Health Auditing and Administration Using IoT With the Help of Cloud

** Raghvendra Narain Tripathi*

Abstract

One of the biggest applications created with the Internet of Things (IoT) is advanced online health administration system. Using sensors which are worn or are either present in networks gives huge amount of data which are related to the physiological health of consumers. By collecting and analysing this information, one can meet big challenges in the domain of health care system. With the help of this amount of information and processing techniques, we can bring some of the biggest changes in the domain of health administration system such as (a) With these techniques and information we can replace the post disease treatment with pre-disease treatment (b) It can also help in making personal profile of patients and so, profile treatment which is required by patients can be done. (c) It also helps in minimizing the operating cost while maximizing the output of the health administration system. This paper shows the convenience and risks associated with the use of IoT for achieving the dream of the advanced health administration system.

Keywords : **Analytics, IoT, online health administration system, presentation**

I. INTRODUCTION

Computational and comparative accuracy of present healthcare systems is very low as these store data only for a limited period of time and there are no prediction capabilities in such systems [4] [1].

In recent years we have seen the growth of using wearable sensors and these sensors are present in the market [1][2]. Not only common persons, but researchers have also shown great interest in these sensors. Lot of information can be collected and stored with the help of these sensors for future use. This information is basically related to physical and mental health of patients and it can be used while treating them [2][3]. On the basis of current technologies, no one can say that in the coming future routine check-up of patients will be done using the information which is sent by wearable sensors in the past three days. In this period, sensors will collect information on various parameters and then send it to the database. When a patient wants to present the report to the hospital administration, the administration can take better decisions of doing treatment if there is any disease or it can give better advice for a better healthy life. The report shows more information than a normal test report which is made with the help of a particular test. With the help of this technology, we can bring big changes in the domain of health administration system while reducing the operating costs and increasing the speed, and also increasing the accuracy in testing.

With the present technology, this type of system can be made in the coming years. On the other hand, wearable sensors have a small impact on the current medical system**.** This paper attempts to show the scope of these technologies in medical field as well as discuss problems which need to be solved before using these technologies with the medical domain. This paper has been structured in the following way: Section II describes some of the major works that have been done in this domain. Section III gives a model of online health administration system using Internet of Things (IoT) using Cloud. Sections IV to VII describe the challenges of different modules of online health administration system. Section VIII describes the working of the recommended system, section IX describes the advantages of the recommended system. Section X concludes the paper.

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* R. N. Tripathi is Network Support Engineer with KB Info Solutions Private Limited, Ayodhya, Uttar Pradesh - 224 001. Email : raghvendran78 @ gmail.com ; ORCiD iD : https://orcid.org/0000-0003-4055-449X

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II. BACKGROUND

Generally, all the online health administration system had three level models in which WBAN is a collection of wearing sensors which works as a data collection module and other three modules are talking module, networking module, and processing module [3] [4]. The recommended system uses wearable sensors for calculating various biological parameters such as body temperature, oxygen level etc.

Sensors collect information and send it to the gateway with the help of a Bluetooth connection and after this the Gateway changes the name of the file to the observation file. It is then sent to the main server through the internet so that hospital administration can access the file when required. In addition to the technology of data collection, data storage, data analysis, and presentation are the key modules of an online health administration system. Correct treatment and check-up of patients depends on correct analysis of information which is collected for various biological parameters and this information is collected for a very long time. Working with this huge and diverse data makes the hospital administration error prone. Data mining and data presentation methods are becoming the solution of these issues.

Using online health administration requires reforming the classic health administration system and using these with IoT can increases many factors such as how smart it is, flexibility etc.

Any equipment which is using IoT can be easily located and accessed using the internet. An IoT dependent online health administration does the classic work of classic health administration system such as exchanging information with other systems using internet. An example of such a system is that it creates an alarm for the nearest doctor when a patient is facing any critical issue.

III. SYSTEM MODEL

↳ **Data collection :** It is done by many wearable sensors. Many biological parameters such as body temperature and oxygen level are measured. These sensors are joined to the network with the help of a switch which is generally the mobile phone of the patient which is present in the pocket of the patient.

The data transferring module is responsible for transferring the information of the patient from the patient's home to the hospital with full security and privacy measures. Generally, the data collection part is collection of short-range radio waves such as Zig Bee or minimum energy usage Bluetooth for sending information to the switch. After that the collected information is sent to the hospital with the help of mobile data or the Wi-Fi via a switch. Sensors which are present in data collection module make an IoT model and according to it any sensor can be used from any location with the help of internet.

The cloudlet can work as a local calculation unit and it can be directly used by the switch with the help of Wi-Fi network. In extension to the interim storage used before sending the collected information to the Cloud, it can also do many important tasks like working on the collected information of the patient. The Cloudlet can also send the collected information to the Cloud when there is a bar on a mobile device such as interim lack of power supply and many more.

