Internet based highly secure data transmission system in health care monitoring system

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ABSTRACT

The health care systems in our contemporary countries are advancing rapidly in terms of maturity and professionalism. In an effort to alleviate the current burden on the public health system and boost the popularity of regular health self-checks, this method has been developed for producing prediagnoses that are easier to use, quicker, and more accurate. To ascertain how well the heart is circulating oxygen throughout the body, a pulse test, a painless examination that measures an individual's degree of oxygen saturation, is used. It can be used to evaluate the state of any patient with a disease, particularly those with pulmonary problems. Diseases in these patients could need ongoing observation and care. Our system comes to the rescue in order to resolve this problem. This portable system is simple to use and may be taken anywhere by the subject. The internet of things (IoT) will update the pertinent parameters. This health monitoring system's controller is made up of an adaptor, a saturation of peripheral oxygen (\( \text{SPO}_2 \)) sensor (a blood oxygen meter), a temperature sensor, a heart rate sensor, a WiFi module, and a liquid crystal display (LCD).

Keywords:
Heartbeat sensor
Internet of things
LM35 module
Saturation of peripheral oxygen
WiFi module

1. INTRODUCTION

People with chronic diseases are becoming more prevalent, and a variety of things, such as food decisions, alcohol consumption, and physical activity, may be to fault. Numerous symptoms and medical interventions can be used to treat chronic disorders [1]. Patients' health screening must be continuously maintained for the early identification and diagnosis of potentially fatal conditions including heart attacks after they are released from the hospital and are taken home [2]. Researchers found that 30% of people with coronary heart disease received rehabilitation at least once every 90 days, with study rates between 25% and 54% within 3-6 months [3]. A cheap solution to these kinds of needs is being provided in the form of health monitoring devices. In such a system, physiological data is stored, processed, and communicated via a local device like a smartphone, and a personal computer. Such systems should adhere to stringent standards for long-term real-time operation, dependability, safety, and security [4]. The advancement of technology has long captivated our attention. We also found that there aren't many comprehensive researches on the use of computer technology to hospitals' needs for an internet of things (IoT) based patient monitoring system [5]. All physical objects are connected to the internet through a network called the IoT using various sensors, and devices. IoT is a clever technique that can reduce the need for human effort and involvement [6]. The IoT, which has given us new ideas like smart parking, smart homes, and smart cities, has fundamentally altered...
the way we live today [7], [8]. There are numerous useful uses for IoT in hospital administration. They joined us as we began reading the published piece and local developments. In the present day, medical knowledge is expanding daily [9], [10]. On the basis of this generating method, people are creating more significant logical accessories, such as a belt that can detect persistent breath and electro dermal movement sensors that may gradually reveal seizure physiology indicators at night [11]. The patient monitoring system is easy to use, comfortable, and painless [12], [13]. The present project's objectives are as follows:

- Because it demonstrates how all data and information are obtained only over the internet, it will be a highly useful tool. The burden and stress placed on the patient's family members who work outside is thereby reduced.
- By connecting with the IoT healthcare system, professionals may get all the required patient data, improving the precision of their diagnoses. Simply put, it enables ongoing and remote patient monitoring.
- By using this method, we may roughly estimate the outcome based on patient health. Furthermore, it will outperform human performance in terms of accuracy, data gathering speed, and error.
- When a patient receives home-based medical therapy in real time, a needless doctor or nurse visit is avoided. Particularly with this strategy, hospital stays and readmissions are less expensive.
- Because of IoT, doctors and family members can confidently carry out their specific responsibilities because they can remotely monitor the patient's health. Every time a certain health parameter raised or fell outside of the predetermined range, the system would also send out alarms. Additionally, family members and medical professionals can act appropriately after getting an SMS alert. Not least among its benefits is that it can assist save lives in an emergency.

