Design of Efficient Storage of Health Care Data in Cloud for Disease Prediction

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A new technology called cloud computing promises creative, low-cost computer hardware and software developments for both industry and academia. This type of computing involves virtualized resources that are dynamically scalable and offered as an Internet-based service. Storage via Wireless Sensor Networks (WSNs) is improving a key technology for numerous applications. The introduction of health monitoring for both home and hospital environments is made possible by modern technology in WSN. Wireless communication has facilitated the development of lighter and more perceptive sensor nodes. These physiological sensor nodes can sense and transmit a wide range of vital indicators, making them useful for health monitoring in Wearable Body Sensor Networks (WBSNs). To create secure, power-efficient, real-time WBSNs that are appropriate for the healthcare industry, more research is being conducted. Benefits from centralised, effective data storage are offered by the cloud. Due to the vast amount of data, this will be increasingly significant in the health care sector. Data related to health care are more sensitive, hence safe data storage is required.

Keywords: Health care, Decision, Health Informatics Machine learning.

1. Introduction

The term "wearable" often refers to electronic systems—a Wearable Body Sensor Network (WBSN) built on smart textiles—that are incorporated into clothing and accessories for continuous monitoring and convenient accessible. These wearable gadgets function similarly to a tiny computer. These computers can also be utilised for communications systems, which let distant users access, exchange, and store data. In the fields of [1] remote health care, telemedicine, distance learning, entertainment, etc., these characteristics are crucial. The usage of wireless technologies in medical devices is growing dramatically in the health care sector [3]. To regulate bodily processes and assess a variety of physiological indicators, some of them are worn on the body and others are implanted. The biosensor-and actuator-equipped implanted devices can monitor blood pressure, regulate heart rhythms, electrically stimulate nerves, detect glaucoma, and keep an eye on the bladder. One subtype of wearable biomedical sensors and systems is called a wearable biomedical sensor-based communicative system (WBSN), which is characterized as being able to monitor physical human functions. The

WBSN devices collect and transmit different physiological characteristics by acting as tiny "base stations" and monitoring vital signs. As microprocessors get smaller and more powerful, it's possible that wearable wireless technology will eventually be able to track and monitor physiological functions. Wireless communication lowers health care expenses by monitoring patients and allowing them to remain outside of medical facilities [6]. It also gives doctors instant access to critical information without requiring hospital admissions. WBSN devices provide significant solutions for managed and preventive care for the elderly [2]. The several biosensors for WBSN is displayed in figure 1.

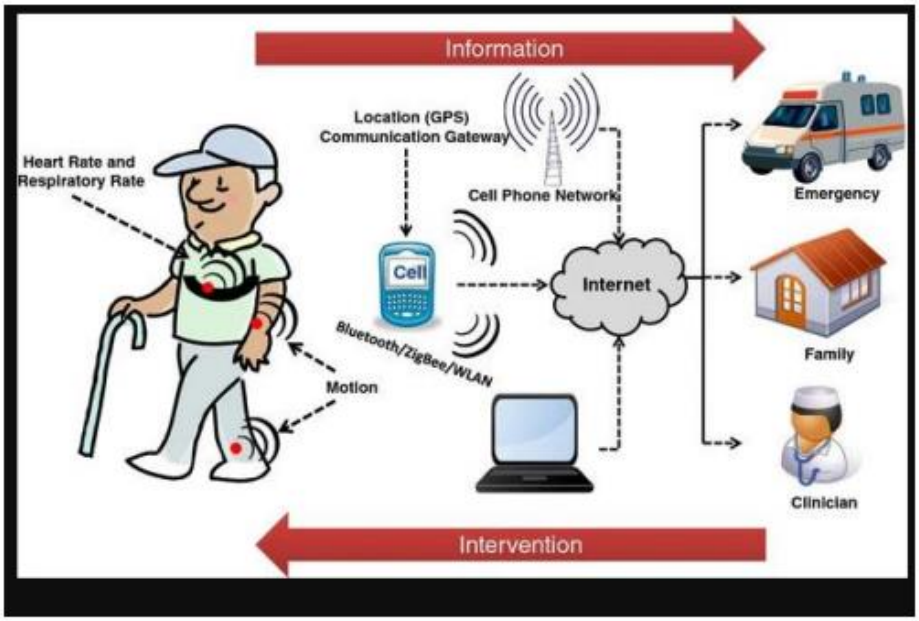

Figure 1 Wearable body sensor network architecture

Compared to conventional health care monitoring systems, the wearable body sensor network-based monitoring system offers numerous advantages. Technically speaking, improving the signal quality is also necessary to dependably receive robust data [9]. While still in its early stages of development, wearable body sensor networks are attracting a lot of scientific interest [12]. It is anticipated that this technology would revolutionise healthcare and give rise to ideas like telemedicine.

The rest of the paper is organized as follows: Section 2 provides the classification scheme for the survey; Section 3 provides an overview of proposed architecture. Section 4 provides a summary and comparison of the results of the various papers discussed in this taxonomy. Finally, Section 5 concludes the paper.

