Developing Innovative Secured Protocol For M Health Application In Wireless Body Area Networks

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Mhealth, Public Health, Disease, Prediction

ABSTRACT

In today's technologically advanced society, cell phones and related devices are essential for managing peoples' individual demands. This is a smart device that determines and regulates how we use our free time, communicate, shop, and engage with the outside world. It still requires a lot of fixes to be effective and strong. The development of tiny devices, or sensors, gave mHEALTH greater adaptability and a fresh perspective. The majority of currently available mobile applications are widely accessible by users, who can use them to take vital signs and evaluate their own physical state. In an effort to increase public acceptability, some mobile companies have developed health applications for smartphones. People use these programs to monitor changes in bodily parameters such as body temperature, heart rate, blood pressure, and pulse rate in order to assess their physical conditions. Using the MSE-BAN architecture, this study has created a stable mHEALTH architecture. The scheduling plan for the study project was created by taking the importance of the essential signals into account. The public health care system that has been suggested can shorten hospital stays and enable clinical staff to continuously monitor patients.

1. Introduction

The term "mobile-health" (mHEALTH) refers to the use of digital technologies in healthcare to both digitise healthcare services and establish a digital culture around health-related issues. The two main factors transforming health care in this new digital format are mHEALTH and e-Health. The goal of mHEALTH, the digital health care model, is to provide medical treatment anywhere, at any time [1]. With the aid of electronic communication, telemedicine helps many modern health care systems to enhance patients' mental and physical well-being. "Mobile computing, medical sensor, and communications technologies for healthcare" is how the word "mHEALTH," which refers to the exchange of medical information and queries via mobile devices, came about [9]. This technique reduces the expense of infrastructure and is helpful for delivering healthcare services at home or in places with little staff, such rural health centres, ships, trains, and aeroplanes. "Anytime, Anywhere Access with Always best-connected features," or the "4 A's," is how mHEALTH operates. This concept gave rise to the development of cutting-edge network and wireless communication technologies that support health care across a variety of infrastructures. This is a widely used technique to raise the standard of health monitoring and offers a substitute for the existing, widely used, and approved methods of delivering healthcare in various nations. Therefore, the availability of mHEALTH and e-Health supports individuals from all categories and gives the healthcare system a flexible aspect [2].

Applications for mobile health (mHEALTH) are apps that provide health-related information and services on tablets and smartphones. Patients can download a wide range of health apps from app shops that are quite beneficial. Some of the applications are for child nutrition, while others may offer guidance on healthy habits. Accessory items for health and other aspects of people's daily lives are readily available. Some apps facilitate remote communication between medical professionals and patients. For example, one app for diabetics sends automatic glucose levels to their primary care physician. Currently, there are about 325,000 mHEALTH applications accessible [11]. A breakthrough in the field of mHEALTH has been made possible by the creation of small sensor networks that may be implanted either within or outside of the human body. The critical characteristics of the human body can be accessed by the sensor devices and transmitted to any nearby personal device using any of the network protocols, such as Bluetooth, Zigbee, etc. Through real-time monitoring, the sensor devices make the mHEALTH application more dynamic and guarantee data consistency. The mobile health industry is defined as the creation, accumulation, and exchange of medical data via wireless and mobile devices. The public can now use a variety of devices and applications. Mobile health in the consumer-focused world has grown faster since Apple and Samsung entered the market with their feature-rich devices. According to the most recent data, it is anticipated that the mobile health market will increase to around $12 billion by 2024. Nowadays, the majority of doctors use technology on a daily basis for self-updating and consulting. Policies and laws pertaining to mobile health are currently altering the manner. In the area of public health care, the idea of mobile health care sparks a digital revolution. Regarding the acceptance of mHEALTH in public health care, there is no meaningful agreement between the digital health companies and policy officials. Therefore, the health companies do not know which government bodies have jurisdiction over their goods or services. [4].

Framework Of The Proposed Model

The study examines how wireless sensors function in mobile health. The little electronic devices known as wireless sensors are capable of sensing a wide range of data [3]. There are various types of sensor networks that are used in medical applications. They can be wearable, used on the surface of the body, or implanted, which uses sensors placed inside the body, and embedded in the environment, which uses sensors found in the surrounding environment. The Wireless Body Area Network (WBAN) is the use of Wireless Sensor Networks (WSN) to perform real-time health monitoring by implementing them within or outside the body. Vital indicators like blood pressure, heart rate, and oxygen saturation are tracked by them. Global patient monitoring and the health care sector are improved by wearable technology, smartphone capabilities, and the mHEALTH industry's continued expansion. This WBAN makes advantage of wireless networking based on radio frequencies. Within WBAN, every medical sensor tracks distinct critical signs, and the system is made up of numerous sensor nodes that track heart rate and body movement [6]. Wearable sensor devices provide the foundation of the WBAN, which is a network of communication between computers and people. It makes use of methods from ad hoc networks and Wireless Sensor Networks [5]. The data rate, mobility, and deployment strategies of WBAN and WSN are different. WSN is frequently installed in locations that operators may find difficult to access, and additional nodes are needed to make up for node failure. WBAN nodes share the same agility design when it comes to mobility, whereas WSN are often fixed. While event-based monitoring in WSN allows events to occur at irregular intervals, the data rate in WBAN is more definite and interval-based [12]. WBAN employs Medium Access Control (MAC) protocols for communication, which are more precise, need less power, and have lower latency. The protocol ought to provide a satisfactory concert with varying traffic loads. Time-out MAC (TMAC), Sensor MAC

