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Introspecting Cloud Based IoT Healthcare: Mitigating Security and Privacy Issues

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ABSTRACT: Health care is a vital component of life. The current healthcare systems need to work tremendously to cater to ageing population and growth in chronic illnesses. In these modern days, the major purpose of smart healthcare is to build up a solid patient checking framework to give medical emergency services to its patients at the earliest with the expert screening of patients, who were hospitalized or executing their day-by-day life exercises. With the help of IOT in healthcare we present cell phone based remote medical facilities. The framework comprises so many sensors like temperature sensor, accelerometer, ECG etc that review the vitals of a patient from time to time.A proper real time monitoring system is required that would manage the daily developments of ailing patients of chronic diseases. Real time monitoring can be achieved enabling prompt detection and timely intervention of cloud based IoT healthcare devices that aim to provide proactive healthcare services. The paper discusses the basic healthcare devices commonly used to provide continuous monitoring of patients. It also describes the various security and privacy issues related to IoT healthcare.

KEYWORDS: cloud computing, ECG, healthcare, internet of things, IoT, privacy, security, wearable

I. INTRODUCTION

Health care is a vital component of life. Regrettably, the current healthcare systems are under the great deal of stress due to the constantly ageing population and growth in chronic illnesses, and there is a tremendous need for resource like the hospital beds, doctors, and nurses. Obviously, a solution is necessary to alleviate the load on health-related systems is required to deliver high-quality care to at risk individuals.

Many recent studies have focused on the internet of things, which were being widely recognized as viable remedy to ease the stresses on health-related systems. This research focuses on the monitoring of patients with certain illnesses, including diabetes and many more. Further study is being done with a focus on some of the goals, such helping with rehabilitating with the continuous tracking of a patient's growth.

Cloud based IoT healthcare [1] refers to the integration of Internet of Things devices, sensors add applications in the healthcare industry with data generated by these devices Being stored processed and accessed through cloud computing infrastructure, Healthcare devices such as wearables medical sensors and monitoring equipment are connected to the Internet, allowing real time data collection analysis and transmission. The collected data is stored securely and processed in the cloud which enables healthcare providers researchers and patients to access the medical related information for various purposes like remote patient monitoring disease management and personalised healthcare services. Cloud based IoT healthcare [2] offers benefits like scalability, improved data accessibility, cost effectiveness and ability to provide and advanced analytics and machine learning algorithms for better healthcare outcomes.

II. INTERNET OF THINGS IN HEALTHCARE

Although similar fields of study have shown remote health monitoring [3] to be feasible, its important benefits in other contexts may be more significant. The load on hospitals might be reduced by using remote health tracking to monitor non-critical patients at home instead than in a government facility full of staff members and beds. People who live in remote

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areas may have better access to healthcare, and the elderly people may be able to stay at home independently for a longer amount of time. In essence, it can improve people's capacity to always manage their own health, reduce burden on healthcare systems, and expand accessibility to health-related resources.

Though, there aren't many drawbacks to remote health monitoring. The biggest drawbacks are the risk on the security of medical data of various patients which are sensitive in the form of a single data structure, the possible need to periodically recalibrate the sensors of the person to ensure as they are monitoring accurately, and the threat for disconnecting a patient from healthcare services if they were outside; they either fell out of cellular range or their batteries die. All these problems are relatively solved throughout this work The IoT solutions for the remote health monitoring are emerging as an increasingly realistic option for the foreseeable future's supply of healthcare as efforts to lessen the drawbacks continue.

The potential of the IOT as health-related solutions has recently been recognized by several academics due to the numerous advantages of remote health monitoring. IoT on health type systems has been created for several works over a variety of purposes, such as assistance with daily living (ADL), diabetes management, and for old people, and more. Though, these systems were all developed with various goals in mind and are interconnected because they make use of the same enabling technology.

Several researchers have expressed a special interest in the issue of physical rehabilitation following injury. A system that creates a rehabilitation plan specifically for a person based on their symptoms has been created in [4]. The patient's condition is matched to a data structure of the signs, symptoms, and therapies of earlier patients. In the 87.8% of cases, where the doctor totally agreed towards system and made nothing changes to the suggested treatment plan. Symptoms must be manually entered into the system, and the doctor must then authorise any suggested treatments therapy.

A workable approach for tracking blood glucose levels in diabetic patients was put out. Patients using this method must manually obtain blood glucose measurements at predetermined times. Although realistic and demonstrably realizable, this system might be made much better by automating blood-glucose readings. In, a heart attack detection device was created utilizing pre-made parts and a unique antenna. An ECG sensor and microcontroller work together to analyse the heart's activity. The user's smartphone receives this data through Bluetooth technology which allows for further ECG data analysis and application presentation.

SPHERE [5] is a system that is still being developed that makes use of vision-based i.e., image-based wearable, and the environment sensing to track general needs and health. With the help of this initiative, elderly and chronically sick individuals will be able to remain active while enjoying the luxury of their own homes and having their health care needs monitored. If any problem develops, this enables carers and medical professionals to intervene. Machine Learning will be useful on understanding diseases and as well making judgements regarding treatment of the patient, according to researchers working on this subject.