2. Related Works

A wearable body sensor network faces a number of difficulties. One of the primary issues with WBSN is sensor design. The purpose of these sensor nodes is to gather bodily signal data [11].

Data fusion, which comprises activity recognition, feature extraction, data classification, and data compression, is the next problem. Communication over a network is the next problem. Lastly, the biggest obstacle is security. Observe that the patients at the medical facility have numerous problems. Privacy concerns may arise. Security concerns are a major problem in the healthcare industry [4]. Two categories of security issues can be distinguished. They are system security and information security. In [5] categorised the dangers into two main groups. Both passive and active are they. In this case, active threats provide a greater risk than passive ones.

A new technology called cloud computing promises creative, low-cost computer hardware and software developments for both industry and academia. It is a type of computing where virtualized resources are dynamically scaled and made available online as a service [14]. With the exception of the healthcare system, the internet has evolved into an encyclopaedia that offers instant answers to the majority of issues. Through online management, cloud computing relocates internal computer and storage infrastructure to distant servers. The adoption of Electronic Health Record (EHR) systems raises the risk of data-related assaults exposing medical information to loss of availability and confidentiality (Catherine et al., 2020). One of the most significant uses of cloud computing in healthcare is medical imaging. Cloud computing is being used in the healthcare industry to link remote medical centres and provide remote treatment and real-time patient data analysis. Cloud systems would enable the real-time global sharing of medical pictures [7].

3. Methodologies

Computer technology has advanced recently to enable cloud-based WBSN in e-health care applications. A significant amount of sensor data needs to be gathered. An infrastructure for cloud computing can be used to manage it. The architecture of cloud computing allows for unlimited data storage and the use of various sensors. Data storage, sharing, infrastructure access from anywhere, and pay-per-use WBSN service utilisation are all made possible by cloud computing. Long-term sufferers are monitored by healthcare professionals using the WBSN platform [8].

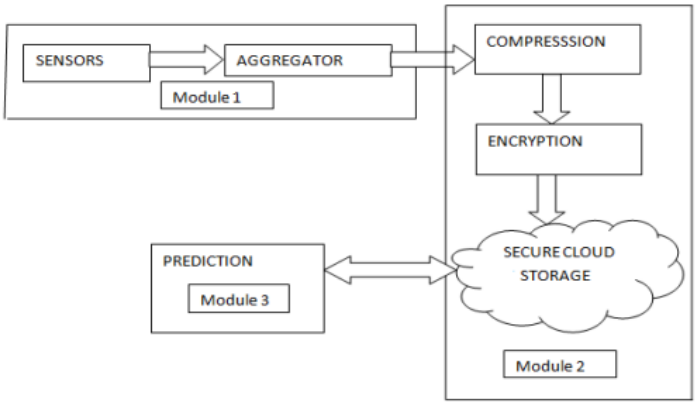

Figure 2 System work flow

The suggested architecture combines wireless connection with a variety of medical sensors to track the patient's health. The health-related information gathered from different body sensors is combined and sent to a cloud server. Data from wearable body sensors is being sent by the cloud server [13]. There are two design approaches for the Health Information Exchange (HIE). They're:

1. Directed Exchange: When using the HIE approach, patient data is transferred directly between two nodes. It does not, however, retrieve or process the medical data.

2. Data Aggregation: Using HIE techniques, independently identifiable health-related data is stored and aggregated.

The purpose of the aggregator is to gather regularised health-related data from several sensors. The aggregation algorithm is used to collect medical data efficiently. Data aggregators are used to transfer data while using less energy, extending the life of networks, minimising costs, and being lightweight. The sensor data is grouped using clusters created by this method. The patient and the distant cloud server are connected via the aggregator. Along with gathering medical data from wearable body sensors and forming a cluster head to send the data, it also initialises and configures the sensors used in the WBSN programme and interfaces with the remote cloud server. The aggregator's health-related data serves as a temporary repository for medical data until it is sent to a cloud server. For centralised access, the data is stored on a cloud server [10].

4. Results and Discussion

This paper develops a WBSN architecture for cloud servers, aggregators, and various sensor nodes (such as temperature, pressure, ECG, EEG, and EMG) for patient monitoring systems.