(SMAC), Baseline MAC, and Zigbee MAC are a few well-liked WBAN protocols. Systems and security are the two categories into which WBAN needs are divided. Three categories of system requirements exist: device type, data rate, and energy [7].

2. Methodology

The body of the patient forms a body area network with the interconnection of wireless sensor networks in the study's proposed Multi Sensor Enabled Wireless Body Area Network (MSE-WBAN) architecture. Through the signals sent by implanted sensor devices inside the body or in its peripherals, the architecture can guarantee continuous patient monitoring [8]. The signal can be read by the nurses or doctors as needed if it is saved on a server. In Figure 1, the intricate construction is displayed.

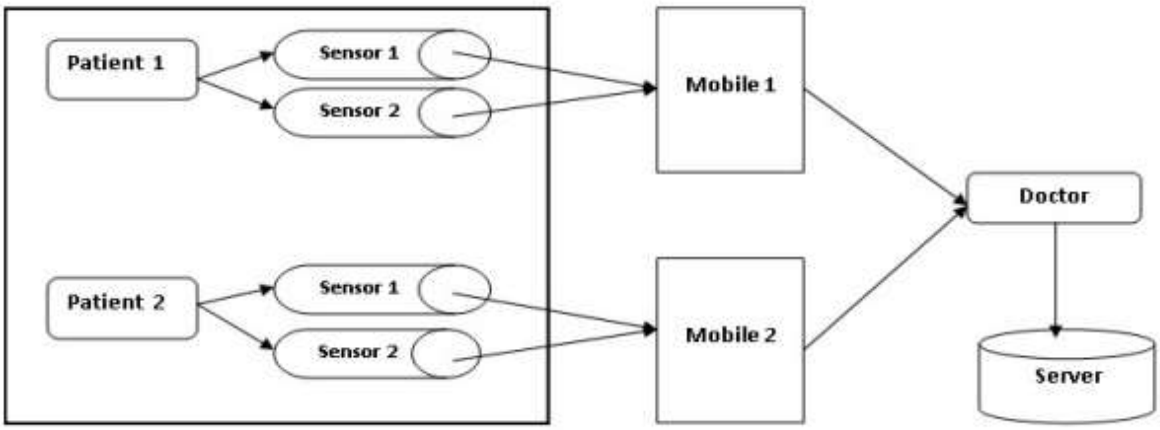

Figure 1: overall proposed framework

A gateway that collects signals from various parts of the body and notifies users of them should be present. Body Control Units are the external personal devices that include smartphones. The monitoring device, which houses the database for data storage, is the third group of devices in the device layer. Both data security and authenticity must be preserved by this storage server [13]. The third layer is made up of the several protocols that regulate how signals are transferred from various intermediate wireless devices to the mHEALTH centre. Various studies have developed a variety of methods that facilitate effective data transport. Because the protocols are intended for the MAC layer, they need to be precise, low power consumption, and low latency. The protocol must to be effective enough to function well under different traffic loads. TMAC, Baseline MAC, SMAC, and Zigbee MAC are a few of the widely used protocols. Wireless TMAC is used in the construction of the protocols; in this protocol, the node is awakened for a specific amount of time, known as the active time. It is a duty cycling protocol, and the duty cycle varies based on the network's traffic load. It corresponds exactly with the volume of traffic. The protocol uses little power and can withstand variable loads.

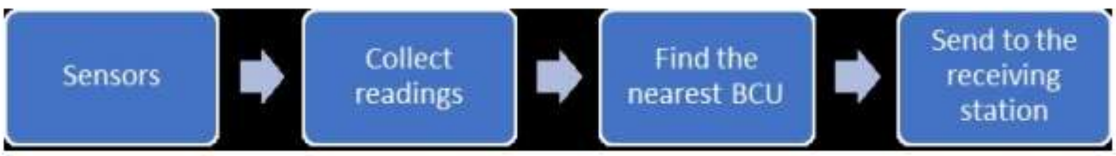

Figure 2: The MSE-WBAN Architecture

- SMAC: with a set duty cycle, it is comparable to TMAC. The protocol is unsuitable for managing WBAN's constantly fluctuating data rate.

