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IoT Based Health Monitoring System Using Raspberry pi -A Review

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Abstract *–One of the biggest issues facing humanity today is health. Cardiac illnesses, lung failures, and heart-related illnesses are all on the rise. Elderly patients' or hospital patients' health must be monitored, but doing so needs practitioners and doctors to be on constant watch.The Internet of Things (IoT) and the usage of information technology have a big impact on how healthcare is provided. A portable device with sensors that can detect various physiological parameters, including the patient's body temperature, blood pressure, electrical heartbeats as seen on an electrocardiogram (ECG), blood oxygen saturation, heart rate, body fall detection, traumatic brain injury, and activity monitoring would be created as part of the proposed IoT health monitoring system. This information would then be transmitted to a medical server over the Internet.This enables medical professionals to better diagnose patients and remotely monitor their health. When sensor values surpass specified thresholds, the device also has an emergency alert capability that notifies the patient and the doctors. Patients who use IoT for data gathering and remote monitoring can avert life-threatening situations and receive prompt, affordable medical care. A portable health monitoring gadget also enables users to check their health indicators on a regular basis and seek treatment for any irregularities at an early stage.*
Keywords: *System on a chip (SoC), MQTT (Message Queuing Telemetry Transport), Internet of Things (IoT), remote health*

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I. INTRODUCTION

The Internet of Things (IoT) is a network of connected devices that communicate and interact with each other and their environment. These devices, which can range from smart devices with advanced artificial intelligence to simple objects without communication capabilities, use unique identities to facilitate communication and management within the network.

*IoT Layers:*Internet of things can be differentiated into five different layers. Each one having their own responsibilities and functionalities.

1. *Perception Layer:* which includes sensors and other data-gathering devices.
2. *Network Layer:* which handles communication and data transfer.
3. *Middleware Layer:* which stores and manages data
4. *Application Layer:* which provides services specific to the field in question.
5. *Business Layer:* which conducts detailed analysis and guides future actions

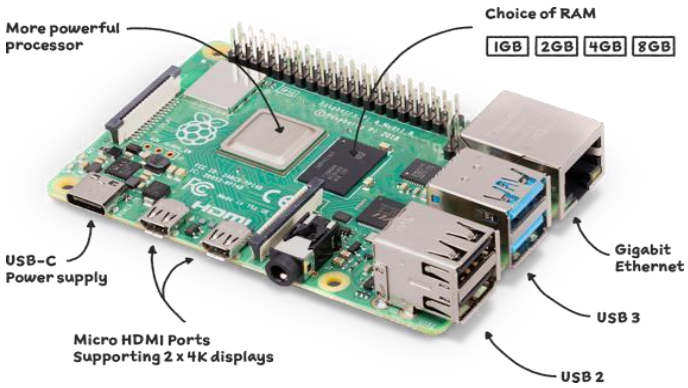
Raspberry Pi can be integrated into IoT projects through the use of libraries or frameworks, such as the gpiozero library provided by the Raspberry Pi Foundation, or by utilizing cloud platforms such as AWS, Azure, and Google Cloud.

In addition to using libraries or frameworks or utilizing cloud platforms, Raspberry Pi can also be integrated into the Internet of Things (IoT) projects through the use of standalone IoT platforms such as Particle.

Raspberry pi:

A reasonably priced, credit-card-sized computer called the Raspberry Pi is frequently used in prototyping, teaching, and hobbies. It was created by the Raspberry Pi Foundation, a UK-based organisation, with the intention of advancing computer science teaching in classrooms. Raspberry Pi computers can be linked to a keyboard, mouse, and display to work like a desktop computer and have a variety of input/output options. They are appropriate for usage in IoT projects due to their numerous connectivity choices, which include

Ethernet, Wi-Fi, and Bluetooth. Different Raspberry Pi models are available, each with a different amount of processing power, memory, and I/O options.



