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Development Of An Iot-Based Healthcare System

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Abstract
In order to provide medical aid from a distance, telemedicine is a multidisciplinary concept that includes physiology, biomedical apparatus, and telecommunications. Numerous barriers to receiving health care support, including a lack of doctors, a huge population, and geographic distance, can be effectively addressed by telemedicine. Notwithstanding the many benefits, telemedicine is not being used to its full potential because the necessary equipment is now somewhat costly. The need for telemedicine is growing as the population grows and healthcare facilities are dispersed inefficiently. Conventional methods of monitoring and disseminating physiological data are time-consuming because they are not automated and require skilled personnel to manage. The effective deployment of telemedicine applications requires IoT-based systems with physiological monitoring capabilities. For telemedicine to be effective, many sensors must be linked into IoT-based systems in order to track patient data and transmit it to distant medical experts.
Keywords: *IoT, healthcare industry, applications, human interactions*

1. INTRODUCTION

A typical telephone conversation and video conferencing is not an effective way of telemedicine as the doctor might not know the physiological parameters of the subject. For this, a holistic system with different sensors is required to make the doctor feel the virtual presence of the patient with all the possible physiological parameters. With the latest evolutions in embedded systems and the Internet of Things, a low-cost, portable telemedicine system is developed [1]. The sensors are operated with power-efficient circuitry without affecting precision and repeatability. The signals of the sensors are processed and plotted with advanced programming language algorithms [2]. The system seamlessly monitors the parameters and visualizes the measurements via the created graphical user experience. As the designed system is very much user-friendly, it can be operated with little training, unlike most other medical equipment [9]. The designed system is capable of measuring multiple physiological parameters with good stability [4]. The parameters include saturation percentage of oxygen in the blood, skin temperature, heart rate, pulse rate electrocardiogram, and pulse transit time based non-invasive blood pressure. Consequently, IoT has redefined monitoring, diagnosis, treatment, and therapeutic practices in healthcare, leading to reduced costs and fewer errors [3].

Healthcare departments worldwide are facing significant challenges due to rising user demands and severe underfunding. The Internet of Things (IoT) is poised to enhance the efficiency and effectiveness of healthcare services [10]. By equipping devices with sensors that monitor their surroundings and enabling internet connectivity for real-time data communication, organizations can significantly improve their data collection and reporting capabilities. On a practical level, IoT facilitates better tracking of essential and costly medical equipment, indicating a growing interest in IoT solutions within the healthcare sector. The anticipated transformation brought by IoT in healthcare is already underway, with current applications representing only the beginning [13]. It is anticipated that advancements in artificial intelligence-driven networking would enhance knowledge of therapeutic modalities and promote preventive care, signalling a bright future

2. REVIEW OF LITERATURE

One of the greatest choices for a medical expert's virtual home visit is video conferencing, which also offers worldwide teleconsultation. In the telemedicine system, the patient and the physician interact online, and the doctor keeps an eye on the patient from various locations. This further reduces the time

it takes for a patient or a doctor to travel from a rural to an urban region. The telemedicine system consists of picture capture, processing, and display of the necessary data. In order to provide better medical care from distant locations, a medical expert's virtual visit to the intensive care unit (ICU) is essential. Görset et al. created a telemedical system that can offer patients in remote areas mobile telemedicine services. In highly industrialized and populated nations, providing appropriate medical care facilities is a difficult problem [5]. Patients in these nations who live in remote areas are unable to receive timely access to quality medical care, which can result in death. In order to check the health parameters of people living in remote areas and communicate the information to the appropriate location so that the appropriate actions can be taken, a system must be created and made available at all times. A distributed network system is used in this study to support the medical care system in a remote location. The system is designed to measure health metrics using a few sensors. The system is coupled with a teleservice center to evaluate data and help patients in a critical situation from a distance. The system's architecture reduces medical expenses and travel time because patients don't have to travel to and from medical institutions. Medical care facilities in remote places can benefit from innovative solutions thanks to the telecommunication and data acquisition systems' remarkable rise in potential. Because the many sensors are interconnected and provide connectivity for remote observation, the system aids in the treatment of a number of illnesses [11]. The ECG, blood pressure monitor, weighing scale, and pulse oximeter make up the majority of the system. In this study, a smartphone and the Data Acquisition Unit (DAU) process the measured data from the sensors [6].

3. MATERIALS AND METHODS

Research is currently underway to enhance the usability and connectivity of existing healthcare implementations. Low-power operation, which combines ultra-low power voltage converters with energy-harvesting devices, is a major area of interest for researchers. Furthermore, the goal of creating graphical user interfaces that are easier to use and more intuitive is to increase usability and make it possible for users to more efficiently traverse system settings. It is also anticipated that the incorporation of accurate analog control activities, including high-resolution analog-to-digital converters, will improve output and efficacy.

