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Privacy and Security in IOT Cloud-Based Healthcare System

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ABSTRACT

One of humanity's greatest difficulties is health. In the recent decade, healthcare has gotten a lot of attention. Technology is important in healthcare not just for sensory equipment, but also for communication, recording, and display devices. It is crucial to keep track of a variety of medical markers as well as the post-operative days. As a result, the Internet of things has been used in healthcare. The patient monitoring system has recently become one of the most significant breakthroughs due to its superior technology. A current strategy is essential at this time. The underlying problem with the previous method is that in severe cases, health care professionals must be present at the patient's location to monitor symptoms on a regular basis. To address this problem, health care professionals must develop a patient monitoring system that allows them to monitor their patients remotely. The idea is a mobile based wireless health monitoring system that might provide real-time online information on a patient's physical status. The Raspberry plays a vital role in this project, as are sensors like as temperature, pulse/heart rate, and PIR. These sensors are connected to an Arduino board which reads the sensor data and send it through a serial connection to the Raspberry Pi. The sensor data is now saved in a file on the Pi, which is then uploaded to the cloud over the Internet. Finally, the user app retrieves the data.. The same data is then transferred to the patient and doctor via Firebase to further improve treatment by obtaining patient information in a timely manner.

***Keywords*--** Health Care System, Raspberry Pi Board, Heartbeat Sensor, Temperature Sensor, Cloud, Internet of Things, Esp8266

I. INTRODUCTION

The Internet of Things (IoT), which uses a few interconnected devices and networks to deliver digital solutions and monitoring systems across healthcare systems, is a game-changing technology in this field. Security is a significant concern in the creation of an IoT-based healthcare system since it deals with sensitive and secret patient information.

The internet has a significant influence on our day-to-day lives in a variety of ways. The basic idea behind this widely acknowledged technology is to link items to the Internet in a simple and effective manner. When items or devices are connected to the Internet, users may access and control them from anywhere in the world. These gadgets may also be operated with the help of computers, which allows users to configure the device [1],[4]. Under certain situations, the gadgets can conduct a series of operations. To communicate, these gadgets use sensors, microcontrollers, and transceivers. Military, business, healthcare, retail, and transportation are some of the most common uses of wireless communication networks.

These networks can be wired, cellular, or ad hoc. In society and industry, wireless sensors (WSNs), actuator networks, and vehicle networks have all attracted a lot of interest. The rising use of Internet of Things (IoT) gadgets and IoT networks in recent years has made them vulnerable to different security assaults. To provide confidentiality, authentication, access control, and integrity, among other things, effective security and privacy protocols must be deployed in IoT networks. A complete assessment of security and privacy problems in IoT. Is presented in this research. Unfortunately, the bulk of these devices and apps are not built to withstand security and privacy attacks, resulting in a slew of security and privacy vulnerabilities in IoT networks, including confidentiality, identification, the integrity of data, access control, and secrecy[2]. Information security is a concern for both cloud consumers and cloud service providers. Because there is a risk of cloud-based attacks that compromise security features such as confidentiality, availability, and integrity. Intrusion Detection Systems (IDS) is used to improve the system's security and resilience to both internal and external threats. The basic objective of an intrusion detection system is to identify an intrusion and, if required or practicable, to take steps to eliminate it. There are primarily two approaches for detecting intrusions [3].

II. INFORMATION AND TELECOMMUNICATION TECHNOLOGY IN HEALTHCARE

Since the introduction of information and telecommunication technology, the healthcare environment has drastically changed. Patient care and the cost of treatment accessibility of healthcare providers and higher quality healthcare services are easily accessible.

This is only feasible because of the technological innovation in the network system , wireless network system or the wide-area public wireless network system, which allow patients to contact the practitioner directly and request treatment. Rural patients can easily access the practitioner at their home location [4].

2.1 Medical Artificial Intelligence

Devices can assist a physician to make better diagnoses and making better clinical decisions to get better results. Data in the healthcare system are rapidly increasing and converted into big data, thus, artificial intelligence techniques are used in big data analytics [4].

2.2 Decision Support System

It is extremely challenging to make decisions in an environment with full of uncertainty. It is simple to move towards the objective after the course goal and how the action will take place have been determined. But in uncertain situations the goal is not decided; it is given in terms of probability. It cannot be decided to move forward, and whether action is taken by us to move towards the goal or not. Action can have various possible outcomes. To mention the quality of the actions a utility value is attached to every move. Utility theory and probability theory give rise to the rational decision called decision theory: decision theory = utility theory +probability theory. The basic idea of decision theory is that a rule is rational if and only if it chooses the action that yields the highest expected value of utility averaged over all the outcomes of the actions. This is called the maximum expected utility [4]. Information extraction from a noisy "junk" or unrelated content in web pages has plenty of applications. It incorporates with information retrieval and indexing to reformatting for better human consumption. A user is good to differentiate between the related content and the unrelated content. But with this semi-structured tool the user can do it better and efficiently[5] .