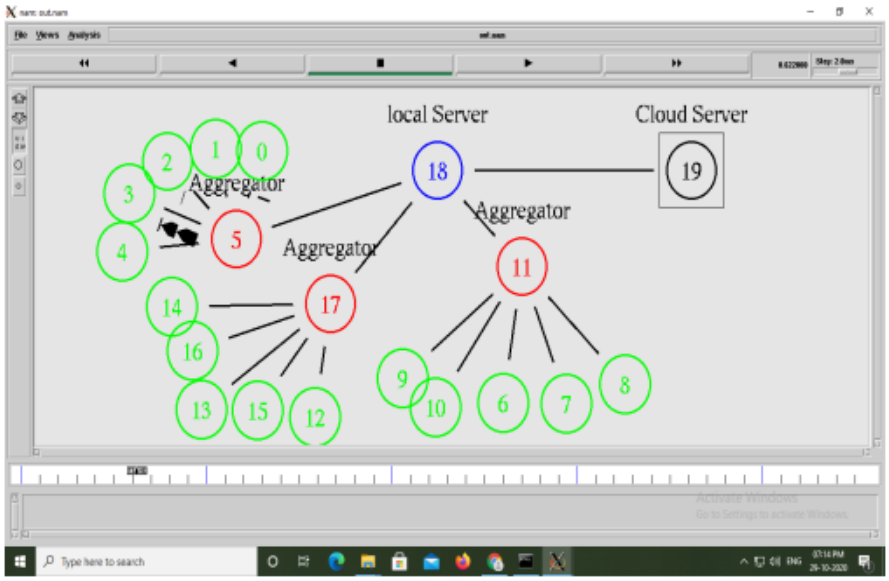

Figure 3 Data aggregation network simulation

In NS2, the data aggregation network is put into practice. The wireless ecosystem comprising wearable body sensor nodes, an aggregator, a local server, and a cloud server is depicted in Figure 3. The WBSN is equipped with pressure, temperature, EEG, ECG, and EMG sensors as input nodes. The green node is a representation of the WBSN nodes. In that order, red, blue, and black represent the aggregator, local server, and cloud, respectively.

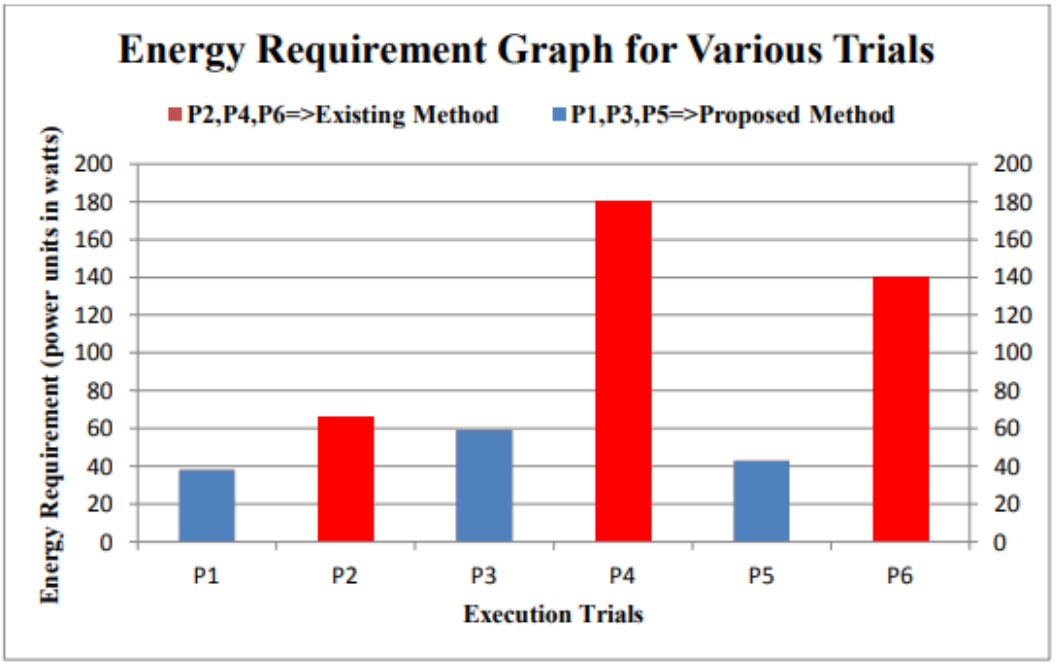

Figure 4 Energy requirement graph

The body sensor nodes used in this work, including the temperature, pressure, EEG, and ECG sensors, provide the input. The energy needed for the different trials is analysed. The energy required across the execution trials is shown in the graph (Figure 4). The energy need is shown in the above diagram as p2, p4, p6 without aggregation and p1, p3, p5 with aggregation. It is distinguished by a number of multitrials. The graph unequivocally demonstrates that energy is reduced by 50% when aggregation is used.

5. Conclusions

The gathering of data from WBSN, effective data transport, compressed, safe data storage, and illness prediction are the primary foci of this research project. The healthcare industries are receiving an increasing amount of data, but they lack the expertise and technological tools to use the data more effectively for their research. Applications of machine learning are utilised to improve lives and lower medical expenses. Ultimately, a multi-kernel support vector machine-based classification algorithm—a prediction model for the cloud-based health care system—is used to build a machine learning framework. The cloud-based system allows for the constant retrieval of patient data. The system functions as an expert system, utilising past

patient data to forecast the patient's illness and recommend a course of treatment. The proposed method support for health monitoring in real-time updates on the patient's status to the doctor's device.

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