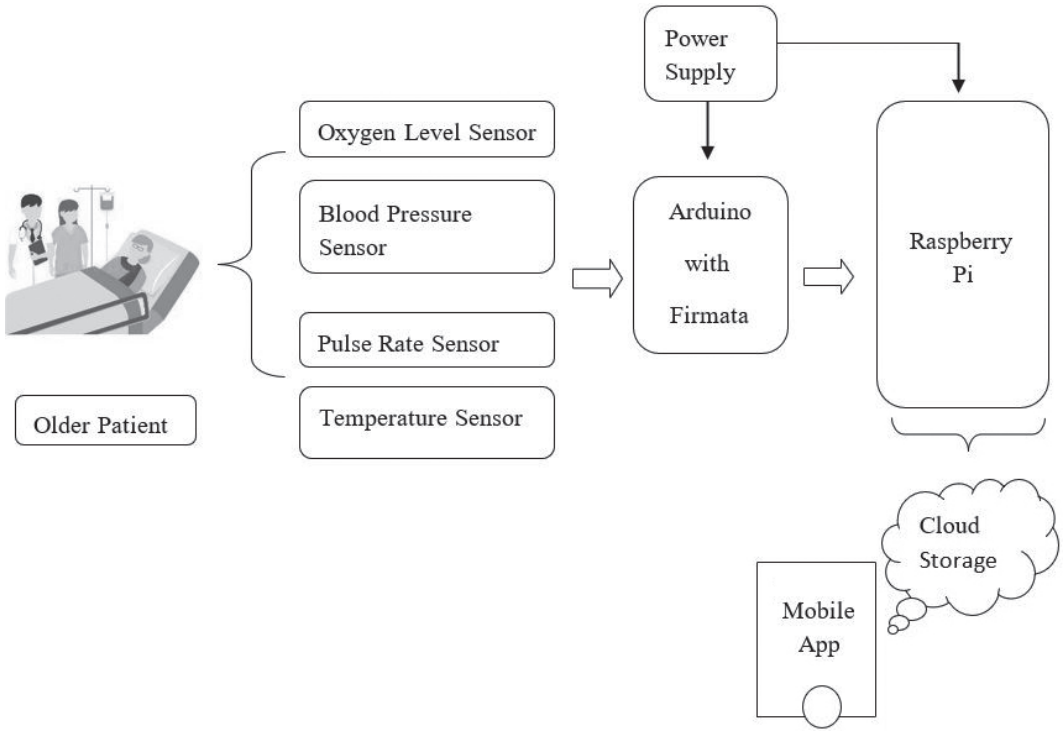
METHODOLOGY

This Internet of Things-based health monitoring system is extremely effectively different from the traditional healthcare system. Using IoT to deliver the needed results and performances is also quite difficult. Utilizing electronic data transmissions and embedding sensors are two aspects of IoT work. Sensors, detectors, monitors, and microcontrollers are initially connected in order to synchronize. The analogue signals are picked up by the sensors and transformed into digital signals afterwards. The Raspberry Pi's built-in analogue to digital conversion helps to get data in the right digital format. The most popular and widely used IoT device is the Raspberry Pi. Data conversion is followed by data storage. Information is being sent to a server or the cloud. A local server is used in this investigation to show variations in the values or readings acquired simultaneously. The block diagram illustrates how the suggested model functions (see next page).

HARDWARE DESCRIPTION

The main hardware that is the backbone of the whole system is the following:

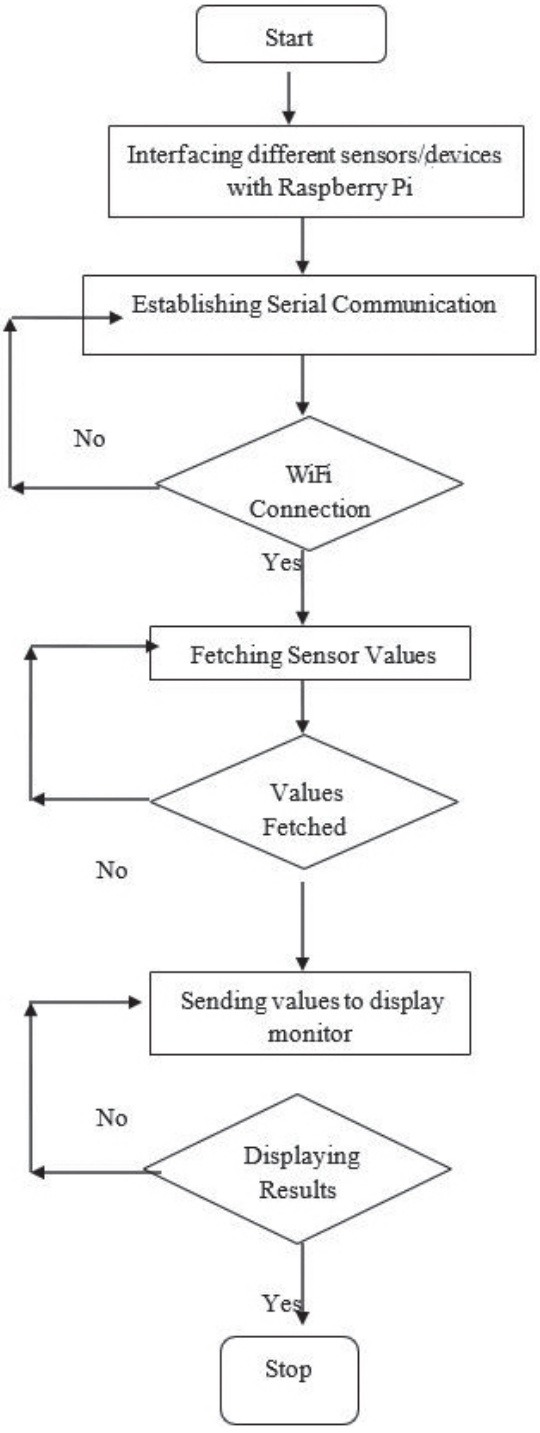
- **Raspberry Pi:** A single-board processor roughly the dimension of a credit card is called the Raspberry Pi. The Linux/Android operating system that the Pi uses was modified to perform smoothly on the ARM chip that powers it. With Linux installed, this tiny device's capability is improved to the point where it can be used to automate systems. It features an internal display, a LAN connector for connectivity,



Block Diagram

and can operate with sensors and external devices. The fact that Python can be used to programme it is an extra benefit.

- **Blood Pressure Sensor:** The microcontroller receives three separate values or pieces of data from the BP sensor, which is wrapped around the arm. The Raspberry Pi receives these data, the first of which is systolic, the second of which is diastolic, and the third of which is pulse rate. Board-mount blood pressure sensor Sensor BP0001 with a pressure range of 0-300 mg and an accuracy of around 1 per cent is employed in this study. The BP sensor schematic.
- **Temperature Sensor:** Without coming into contact with patients, the MLX90614 non-contact temperature sensor measures temperatures close to the human body. The MLX90614 combines a low noise amplifier, 17-bit ADC, and a potent DSP unit to provide a thermometer with great accuracy and resolution.
- **Pulse Oximeter:** The MAX30100 sensor module includes a heart rate examine and a pulse oximeter. It makes use of two LEDs, a photodetector, improved optics, low-noise analogue signal processing, and other components to find pulse and heart rate signals.


Start
Interfacing different sensors/devices with Raspberry Pi
Establishing Serial Communication
No
WiFi Connection
Yes
Fetching Sensor Values
Values Fetched
No
Sending values to display monitor
No
Displaying Results
Yes
Stop

Flow Chart

DESIGN OF THE SYSTEM

The whole system consists of three fundamental steps:

- *Data Capturing:* The Raspberry Pi microcontroller is initially connected to the intended sensors. The Raspberry Pi's GPIO pins that have been chosen and set up as input are connected to the sensor outputs. The Raspberry Pi's Rx pin is connected to the output pin of the BP Sensor Tx pin. The microcontroller along with the sensors are provided a power source of +5 V once precise hardware connections have been made The patient's temperature is detected by the MLX90614 non-contact temperature sensor, which is placed close to the patient's body. The microcontroller receives three separate values or pieces of data from the BP sensor, which is wrapped around the arm. These values are to be provided to the Raspberry Pi for processing; the first value is the systolic value, the second is the diastolic value, and the third is the pulse rate.
- *Data Processing:* The I2C/IIC communication protocol is used by the MLX90614. Both the item temperature and the surrounding temperature are measured by this sensor. Following are the steps for interacting with MLX90614: 1. I2C can be enabled in the Raspberry Pi's interface settings. 2. Downloading the MLX90614 packages or libraries. 3. The packages are installed. 4. After installation, the MLX90614 must be connected to the Raspberry Pi circuit. 5. After all connections have been made correctly, use the command i2cdetecty1 to confirm the sensor address value on the I2C bus. 6. If the address value is successfully determined, it will be displayed on the terminal. 7. Move your hand over the values to see if there are any variations.
- *Data Storage:* This completes the system's design process. This step involves creating the data logging communication channel on ThingSpeak: 1. Register with ThingSpeak, 2. Establishing a unique channel, 3. Using ThingSpeak's API Key, 4. Creating a.py extension for python code, 5. Start the Python programme, 6. View the sensor values displayed on the screen, and 7. Verify data logging on the ThingSpeak website. Chart on the ThingSpeak channel that displays different graphs based on changing values. Now that it has recorded the sensor data, the Raspberry Pi sends the outputs of those numbers to the display monitor so that users may see the correct values. The relevant information is concurrently displayed on the screen and saved in the cloud for future record-keeping when a channel is formed on ThingSpeak. This gives the doctors the ability to display the data on the screen, store it in the cloud, and retrieve it for later analysis. The data from the cloud can be promptly evaluated by other users and researchers.

RESULT AND ANALYSIS

Health monitoring systems typically collect data about an individual's health status over time, such as heart rate, temperature, and SPO2 levels. This data can then be analyzed to

identify trends or changes that may indicate the development of a health problem or the health monitoring of elderly patient. However, by analyzing the data collected by these systems, healthcare providers can identify potential health problems early on and develop more effective treatment plans, ultimately improving patient outcomes. moreover the table 1 comprises data values between a heart rate sensor and a commercial sensor of elderly people along with table 2 analyses between a commercial IR sensor and a body Temperature sensor and table 3 explain about SPO2 system data values compared to those from a commercial Oximeter of en elderly patient.

Table 1: Data Values between a Heart Rate Sensor and a Commercial Sensor

Sl. No.	*Actual Value (bpm)*	*Observed Value (bpm)*	*Relative Error*
1	68	69	1.47
2	69	71	2.89
3	70	7	0
4	72	70	2.77
5	71	73	

Table 2: Comparing Data between a Commercial IR Sensor and a Body Temperature Sensor

Sl. No.	*Actual Value (c)*	*Observed Value (c)*	*Relative Error*
1	29	33	3.03
2	28	34	2.90
3	29	34	0
4	30	35	2.85
5	29	35	

Table 3: SPO2 System Data Values Compared to those from a Commercial Oximeter

Sl. No.	*Actual Value (%)*	*Observed Value (%)*	*Relative Error*
1	98	98	0
2	96	97	1.04
3	97	97	0
4	98	99	1.02
5	95	9	1.05

CONCLUSION

This method gives doctors the ability to easily and quickly identify each patient's information on the display monitor in their office. Doctors are able to distinguish between a patient's past values data and current values data. The Internet of Things presents opportunities to increase the features and advantages of this system, as well as

to increase the number of biological sensors and data storage in the cloud. As a result, IoT technology will make this monitoring system more flexible and updatable in the future. In order to diagnose and treat patients, we have advised using technology to track their temperature, heart rate, blood pressure, and levels of oxygen. The two key issues with the prototype are protecting the patients' data and making it accessible to doctors in a timely manner with the least amount of delay. Data encryption is one method for protecting data against security breaches. The edge computing method would be used to do this.

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