III. LITERATURE REVIEW

Several attempts have been undertaken in the domain of IoT data processing and storage. Some existing relevant work around IoT data protection in the cloud service may be summarized as follows:

Health is a fundamental capability that people require to properly sense, feel, and act, and as such, it is a key step in the development of both the individual and the environment in which they live [3]. As a result, proper ways and means must be provided to enable optimal health care based on parameter monitoring and direct provision of medical aid.

Development and application of new technologies, particularly internet Online and Wireless also known as the internet of Things (IoT), offer a worldwide framework for the development of health care system infrastructure [5][2]. This results in an e-health system that provides a vital set of information to all participants (patients, nursing and medical personnel, and health insurance companies) in real-time, regardless of their current location. In many circumstances, real-time model parameters are not accurately recorded in clinics and hospitals, making it difficult for hospitals to monitor patients' health status on a regular basis. Constant monitoring of ICU patients is also impossible.

This method is useful in dealing with problems like these. This project is intended for use in hospitals to monitor and measure different characteristics such as temperature, heart rate, and movement. The findings may be recorded and shown on a monitor using a Raspberry Pi. The result is then saved in the cloud and communicated to the user's end application over Wi-Fi. Doctors can get the findings using an app.

IV. OBJECTIVE OF THE PROJECT

The project's goal is to create a dependable patient monitoring system that allows doctors to remotely check a patient's health state. The doctor regularly monitors the patient in this initiative without ever visiting the patient. Physiological characteristics such as temperature, heart rate, and mobility are sensed using a variety of sensors. These detected signals are sent to the Raspberry Pi through ADC, which converts analogue impulses to digital signals, allowing the data to be updated continually. Data is delivered to the cloud over Wi-Fi and stored, after which it is wirelessly sent to user end application. As a result, the doctor may view the patient's data while seated in his cabin.

When the patient is in a critical situation, he takes the essential steps to help them.

Firebase Database with Arduino UNO and ESP8266 Module. Storing data (such as sensor data) in a database that can be accessed from anywhere by the Internet can be very useful. Firebase makes it easy to store and retrieve data. This is a better option, which can store the data without any attack and send it from one place to another securely through WiFi. Due to this health services to the patient can be done continuously at home.

V. A FUZZY MODEL FOR PROCESSING AND MONITORING VITAL SIGNS

Rule 1: If any patient has a MAP value low and POS2 is also low then there is clinical instability.

IF MBP is low AND POS2 low THEN the patient is unstable

Rule 2: If MBP is low and SPO2 is normal then it signifies low MBP.

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IF MBP is low and POS2 is also low and some time high then MBP is low
Rule 3: If normal MBP and low SPO2 then hypoxemia.
IF MBP is normal AND POS2 is low THEN hypoxemia
Rule 4: If normal MBP and normal SPO2 then stability in clinical condition.
IF MBP is normal AND POS2is normal THEN the patient is in STABLE condition.
Rule 5: If high MBP and low SPO2 then instability in the clinical condition.
IF MBP is high AND POS 2 low THEN UNSTABLE.
Rule 6: If high MBP and normal POS2 then high MBP
IF MBP is high AND POS2 is normal THEN MBP is also high [7].

Now suppose we are realizing the implication relation of SPO2 is high then MBP is low
This Means $SPO2_{(HIGH)} \rightarrow MBP_{(LOW)}$
The value of $SPO2_{(HIGH)\ is}$ (20,.2) (25,.4) (30,.6) (35,.6) (40,.7) (45,.8) (50,.8)
And MBP low is
(1,.8) (2,.8) (3,.6) (4,.4)
Now we compute implication relation Means $SPO2_{(HIGH)} \rightarrow MBP_{(LOW)}$
R [.2 .2 .2.2,.4.4.4.4, .6.6.6.4, .6.6.6.4, .7.7.6.4, .8.8.6.4, .8.8.6.4]

VI. PROBLEM DEFINITION

In today's medicinal services framework, patients who remain at home after surgery are checked by an overseer or a medical career. This method may not be capable of continuous monitoring, because anything may change in a well-being metric in a matter of seconds, and if a guardian or attendant is not there now, more significant injury can occur. As a result of this invention, a period has been formed in which the web governs the world, and it has been proposed to add to another sharp health awareness framework in which the patient is checked on a regular basis[8,9,10].