- Zigbee MAC: TDMA or CSMA/CA are the two methods that the protocol supports. This protocol performs mediocrely when utilising the CSMA/CA method, however it significantly lowers power consumption when using TDMA.
- Baseline MAC: CSMA/CA technique is used in this protocol. The protocol performs mediocrely in terms of throughput but above average when it comes to energy consumption. Cellular technology employs GPRS, 3G, 4G, and other architectures.

The clinical personnel who are always keeping an eye on the signals make up the remote monitoring layer. This layer can guarantee the data's centralised control. The functionality of this layer includes SMS services for medication, emergency situation information, the ability to hold video conferences as needed, and more. The storage layer, which is the lowest layer, can be combined with the remote monitoring layer. Here, all of the signal data—including the user's details—is digitally saved. Under certain security restrictions, it could be given to the physician as needed [10]. Figure 2 displays the architecture's flow diagram, for cellular and LAN technologies.

3. Results and discussion

In a palliative clinic, patients test the architecture. There are about 35 patients listed at the clinic. The patient's house is visited earlier by nurses and health visitors, who take readings. There are elderly patients with chronic illnesses like cancer, asthma, paralysis, and other conditions. We have attached sensor devices to five of them in order to collect data; the readings are then captured and sent through the bystander's cell device. The two doctors at the nearby clinic, shown as servers 1 and 2 in the tables, are responsible for recording and analysing the data that was gathered. It has been demonstrated that the current mobile health applications are inconsistent and inaccurate. However, by boosting throughput, packet reception ratio, and data accuracy, sensor-enabled architecture can enhance service efficiency. Figures are used to assess and clarify the metrics. Thus, the mHEALTH service can be greatly enhanced by the multisensor enabled design.

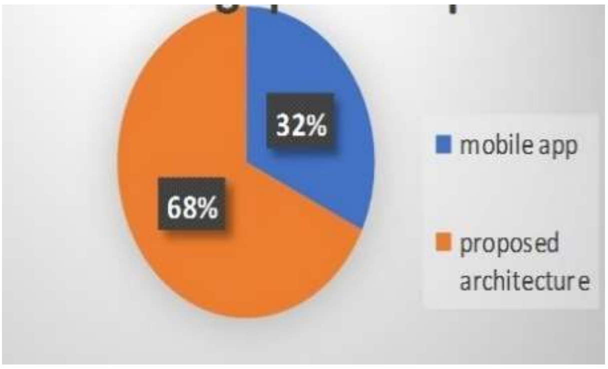

Figure 3: Comparison of Throughput

Figure 4: Packet Receiving Ratio in Mobile Applications and Sensors

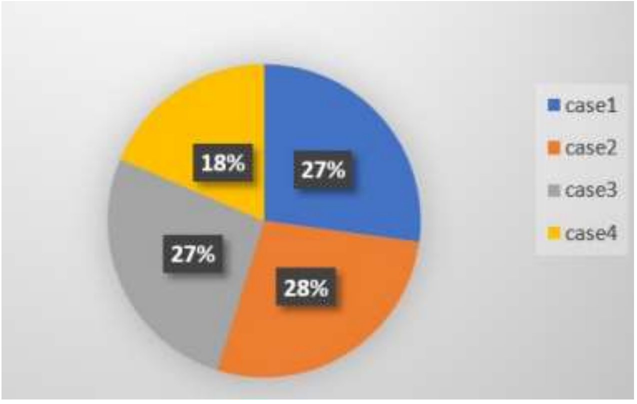

Figure 5: Packet Receiving Ratio in Sensors

Plots of the results are shown in Figures 3, 4, and 5. According to Figure 3, the throughput of mobile apps is 32% and that of sensor-enabled architecture is 68%. This is due to the sensors' ability to continuously monitor the environment in which they are implanted or inserted. The packet receiving ratio during the observation is explained in Figure 4. In comparison to the smartphone app, there are much more packets sent every minute due to the sensors' ability to generate continuous data. When it comes to health applications using mobile devices, the idea of continuous monitoring while a patient is mobile can be very challenging. Figure 5 displays the data obtained using a smartphone app to monitor heart rate as well as data obtained using particular sensors to determine heart rate. It is clear that the sensor readings are quite close to the accurate heart rate value. The readings on the mobile app are inconsistent and inaccurate.

4. Conclusion and future scope

The MSE-BAN architecture and the present mHealth application through mobile apps are compared in the study. There is no defined format for the mobile applications related to health care. The availability of applications may vary depending on the mobile manufacturing firms or the phone's supported operating system. In addition to continuously monitoring vital signs, the applications allow users to talk with medical professionals about issues pertaining to their health. The suggested model makes it feasible to monitor the patient continuously. Thus, the suggested approach can be used to provide emergency care for patients who are bedridden. The body signal measurements are taken at different times of day for the purpose of evaluating the parameters. It has been demonstrated that the suggested model has more incoming signals than the current mobile health application. The study evaluates the parameters throughput and packet reception ratio in both scenarios and demonstrates the effectiveness of the model.

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