III. MODEL FOR UTILIZATION OF IOT BASED HEALTHCARE DEVICES

Many needs for the design of such systems become clear after analysing this diverse spectrum of current IoT-based healthcare systems. The use of sensors for patient health monitoring is emphasized in each of these studies. They all consider wearable sensors, namely wireless and externally worn sensors, to be crucial to their own systems [6]. The usage of environmental or vision-based sensors around the home is also recommended by several researchers and medical practitioners. This limits the system's applicability to a single physical place, though. The necessary sensors should be implemented as tiny, transportable, and externally worn nodes. Patients would have access to a non-intrusive, cozy solution that could track their health wherever they went. Patients would be less resistant to employing health monitoring technologies if implanted sensors or cameras were needed as a result. Also, compared to implanted sensors or vision-based sensors put in the home, externally wearing nodes would be easy to fix or replace.

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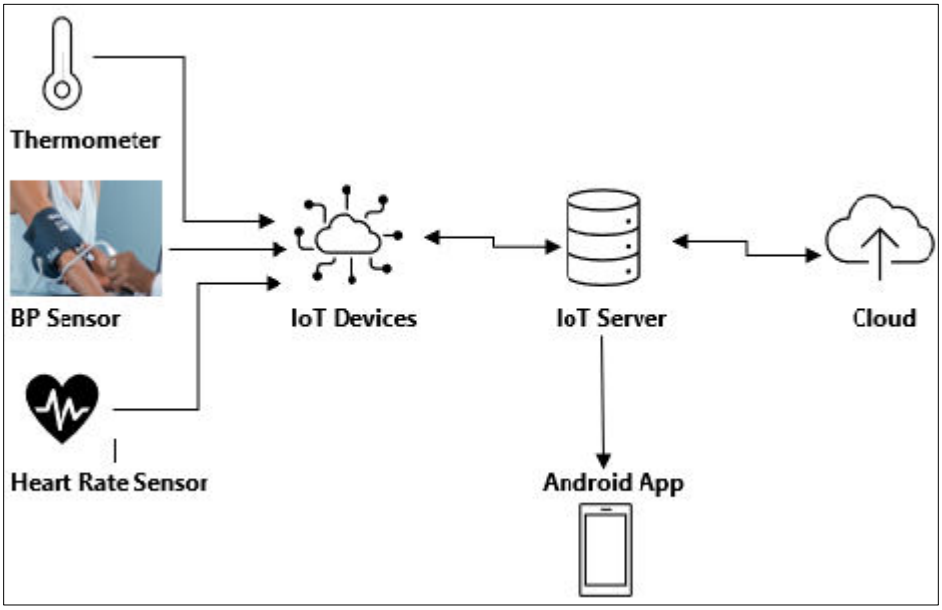

Figure 1: IoT based Healthcare Model

Systems already in place show how crucial communications are to an Internet of Things healthcare system. Short-range communications, such Bluetooth, are recommended in numerous system models now in use for sending sensor data to a smartphone to be analysed as seen in figure 1. The patient's processed information may subsequently be transferred to the healthcare practitioner, usually a doctor, using SMS or the Internet using long-range connections like LTE. The main drawback of this is that cell phones often have short battery lives and need to be recharged frequently; a patient with a dead battery would be cut off from healthcare practitioners. It might be better to use a low-powered node created expressly for managing healthcare information.

Several earlier efforts have demonstrated the necessity of cloud storage that can accommodate large amounts of diverse data for a big data healthcare system. There would be 168,000 new data points per week if even a thousand people wore a single pulse sensor that interacted hourly with a cloud storage database through an LPWAN [7]. As more individuals wear sensors linked to the cloud storage infrastructure and as new sensor types are developed, this number dramatically rises. In the high-computing environment of the cloud, machine learning algorithms may be applied using the enormous data that will quickly generate and keep growing in cloud storage. These algorithms may be used to sift through the vast amounts of data, find patterns in diseases that weren't recognized before, and provide a variety of services, including diagnostics and treatment regimens.

Wireless Body Area Network (WBANs) have been seen as an essential component of a healthcare structure built upon the IOT, each having precise sensors with low power consumption. For such a system to be developed successfully, form factor is crucial. 5 basic sensors were considered: 3 for the monitoring the vital x signs of pulse, the respiration, and temperature of the body, and two more to check blood oxygen levels and blood pressure, both of which are frequently recording into the hospitals setting. Few basic devices in context have been described.

Heartbeat Detectors

The heartbeat, which is arguably the most often observed Heart attack, pulmonary embolism, and vasovagal syncope are just a few of the emergency scenarios v that might be recognized by a vital sign. Readings from the fingertip and earlobe are not particularly wearable. Even though the wrist sensors are frequently considered to be the most comfortable for long-term usage, a chest-worn device is equally wearable.

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Numerous fitness monitoring wristwatches and chest straps [8] with pulse measuring features are offered commercially. These include the Polar H7, FitBit, Pure Pulse, TomTom Spark Cardio, and HRM-Tri from Garmin. All of these businesses, however, make it clear that their products are not intended for medical usage and shouldn't d be used to make medical diagnoses issues. Because of this, a crucial health monitoring system cannot be immediately built using the sensing technologies used by these gadgets.