VII. PROPOSED SYSTEM/METHODOLOGY

The complete system may be broken down into three parts: Sensor Node, Cloud Backend, and User Node. The raspberry-pi receives and analyses sensor data via an Atmega-328, which converts analog values to digital and sends them to cloud storage and the user over the internet. Figure 1 depicts a comprehensive block schematic of the system. This primarily contains the Sensor Node, Cloud Backend, and User Node[11,12].

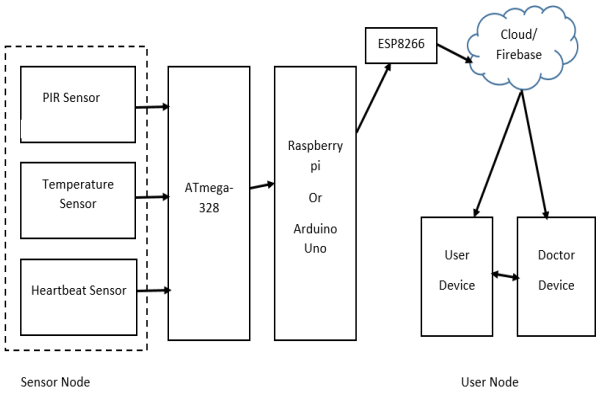

Figure 1: Block Diagram of Remote Patient monitoring system

Spark is a fast and general-purpose cluster computing system for large-scale in-memory data processing. Spark has a similar programming model to Map Reduce but extends it with a data-sharing abstraction called Resilient Distributed Datasets or RDD. A Spark was built with iterative algorithms, as well as support for in-memory storage and fault recovery. Spark Core consists of two APIs i.e unstructured and structured APIs. The unstructured API is RDDs, Accumulators, and Broadcast variables.

Processing: Large-scale datasets are frequently noisy, duplicated, and contain a variety of data kinds, posing significant hurdles to knowledge discovery and data modeling. In general, intrusion detection algorithms work with one or more forms of raw input data, such as the SVM algorithm, which exclusively works with numerical data. As a result, we prepare the data and transform the dataset's categorical data into numerical data[5, 13,14].

Objectives used

- Sensor Node
- Cloud/Firebase
- User Node

This is a user-assistance layer. It is a system that allows users to access sensor information and assess the state of patients. Client nodes is an Android application that runs on a smartphone. The user (doctor) may get sensor data and receive a push notice if the value exceeds a threshold value, as well as examine different patient details through report in an app.

Hardware Description

- Raspberry Pi
- ATmega 328
- Temperature Sensor
- Motion sensor
- Pulse/Heart Rate Sensor
- ESP8266

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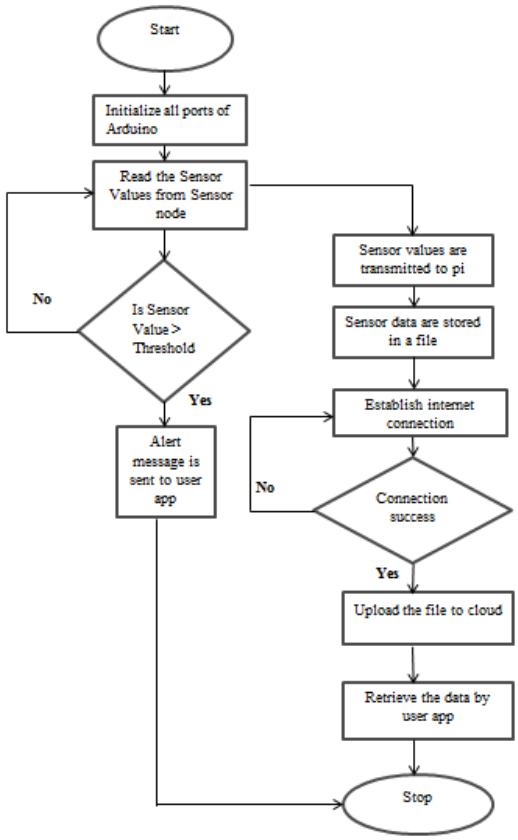

Figure 2: Proposed Flowchart for Remote Patient Monitoring System –an IoT-based approach

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Health care has recently emerged as a major breakthrough due to its superior technologies. To succeed in today's environment, you must have a current approach. If the patient is in a critical condition, health care personnel must be present at the patient's location on a regular basis in order to monitor their symptoms. This issue can only be solved by the development of a technology that allows medical practitioners to remotely monitor their patients. Mobile-based wireless health monitoring systems could deliver real-time online information on a patient's physical condition. In this project, the Raspberry Pi and sensors like temperature, pulse/heart rate, and PIR play a significant role. A serial connection between the Arduino board and the Raspberry Pi reads the sensor data and sends it to the Raspberry Pi.

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