↳ **Cloud processing** is a collection of three key modules that are storage, analytics, and presentation. Many research works on using the Cloud in the medical domain have already been published [4]. Analytics part uses sensor information as well as e-health records that are

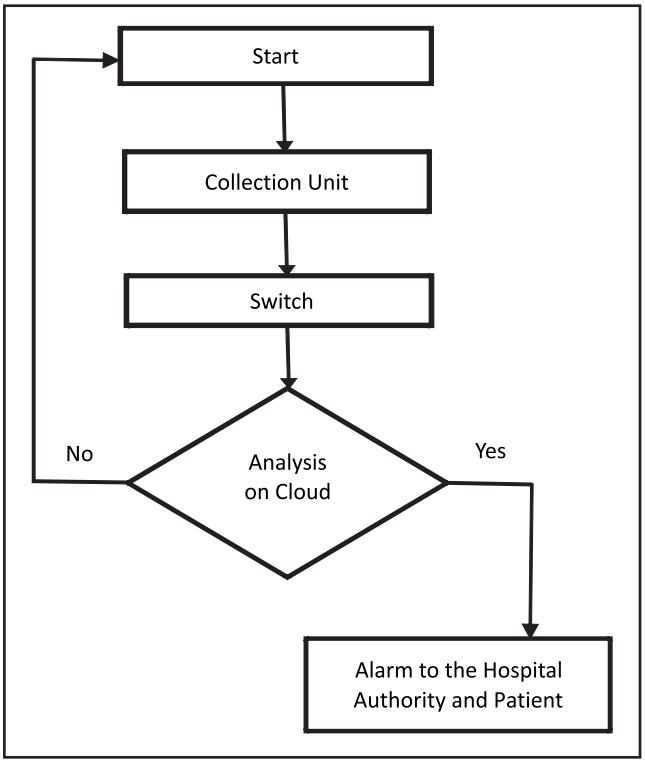

Fig. 1. Online Health Administration System

becoming important and can help in diagnosing many diseases and treating them.

Presentation is also very important because it is very tough for any medical person to take out correct information from such a huge amount of information which is sent from sensors. Presentation method should make the analysis of information simple so that it can be easily understood by the medical staff.

Critical modules of the whole system and various ways of joining it with online health administration system with hospital treatment are shown in Fig. 1.

IV. DATA COLLECTION AND SENSING

Biological data collected by wearable equipments are the combination of small sensors that have the power of calculating various biological parameters such as oxygen level and much more. There is a small pre-processing hardware module and a communication module which is used for sending the calculated information.

The need of wearing sensors imposes physical limitation on the structure of the sensors. The sensors must be light and small so that they do not cause discomfort to the patient, and therefore, have to work on small batteries that are power efficient. The batteries may be rechargeable or replaceable and for ensuring that the information is not destroyed while recharging or replacing the batteries, it is highly recommended that these sensors should be able to work for a long time without requiring a recharge or replacement of batteries.

The minimum power work opens the issue of quality of information in parameters of receiving signal to noise ratio. Current models of adjustable sensors that can be put near the skin of a patient are the best ones for the medical domain in comparison with other alternatives. It was found that sensors which are near the skin of a patient give more biological information as compared to other sensors or devices which are far away from the skin. Many efforts have been made to increase the working time of wearable sensors such as using minimum power devices etc.

V. CLOUD DATA COLLECTION AND PROCESSING

Information collected by the switch is required to be sent to the Cloud for longer duration of storage. Storing information on the Cloud is advantageous for patients and hospital authorities as it offers benefits such as flexibility, and accessibility. Use of techniques of presentation and analysis of information can minimize the working cost of diagnosis and treatment of a disease. Various types of Clouds that can be used for storing medical information for longer duration are discussed next.

(a) Hybrid Cloud Model : Cloudlet has a very small amount of resources as compared to enterprise Cloud to do various works on the information. Talking between a Cloudlet and a Switch is done with the help of Wi-Fi network. Direct connection between these two devices leads to minimum information loss while sending the information while doing the very important work on that information. Long Term Evolution (LTE) technology gives direct usability from the switch to the Cloud by forgetting the Cloudlet in between and it may result in information loss while sending the information.

(b) Context : Aware switching with the help of intelligent device : As it has been described earlier in the paper that smart mobile phone can act as a switch in the IoT model because the number of days a mobile phone can have access to LTE and Wi-Fi network for sending any information from here from one place to another. Collected information must be stored in the Cloud and for collection and storing of information to the Cloud, there must be context aware switching between the switch and the Cloud.

(c) Privacy of the Data Switch : We know that all the personal information of the patient must be removed from the collected information while transferring it to the Cloud. Advanced encryption methods must be used for securing the collected information.

(d) Secure information collection in Cloud : Privacy is one of the critical things while storing any information in the Cloud. According to the term explained by Health Insurance Portability and Accountability Act (HIPAA), all the confidential elements of biological records must be secured from getting exposed to other people. Whenever the biological records are sent from switch to the Cloud, all the security measures must be taken care of. A very protected and secure framework is recommended for using this type of important biological records. Protracted

biological information calculation on the cloud is an issue.