II. STATE OF THE ART

Health monitoring has historically involved constant diagnosis and observation, which can occasionally lead to mistakes like incorrect diagnoses, forgotten medicines, and lost data. A device-dependent monitoring system that can be created utilising the Internet of Things can be used to eliminate these problems (IoT). IoT devices have intelligence and can analyse and transfer data to the network after collecting it intelligently. In the healthcare industry, these features can be utilised to gather patient data both locally and remotely, process it, and then transfer it to other nodes for analysis. Hence IoT applications in healthcare primarily serve three purposes: Tracking a person or thing, identification and authentication, and sensing and data gathering are all examples of tracking.

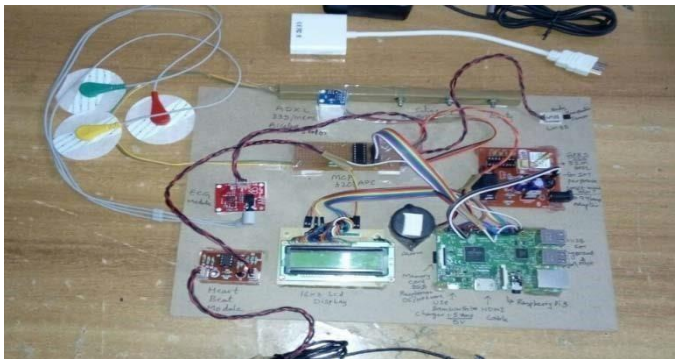


Fig. A prototype Raspberry Pi-based health monitoring system circuit

Here, the term "data collection" refers to the gathering of health-related information such as body temperature, blood pressure, heartbeat rate, and ECG characteristics.

III. LITERATURE SURVEY

An Internet of Things (IoT)-based health monitoring system is suggested in a work by Mohammad Monirujjaman Khan et al. Users may monitor key health indicators and communicate data with doctors using the system, which is safe and available to medical professionals everywhere. Body temperature, heart rate, and blood oxygen levels are measured by the system using an Arduino board, and the information is sent to an app and an LCD display. The method is meant to be helpful for diabetic, COVID-19, asthmatic, geriatric, and other patients with chronic conditions.

Neel Kamal and Prasun Ghosal suggest a three-tier design for an IoT-driven health monitoring system utilising Raspberry Pi in another article that was presented at the 2018 IEEE International Symposium on Smart Electronic Systems (iSES). The system processes data locally before transmitting it to a web page and can generate various reports in two modes (precision and quick). By examining body temperature and heart rate data, it can identify hypothermia, heatstroke, and bradycardia in patients. It also offers authentication to obtain patient health data from healthcare providers. The system is reasonably priced, reliable, and equipped with controllers to offer real-time monitoring and appropriate actions.

In a presentation that was presented at the IEEE Engineering in Medicine & Biology Society's (EMBC) 43rd Annual International Conference in 2021, M. De Santis et al. outline the design of a wearable device for physiological parameter monitoring in a COVID environment. The apparatus is a portable electronic system that

can track many physiological parameters, including blood oxygenation, body temperature, air quality, respiration rate, and ECG. A Raspberry Pi Zero W coupled to a Healthy Pi4 serves as the primary processing unit. The latter offers the clinical pulse-oximeter interface, while the I2C protocol is used to provide measurements of temperature and air quality. Finally, ECG and blood pressure data are provided using a Bluetooth module. Python and Matlab are used to elaborate the collected data.

SeyedShahimVedaei's research was supported by the Natural Sciences and Engineering Research Council of Canada (NSERC). Using an IoT framework, the participants' health status is monitored, and people are warned to keep their physical distance. A wearable Internet of Things node and a smartphone app are combined in the proposed system, allowing the IoT sensor node to collect user health data like temperature and blood oxygen saturation while the smartphone is connected to the network and transmits the data to the server. The paper suggested a Radio Frequency (RF) distance-monitoring device that operates in both indoor and outdoor settings to warn users to maintain the physical distance. Using ML algorithms on body metrics, it is possible to track participants' health status and notify them in real time. A vocal coughing-detector, which also records the frequency and severity of coughing, continuously listens to the user's voice. The fog-based server is used to process data that has been received from an IoT node using a cellular network or LoRa connection. Thanks to local data processing, the IoT node can also be used in places without internet access or fog-based networks. Users can utilise the technology to monitor their daily activities and lessen their risk of coming into touch with the coronavirus.