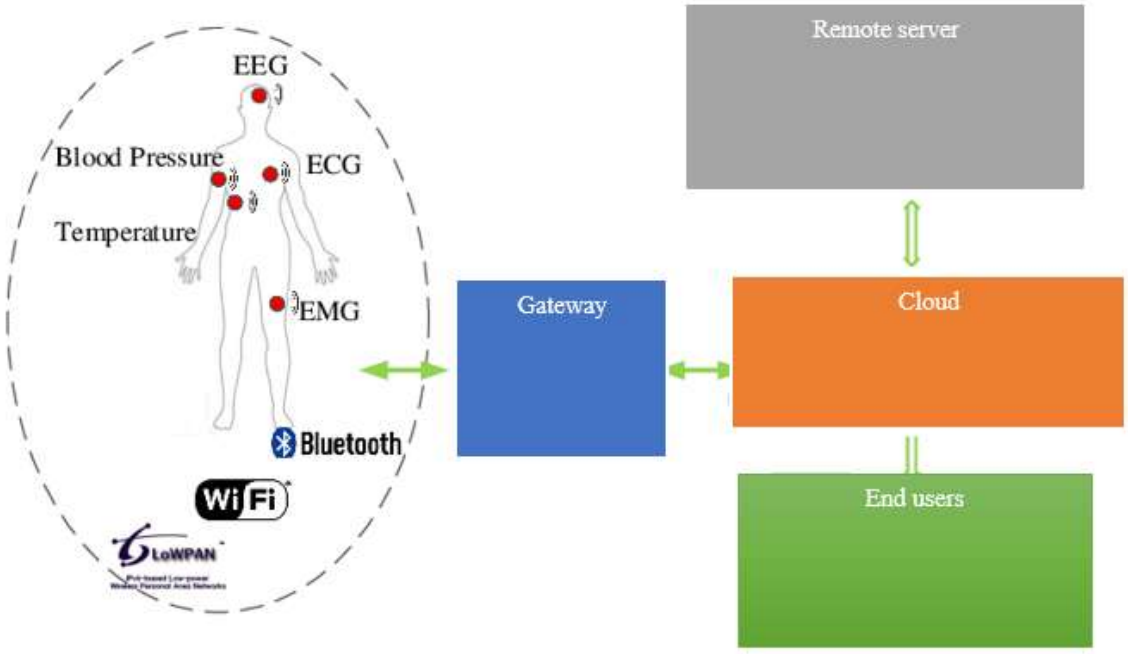

Figure 1: IOT based health monitoring

The increasing use of smartphones and the declining cost of sensors are also anticipated to support the growth of IoT in the healthcare sector [6]. New technologies have the potential to revolutionize healthcare, but their actual use presents some difficulties. The creation of enormous volumes of data

from several linked devices and the dangers of cyberattacks and data breaches are important concerns. Despite the encouraging developments in healthcare brought about by IoT and AI, many medical institutions are still hesitant to implement new technologies. The extensive data collected, including digital pathology, diagnostic, sensor, EHR, and imaging data, can lead to overwhelming data management challenges. This situation raises concerns about unauthorized access by cybercriminals, who may exploit the data for identity theft, drug trafficking, or fraudulent insurance claims. To reduce these concerns and improve the future use and uptake of IoT in healthcare, data scalability and cybersecurity must be addressed.

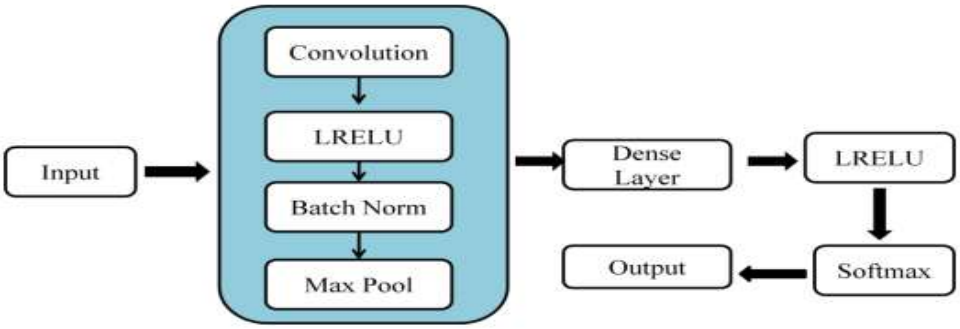

Figure 2: Modified proposed framework

Created by the Cerner Corporation, the DocBox significantly mitigates the most severe impacts of sepsis, enhancing survival rates to between 20 and 30 percent[15]. Through a successful interface, it has successfully connected IoT with medical devices, allowing healthcare executives to extract data insights from complex medical equipment and enhance patient outcomes[12]. Additionally, closed-loop insulin delivery systems, continuous glucose monitoring devices, connected inhalers, and ingestible sensors are some of the innovative commercially available technologies that are transforming conventional healthcare procedures via the Internet of Things. The Internet of Things' increasing popularity could lead to life-saving uses in the medical field. IoT can improve the entire health care system, improving the patient experience by collecting data from bedside devices and enabling real-time patient information access and diagnosis. It is projected that 87% of healthcare institutions would have implemented IoT technology by 2019 [7].

4. RESULT AND DISCUSSION

Despite the potential health benefits of the Internet of Things (IoT), several significant challenges remain before secure and efficient data-collection frameworks for IoT healthcare monitoring systems can be created [15].