VI. ANALYTICS

Correct analysis of medical information is very important for correct treatment of a patient and sometimes analysis of tests conducted by laboratories do not give correct status of the body of the patient which leads to a risky situation. Laboratory test analysis takes longer time for creating the report of current status of a patient. With the help of pattern matching and regression analysis of the information which is collected, and the pattern of various diseases, diagnosis can easily be done for any disease. With the help of regression analysis of the collected information and various symptoms of various diseases, the current status of the patient can be found and from this report the doctor can begin correct treatment for the disease.

VII. PRESENTATION

It is a very difficult task for any medical staff to extract correct information from a huge amount of data and the report should be in simple and understandable format which can be understood by any person.

Presentation is considered an independent research area in both the biological domain as well as day to day life of people. As we know that colour plays a very important role in presenting anything in this world, they are used to differentiate various types of information.

Various types of colours are used to represent various types of information in the report.

Data collected from various sensors can be represented with the help of various colours which can be easily understood by people as compared to text only.

VIII. WORKING OF THE RECOMMENDED SYSTEM USING FLOW CHARTS

The system starts when it gets power from transformers. The collection unit collects information from sensors and sends it to the switch through Bluetooth. After this the switch changes the name of the file with the name of the patient and date of collection. Then the collection unit sends the file to the remote Cloud where analysis of information is done with various categories of biological parameters. After this, analysis of the information is done with the help of various pattern matching and machine learning algorithms. The presentation unit then makes the report understandable in a simple format which can be understood by any medical person. While doing the analysis if the value of each category breaks the bar, the server sends an alarm to the hospital administration system that the patient needs immediate action or treatment.

IX. ADVANTAGES OF USING THE RECOMMENDED SYSTEM

Various advantages of using the recommended system are:

- Change the technique of post disease treatment with pre-disease treatment.
- It helps in making an individual profile for each

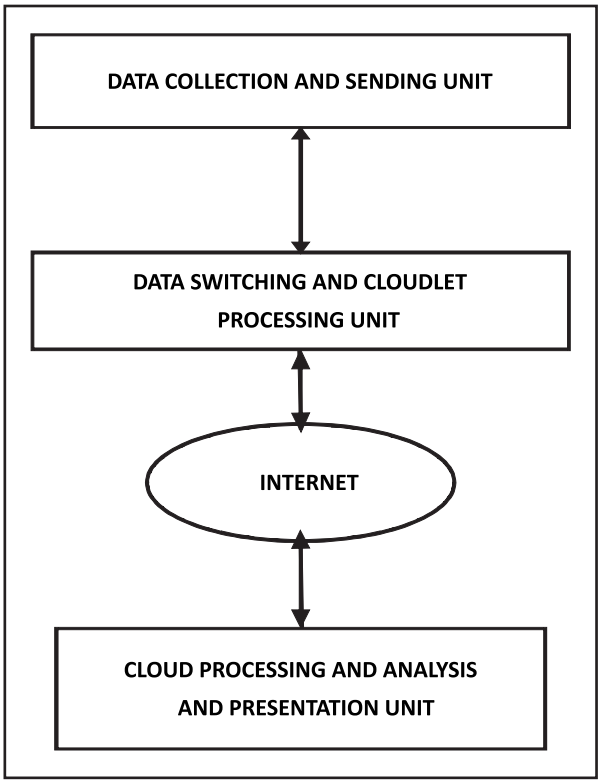

Fig. 2. Working of Recommended Online Health Administration System

patient so that we can access the information when it is required.

- It increases the throughput of the system.
- It reduces the overall operating cost of the system.

X. CONCLUSION

In this paper, I have reviewed the current status of online health administration system and the future of health administration system with IoT and Cloud processing which include various techniques such as classification and regression techniques. In the current health administration system, it is very slow and costly. In the future, post disease treatment system using wearable sensors with machine learning and cloud processing system, we can make an advanced online health administration system which is likely to behave like the system recommended system in this paper.

In this recommended system the sensor collects biological information and it sends it to the switch with Bluetooth. After this, the switch sends information to the Cloud of the hospital where the processing in the collected sensor information is done. The analysis of information collected from the sensor is done with the help of biological information and in this processing, first the pattern matching of the symptom of the patient is done with the classification analysis. After finding the disease of the patient, the regression analysis of the medical information is done to find the current status of the patient. The report is generated after this and it is sent to both the patient and the hospital authority. Treatment or advice are given to the patient accordingly.

- Various advantages of the recommended system is that it reduces the overall working costs of the health administration system and it also increases throughput of the health administration system. It also maximizes the correct testing of the health administration system. This type of administration system is possible in the coming years but we want this type of health administration system, especially for fighting diseases like COVID.

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About the Author

Raghvendra Narain Tripathi completed M.C.A. in 2020 from Amity University, Noida. He is working as Network Support Engineer with KB Info Solutions Private Limited, Ayodhya. He has done certifications from CISCO such as CCNA, Cyber security essentials, Linux essentials; certifications from Fortnite, Network Security Associate and certifications on Python and Data Science from National Institute of Electronics and Information Technology. His areas of expertise are network management, network security, and server administration.