According to my assessment, there is a dearth of basic healthcare for the populace in rural areas. Additionally, they cannot find adequate medical care. After the illness or fever becomes too severe, a large number of people receive treatment. Numerous rural residents cannot afford treatment when the cost is taken into account. Therefore, this project is being designed to make the first part of the treatment procedure easier. Since the goal of this study is to provide a key metric for disease diagnosis. Lack of administration and resources make it difficult for developing nations to address the concerns of individuals. A regular person cannot afford the costly daily health checks. Numerous systems that provide simple and reliable care have been created for this aim. With properly handled equipment, this technique cuts down on time. This social contribution will be highly valuable. Because people can identify the body's improper behavior before developing any significant diseases. With the aid of IoT, the person who is more concerned about any other loved one can take care of and monitor his health while sitting in any location in the world.

2. SURVEY OF RESEARCH

In order to provide better healthcare, the IoT is being frequently used in the medical industry. IoT is a key element of providing patients with better healthcare facilities and assisting hospitals and professionals as well. The ability of this system to collect and exchange data is improved by the IoT network connectivity of connected devices, software, and sensors [14], [15]. The routine monitoring of a patient by reviewing a range of parameters measured and delivered by the sensors attached to the patient's body is the specialty of IoT in the healthcare system [16]. Hospitals are furnished with a large variety of sensor-enabled devices, even in conventional medical systems [17]. In areas where the disease is prevalent, it is always preferable to monitor these people using remote health monitoring technology.

A health monitoring system built on the IoT is the current solution for these kinds of problems [18]. By enabling patient observation outside of typical healthcare settings (such at home), such a remote patient monitoring setup improves access to human services offices while reducing costs [19]. There have been reports of numerical models for IoT in healthcare and the prediction of various diseases using various methods.

Kadarina and Priambodo [20] developed a smart chair that recognises non-constrained bio-signals and can be monitored with a system similar to the one they had established. The smart chair was used to develop a system for sensing physiological signals in sitting posture, such as electrocardiogram (ECG) and ballistocardiography (BCG). This is a prime illustration of how the IoT is being applied to the medical field. A framework was developed by Butt et al. [21] to protect the clinical information that must be transmitted over the internet for electronic patient record systems. Incorporating public key infrastructure, smartcard, and biometrics technologies into a multi-layered framework is what they advise [22].

An IoT-based platform was developed by Ding et al. [23] to let persons with disabilities research and find IoT developments in the healthcare sector that can help them and their community. To examine the most advanced IoT technology and its applications, which can primarily be used for the disabled, they chose
two use cases. Almotiri [24] looked into the potential and technical aspects of IoT in healthcare in order to make it a reality and uncover opportunities. After that, they put out a cloud-based conceptual framework that would establish a network between the patient, hospital, physicians, labs, and other parties, enabling the secure transfer of patient medical data and information with the patient's and their family's permission [25].

3. METHOD

Here, we make use of several hardware and software needs, including an IDE, project factory web server, a controller, a heartbeat sensor, a saturation of peripheral oxygen (SpO₂), an ESP8266, an LM35, and a heart rate sensor. The controller is a board designed for projects that require a maximum amount of random access memory (RAM), additional input and output pins, and sketch memory. For projects that need additional input and output pins, this board is suggested since it has 54 digital I/O pins, 16 analogue inputs, and more room for the sketch. This keeps the Raspberry Pi platform simple while providing a tone of potential for applications. A low-cost controller module that can be utilized for IoT project development is the ESP8266 module. In order to communicate with the ESP8266 module, a set of AT instructions are used. The integrated circuit (IC) temperature sensor LM35's output voltage is linearly proportional to the measured temperature in °C. For projects that are appropriately built plug-and-play heart rate sensors for Raspberry Pi, heart rate sensors are utilized. The sensor clamps onto a fingertip or earlobe and can be connected to a Raspberry Pi using some jumper cables so that we can measure the victim's heart rate. The Raspberry Pi integrated development environment (IDE) is a piece of free software used mostly for creating, editing, and compiling code into the Raspberry Pi module. An open source platform known as project factory web server offers a variety of services primarily intended for creating and developing IoT apps for diverse projects [26]. It offers the capability of gathering and displaying real-time data as graphs or charts.