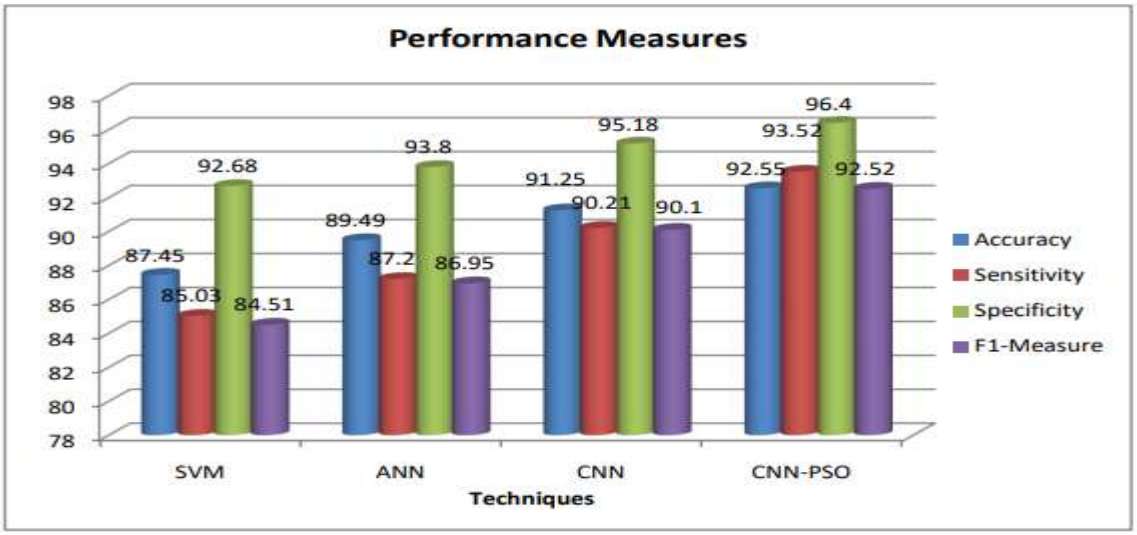

Figure 3: performance measures of different techniques

This section discusses open research issues related to function, performance, data privacy, reliability, security, and stability, among others [8]. We categorize these challenges into several groups: problems with computational intelligence, integration, energy, security, performance, and sickness prediction.

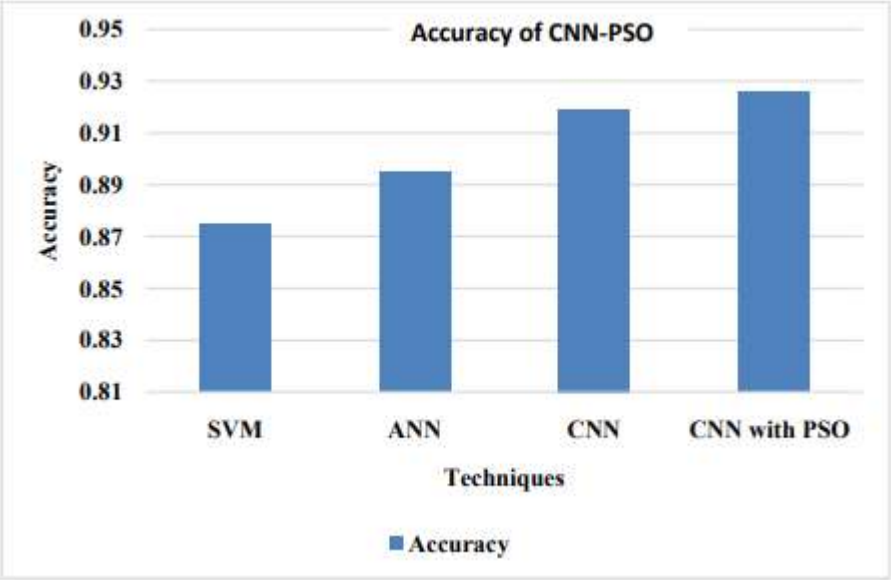

Figure 4: Accuracy plot

Individual privacy protection solutions should give users the authority to decide who is permitted to view and change their data. IoT users must have faith that their personal information will be managed securely and ethically. Laws and regulations like HIPAA and the EU's General Data Protection Regulation (GDPR) have already addressed privacy problems in the development of IoT applications. However, it is still necessary to consider the secondary use of data collected by house IoT remote monitoring.

5. CONCLUSION

Telemedicine is the practice of providing medical care from a distance using contemporary communication and information technology. Applications of telemedicine that have demonstrated their efficacy in resource use include teleconsultation, tele-education, telepathology, teleradiology, and telecardiology. The two main ways that telemedicine is implemented are through the store and forward technique and real-time implementation. The store and forward strategy involve recording patient data in physical records or storage devices. The information is then sent via various channels for the medical expert's assessment. In the second method, the specialist treats the patient while concurrently viewing the records from a distance. Numerous data categories are included in the telemedicine data, such as patient reports, clinical data, personal information, and past medical history. Given the growing population and insufficient medical resources, telemedicine must be implemented.

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