Sensors for Respiratory Rate

The patient's respiratory rate, or the number of breaths they take each minute, is another important indication. Monitoring respiration may help in the early detection of illnesses including lung cancer, airway obstructions, asthma attacks, panic attacks-related hyperventilation, apnea episodes, and hyperventilation all contribute to the development of lung cancer, TB, and more.

Numerous earlier efforts have produced sensors for detecting respiratory rate due to the significance of breathing. Upon reviewing the earlier publications, many sorts of respiration rate sensors become apparent. The first is a thermistor-based nasal sensor that operate under the premise that exhaled air is warmer than the surrounding atmosphere. Consequently, depending on the increase and drop, the sensor calculates the number of breaths taken. This has been demonstrated to function well, although accuracy might be affected by other causes of temperature variations, such as if the device were worn by a chef in a kitchen. Because it is obstructive and obvious, it is also not very wearable.

Detectors of Body Temperature

The body’s core temperature may also be used to identify fevers, heat stroke, hypothermia, and other conditions, is the third vital sign. As a result, a wearable healthcare system should incorporate body temperature as a relevant diagnostics tool. The proximity of the sensor to the human body has an impact on how accurately temperature can be measured. As a result, several studies concentrated on creating sensors that could have an adhesive backing and printed onto thin, flexible polymers and then affixed directly to human skin. While this is a fascinating development, the experiment also demonstrates that temperature can be detected reasonably accurately using a temperature sensor woven into fabrics. System designers are advised to employ fabrics to retain until more readily made flexible polymer-printed k circuits can be used as temperature sensors.

Blood Pressure

BP, while not a vital sign in and of itself, is frequently monitored together with the other 3vital signs. A recognised risk factor for cardiovascular illness, including heart attacks, is hypertension (high BP). In addition, 32% of adult Australians are affected, making it one of the most widespread chronic conditions. 68% of individuals who were afflicted had uncontrolled or poorly managed hypertension. Therefore, adding BP into a WBAN for healthcare would give many patients crucial information. It is still difficult to create a sensor which can be worn for constantly monitoring bp without intrusive methods in the IoT for health-related space.

IV. CLOUD BASED IOT HEALTHCARE SYSTEM - SECURITY AND PRIVACY ISSUES

In recent years, a lot of study has been done on the advantages of cloud computing for medical applications. As advantages result from the 3 main services which cloud computing may offer in health care settings:

• SaaS – It is known by Software as a Service which gives medical practitioners access to apps that let them work a with patient data c or complete other pertinent activities.

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• PaaS – It is called Platform as a Service which offers solutions to networking, e database administration, virtualization, & other tasks.

• IaaS- It is a Infrastructure as a Service which provides the infrastructure physically for servers, storing, and other things. Numerous activities may be accomplished using these services, but the literature clearly identifies two important uses: processing and managing a lot of data. In this part, these two various ideas are each given on their own. It is also emphasised that both are necessary for a cutting-edge IoT medical system and ought to be integrated together in next cloud system architectures.

Privacy and Security in the Cloud

Security is still a major concern with cloud-based solutions [9]. It is crucial in a healthcare environment that authorised parties, including n medical professionals, nurses, experts, and emergency services, have easy access to a patient's health information. Additionally, it is crucial to protect the patient's confidential sensitive health information. The patient may be exposed to identity theft or struggle to get insurance if hostile attacks made their way into the system and exposed the patient's health information. Even worse, if a patient's medical history was maliciously manipulated, it may lead to detrimental effect on the patient's wellbeing.

Healthcare systems that use the cloud for storage can be secured [10] using access control policies and data encryption. A patient's health data access authorization and level of access are both outlined in an access control policy. Additionally, it would put in place an authentication system (such as a password, face recognition technology, etc.) to confirm the individuality of the person trying to get the data. The Encryption of data, meanwhile, offers protection the information while it is being stored. Even if an attacker managed to access the database, strong data encryption would keep them from seeing private health data.

Signal scrambling is regarded as an encryption method. The "tiny data" utilised in this application-layer approach serves as the key for scrambling a small bit of the data and is distributed only to those that have been given permission to use it. There are algorithms in place to stop the little data from possessing statistically noteworthy features, lessening likelihood that a similar assault would be effective and decreasing the danger that it may be used to discover where the little data is utilized. Given its placement at the application layer, which enables to it to develop onto top of current standard or the guidelines of the communication, this scheme would be useful in addition to other security measures.

V. CONCLUSION

In this paper, a novel model is suggested that may be utilised for both general-purpose and monitoring systems particular states in future IoT-based healthcare systems. Then, we gave a detailed as well as organised summary of research with most of the recent details pertaining to every part of suggested paradigm is explained. Several sensors that can be worn discreetly were described, with an emphasis on those that kept track of vital signs like BP, or oxygen levels in the blood. The suitability of Extended and intermittent security issues for medical applications was then compared.Recent studies using cloud technology to store data were presented, and they demonstrated as cloud is an ideal method for the storage and organising huge amount of data in the medical industry.

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