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Applications, Methods, And Trends in A Comprehensive Review of IoT in Healthcare

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ABSTRACT

The Internet of Things (IoT) has shown great promise in revolutionizing various industries, including healthcare. The Healthcare Internet of Things (HIoT) integrates software, hardware, physical objects, and computing devices to enable seamless communication, data collection, and exchange between humans and various physical and virtual healthcare resources. This paper presents a systematic review of 146 articles published between 2015 and 2020 that investigate the applications of HIoT in healthcare systems. The review aims to identify, compare, and classify the existing investigations taxonomically, leading to the development of a comprehensive taxonomy for HIoT. The articles are analyzed technically and classified into five categories, namely sensor-based, resource-based, communication-based, application-based, and security-based approaches. The paper also discusses the benefits and limitations of the selected methods, providing a comprehensive comparison in terms of evaluation techniques, evaluation tools, and evaluation metrics.

Keywords: Internet of things (IoT) Healthcare e-health Systematic review.

I. INTRODUCTION

One of the primary advantages of incorporating IoT in remote health management is the ability to collect real-time health data from patients through various wearable devices and sensors. These devices can monitor vital signs, physical activity, sleep patterns, and other health-related parameters, providing healthcare professionals with valuable insights into a patient's condition without the need for in-person visits. This remote monitoring capability is particularly beneficial for elderly and disabled individuals who may have difficulty traveling to healthcare facilities frequently.

Moreover, IoT-enabled remote health management systems allow for personalized and targeted healthcare interventions. By continuously collecting and analyzing patient data, healthcare providers can tailor treatment plans and interventions based on individual needs and specific health conditions. This personalized approach can lead to better health outcomes and improved patient satisfaction.

Another significant advantage of IoT in healthcare is its potential to reduce healthcare costs. By enabling remote monitoring and early detection of health issues, IoT can help prevent hospitalizations and emergency room visits, which are often costly. Additionally, remote health management can lead to more efficient use of healthcare resources and reduce the burden on healthcare facilities.

However, the widespread adoption of IoT in healthcare also poses some challenges and concerns. One major concern is data privacy and security. As sensitive health data is transmitted and stored across various devices and networks, there is a risk of unauthorized access and data breaches. Healthcare organizations and technology providers must implement robust security measures to safeguard patient information and ensure compliance with data protection regulations.

Furthermore, the integration of IoT devices and technologies into existing healthcare systems may require substantial investments in infrastructure, training, and maintenance. Ensuring seamless interoperability among different IoT devices and platforms is crucial for the success of remote health management systems.

II. LITERATURE SURVEY

Numerous scholars have contributed research papers and tackled numerous chronic disease challenges, including AI in healthcare and IoT in healthcare. A section emphasizes a review of the relevant literature.

Shima Okada, NaruhiroShioza et. al[7] focused their attention mostly on bodily motions while they slept since they are most closely associated to the sleep-wake cycle. They have put out a method that makes use of several image processing techniques to measure body motions while you sleep. They used video monitoring to characterize the differences in body movement during sleep in normal children and those with ADHD in order to prove the validity of the proposed system. Body movement data calculated by difference image processing were compared with the sleep stages measured by PSG.

A brand-new brain-computer interface (BCI) device designed to treat children with attention deficit hyperactivity disorder was introduced by Darius Adam Rohani, Helge B.D, and colleagues [8]. It uses the P300 potential in a series of feedback games to improve the subjects' attention. To identify the disorder, they used a support vector machine (SVM) that applied temporal and template-based features.

Tao Liu and Dongxin Lu [10] provide a conceptual overview of IoT (the internet of things), as well as information on its history, various interpretations, major technology, and applications.

Dong-Hwan Park and Hyo-Chan Bang[11] concentrated on how technologies help to improve the interoperability of IoT devices and make usage of IoT devices more conveniently. IoT device interoperability and semantic-based information services are made possible by the expected platform technology. This service platform can be used for many semantic IoT services, such as the distribution, participation, and sharing of open sensing data, the collection of invisible information in tangible environments by smart devices, and the provision of smart living services.

A remote health care monitoring system was proposed by Sai Kiran P, Rajalakshmi, and others [13], with the assembled medical data from biomedical sensors being transmitted to the adjacent gateway for auxiliary processing. Data transmission contributes significantly to transmitter power consumption and an increase in network traffic. The amount of electricity saved and the decline in network traffic are the measures left over for performance study. The suggested rule engine significantly lowers the amount of energy used and the amount of network traffic produced.