E. N. GANESH proposed and published a Health Monitoring System using a Raspberry Pi and IOT in the Oriental Journal of Computer Science and Technology. The proposed method offers patients more effective and efficient medical care, and the information acquired is networked globally via the internet and communication tools, which are then connected to cloud services. Doctors can use this knowledge to provide a quick and effective treatment. The suggested design is a sophisticated technology that enables a doctor to evaluate a patient whenever and wherever they choose. If the threshold value is achieved, patients are sent an emergency alert email encouraging them to visit a doctor. This technology is useful for disabled patients and patients who are ordered to spend the entire day in bed since it enables the doctor to physically check on the patient from home with the help of the system's built-in Pi camera. By fusing large-scale data analysis with cloud computing and computer technologies, the proposed framework intends to create a new generation of medical systems that can provide patients with high-quality healthcare at affordable rates.

Navjodh Singh Dhillon presented and published a paper titled "A Raspberry Pi-Based Traumatic Brain Injury Detection System for Single-Channel Electroencephalogram" in MDPI journals. This is the first system designed for a portable, affordable device like an RPi that can classify EEG signals associated to mTBI in real time. e-care, self-care, and telemedicine are made possible by the methods developed in this study since they are universal and can be expanded to produce and use predictive models utilising EEG and other physiological signals received from human participants. This effort aims on creating a machine learning-based, fast, portable, and usable EEG classification system for mTBI identification (RPi). This technique is compatible with a wide range of machine learning models, which can be used in conjunction with live EEG recording equipment to identify mTBI.

In the Indian Journal of Public Health Research and Development, Sudha Senthilkumar wrote a piece. The projected health care system is built on the internet of things. Because it is saved on the cloud, the person can check their private data whenever they choose. In an emergency, notification will be sent right away to doctors. It makes use of data from the body's pulse sensor, temperature, humidity, and movement. The physical information of patients is analysed and contrasted to the norm in order to spot abnormal physiological markers. The output of the system shows that it monitors patient health and alerts logged-in individuals when anything unusual occurs to that state.

IV. CONCLUSION

Numerous researches have been done on the application of Raspberry Pi and the Internet of Things (IoT) to health monitoring systems. By gathering and analyzing data on a patient's health factors, such as body temperature, blood pressure, and heart rate, and sending this information to doctors for accurate diagnosis and care, these systems seek to improve healthcare. If sensor levels go above predetermined thresholds, several of these systems can also notify patients and medical professionals of emergencies.

Additionally, some of these devices can be used for continuous monitoring and are portable, which makes them advantageous for older patients or those with chronic diseases. Using machine learning methods, some systems have concentrated on identifying particular illnesses, such as COVID-19 or traumatic brain injury. Overall, these studies have demonstrated the potential of IoT-based health monitoring systems to promote patient monitoring and self-care while delivering higher-quality medical treatment at a reduced cost.

Remote tracking and health monitoring of people using Internet of Things (IoT) based health monitoring systems with Raspberry Pi can be practical and efficient. These systems collect and send data from a

variety of sensors and devices, including heart rate monitors, blood pressure monitors, and activity trackers, using the Raspberry Pi, a small and affordable computer, as the central processing unit.

Because the Raspberry Pi is flexible and simple to programme and setup, users can adapt the system to meet their unique needs by integrating it with a range of sensors and devices. Healthcare personnel may remotely monitor patients and takeactions if necessary thanks to the Raspberry Pi's ability to transmit data in real time. Overall, these solutions have the potential to enhance patient care quality while lightening the load on healthcare delivery networks.

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