4. PROJECT FACTORY INTERNET OF THING SERVER

Users are able to interface with gadgets that can connect to the internet thanks to the Ruby application known as project factory. By giving social network websites and mobile devices an application programming interface (API), it simplifies data access, retrieval, and logging. On the left, you can see the intelligent objects (also known as “things” in IoT) that are situated at the edge of the network [27]. A few examples of devices that gather data include wearable technology, manufacturing floor equipment, wireless temperature sensors, heart rate monitors, and hydraulic pressure sensors. Data from several sources in the cloud can be quickly and effectively gathered using an IoT analytics platform designed for this purpose. The graphic below illustrates how the IoT application's algorithm was developed [28]. A data scientist or engineer tries to understand the obtained data by doing historical analytics on it in this scenario. Data is gathered from the IoT platform and brought into a desktop software environment to allow the engineer or scientist to prototype algorithms that may eventually operate in the cloud or on the smart device. An IoT system is made up of all of these parts [29]. The cloud portion of the diagram's platform, which is offered by project factory, enables quick data collecting and analysis from internet-connected sensors. The Figure 1 gives clear idea of IoT secured server model.

The skin in these places has a substantially higher vascular density than, say, the skin on the chest wall. Pulse oximeters probe the finger, nose, ear lobe, and forehead for this reason. The two most common
types of pulse oximeter probes are the reusable clip probes and the single-patient sticky probes (finger, forehead). Reusable clip probes have the advantages of being simple to use, permitting sampling of numerous body sites when low amplitude waves are present, and being economical in outpatient settings where multiple patients can be measured sequentially with a single probe since only one $\text{SPO}_2$ reading is necessary. Pulse oximeters may be used in a variety of situations that need the monitoring of oxygenation and pulse rates. The use of pulse oximeters increases patient safety by alerting medical staff to hypoxia before, during, or after surgery. Oximeters indicate that the oxygenation during mechanical ventilation is adequate. A device known as a temperature sensor is designed to measure how hot or cold an object is. How well a temperature sensor works is determined by the voltage put across the diode. The relationship between the diode’s resistance and temperature change is perfect. Temperature drops cause a decrease in resistance, and vice versa.

5. RESULTS AND DISCUSSION

A great platform for IoT-based projects is project factory. Using the channels and web pages given by project factory, we can retrieve our data and monitor our system using the thing speak website. For project factory, we have to register. The system then needs an API key in order to function after we've set up what we need on a new channel. This key is required for data setup and programming changes. After the API has been created, the outcome will be shown on a 16×2 liquid crystal display (LCD) display and stored on the project factory server. Users can access the data from that point, examine the findings, and manage their health. Data is gathered by hardware from a variety of sensors and uploaded to a cloud server for the project factory server. The graphical representation of captured data that of temperature, heart beat and $\text{SPO}_2$ is displayed on the server is shown in Table 1. This data can be processed further and utilized to predict the patient’s health. This is helpful for those who require daily care and those who are unable to leave the hospital for doctor advice. The variation of temperature, heart beat and $\text{SPO}_2$ levels can also be observed in the form of graphs which are as shown in Figures 2 to 4 patient measurement.

<table>
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<th>S. No</th>
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<th>HB</th>
<th>$\text{SPO}_2$</th>
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Figure 2. Body temperature levels with respective of time

Figure 3. Heart beat levels with respective of time
6. CONCLUSION

This project is focused on using internet technology to develop a system that would interact via the internet for better health because of how widely utilised the internet is. The IoT is king across many industries, but it reigns supreme in the healthcare sector in particular. The goal of the current project is to develop a smart IoT-based controller-based patient health tracking system. Before transferring the information to the cloud over the internet, this uses a temperature sensor to calculate the temperature and a pulse rate sensor to measure the heartbeat. This data is additionally delivered to the LCD display so that the patient can fully comprehend their health situation. In an emergency, a buzzer also sounds to warn the carer and an alert message is sent to the doctor's phone. By noting the specific website or IP address, the doctor can examine the supplied data. As a result, a system for ongoing patient observation was developed.

REFERENCES

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