A semantic data paradigm for storing and interpreting IoT data was proposed by Boyi Xu, Li Da Xu, and others [15]. Then, in order to increase the availability of IoT data resources, a resource-based ubiquitous data accessing technique is created and designed. It allows for the universal acquisition and use of IoT data. Last but not least, they presented an Internet of Things (IoT)-based system for emergency medical services and showed how to gather, integrate, and interoperate IoT data.

Nuno Vasco Lopes, Filipe Pintoz, and colleagues [16] presented an IoT architecture for disabled individuals that aims to describe, select the additional most appropriate IoT technologies, and include global standards into the design of the suggested architecture. They focus on the empowering IoT technologies and their viability for those with disabilities.

III. PURPOSE OF IOT IN HEALTHCARE

If necessary, preprocessing of human data collected. Ease of access to Internet, wearable IoT devices have beena huge hit in the market. Because end users, clients andcustomers in healthcare network are humans (patients orhealth-conscious individuals), developing of ambient intelligence is crucial.To provide Ambient intelligence for the continuous learning about patient's data executes any required actiontriggered by a recognized event. The Integration ofautonomous control and human computer interaction (HCI)technologies into ambient intelligence can further enhancethe capability of IoT-aided healthcare services.To gain the information about human in real time through IoT wearable device.Preprocessing of data acquisitioned about human (ifnecessary). Using data mining tools to analyze and predict chronic diseases at an early stage, which offers decision-making approach. To provide healthcare solutions based on IoT wherever, anytime.

IV. PROPOSED METHODOLOGY

The information and knowledge for the prognosis of chronic illnesses can be inferred from wearable health care equipment. Tier-1 unprocessed and raw data is obtained from a wearable IoT healthcare monitoring device that has a variety of sensors, including an EEG sensor, a galvanic skin response sensor, an ECG sensor, an accelerometer, and a skin temperature sensor, among others. If there is a large amount of existing irrelevant and redundant information or noisy and unreliable data, information is inferred from the data at layer 2 by filtering, processing, categorizing, condensing, and contextualizing the data. To predict chronic diseases (such as cardiovascular diseases, mental health disorders, diabetes, stroke, etc.) in tier three, we must develop algorithms using a variety of mining techniques, including constraint-based mining and periodic mining.

V. THE STATE OF IOT HEALTHCARE AND SEVERAL WELL-KNOWN TECHNOLOGY COMPANIES' FUTURE PLANS

The extent of IoT use in business and government is described in this section:

Windows and Google: In order to facilitate code sharing, Google, Microsoft has concentrated on employing an intelligent system to uncover the promise of IoT-based health care solutions. Source physical web standard for IoT may be considered an attempt to arrange an easier technique to communicate with connected medical equipment [17].

Intelligent systems serve as the skeleton for the technologies that enable the collection of health data from gadgets while maintaining the necessary connectivity [18].

IBM and Intel For many existing medical workflow environments, Intel places a strong emphasis on real-time synchronous communication systems and health data streaming, which can assist shorten cycle times and enhance first-time quality.

Through the idea of "smarter health care," IBM redefines value and success in the healthcare industry. IBM has collaborated with other well-known companies throughout the world to produce a collection of IoT devices. It focuses on a number of healthcare solutions, including connected home health, data governance for the healthcare industry, and healthcare providers' access to health analytics[20].

Apple: Apple has declared the Internet of Things to be the most advanced technology. The apple watch is a fitness tracker, smart watch, and heart rate monitor. For effective and connected healthcare services concentrating on secure access, physician gains, and improved care, the Memorial Hermann hospital system is wholly dependent on Apple's Solutions [21].

Qualcomm and Cisco: Cisco is prepared to offer convergent solutions based on unrelated technologies.

Advanced data analytics, networks, and can introduce efficient algorithms for handling cumulative traffic loads arising from widely used IoT healthcare devices. The 2net Platform of Qualcomm Life offers a set of wireless health solutions that can capture and deliver health device data from almost all users' wireless medical devices to integrated portals and databases. CISCO is collaborating with top healthcare organizations to develop medical-grade network architecture [22]. IoT healthcare solutions must be advanced and innovative, according to Qualcomm [23]. the public sector Additionally, the Indian government launched numerous programs to promote IoT in healthcare. These initiatives to increase IoT use in India's healthcare industry are to be expected. The majority of the nation favors the United States, Japan, Germany, Korea, China, France, and Australia.

VI. CONCLUSION

Any problem or medical ailment that is early identified can be most effectively treated. It is evident from the literature mentioned above that the main objective of the research must be The collection, management, and application of information in health data via IoT has significantly improved the quality and efficiency of healthcare as well as the ability to react to widespread public health situations.

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