A Review of Routings in Healthcare System Based on Internet of Things

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Abstract: ***A lot of attention has recently been paid to the Internet of Things (IoT) because of its potential and ability to be incorporated into any complicated system. The creation of intelligent systems with high communication and data gathering capacities is made feasible by ongoing technical advancements, opening up significant prospects for a variety of IoT applications; particularly healthcare systems. An IoT must offer more dependable routing as a method of measurement and data collection in healthcare applications. IoT gives healthcare system's crucial properties like availability, mobility, and scalability that serve as the architectural foundation for a variety of high - tech healthcare applications like real - time patient monitoring, environmental and indoor quality monitoring, and ubiquitous and pervasive information access that is advantageous to both patients and healthcare professionals. This study will provide a thorough analysis of HCS routing with IoT support. It will examine recent studies on IoT - enabled HCS, as well as important enabling technologies, significant IoT - enabled applications, and successful case studies in the healthcare industry. This literature review enables practitioners to determine if their problem has resulted in the development of planning approaches, while researchers can identify unresolved issues and focus their research in one direction or another depending on the limitations and goals under discussion. This paper's primary contributions are a synthesis update of the literature on routing in the context of HCS, some remarks on current trends with a focus on the uncertain and dynamic features.***

Keywords: IoT, HCS, PHDs

1. Introduction

The Internet of Things (IoT) can merge contemporary technologies with future life, which is regarded as a promising scenario affecting human life. With the development of the Internet of Things (IoT), the World Wide Web has changed from a homogenous network that only consists of online computers to a network of heterogeneous equipment and devices, including home appliances, mobile electronics, and wireless sensor networks. The IoT also makes it easier for medical information to be transmitted and received. Better outcomes, higher customer satisfaction, and cost savings can all be attained by adhering to primary healthcare's guiding principles. An IoT - based healthcare system, however, confronts a number of difficulties, including the lack of essential standards for IoT - based healthcare, the collecting of unique patient data, the delayed presentation of patient data that has been saved, and huge data. The target servers should receive the data before processing it. High reliability, error - free operation, and delay - free transfer are requirements for the data transfer operation from a source to a destination; these characteristics can change route.

Sensor networks, particularly a BSN, which is known as the most significant subclass of the IoT, have limitations and difficulties that set them apart from other distributed systems. The design of wireless sensor networks (WSNs), which include many protocols and algorithms categorized as other IoT categories, might also be impacted by these restrictions in specific ways. Thus, some of the most significant restrictions on routing include traffic models, energy efficiency, two - sided connectivity, and radio transmitter usage [5]. Although there are many more restrictions than those stated, the preceding network restrictions mostly have an impact on routing difficulties. In order to increase reliability, this study explores various approaches for data packet routing in IoT - based healthcare systems. IoT is experiencing a new revolution that is quickly taking off as a study issue in many academic and industrial fields, particularly in healthcare. Surprisingly, IoT - enabled technology is transforming healthcare from a traditional hub - based system to a more individualized healthcare system as a result of the rapid spread of wearable devices and smartphones (HS). However, given numerous issues, including a lack of affordable and accurate smart medical sensors, a lack of standardized IoT system architectures, heterogeneity of connected wearable devices, multidimensionality of generated data, and a high demand for interoperability, enabling the utility of advanced IoT technology in HS is still incredibly difficult in the area.

Researchers in academic and professional settings are paying more attention to the IoT, which is an extension of the Internet. Big data solutions are being created to cope with the complex and enormous amount of data collected from sensors mounted on structures since the amount of data generated by sensing devices is voluminous and growing quicker than before. A healthcare system is a collection of hardware and software tools created to offer a variety of healthcare services and applications to people, including patients and medical professionals, with the goal of promoting health and well - being in a practical and frequently pervasive way. Healthcare systems and ELE (enhanced living environments) are intertwined (Ambient assisted living). AAL systems offer an effective way to use ICT to address various healthcare concerns. On the one hand, human physiological status monitoring aids in medical state perception and are crucial for at - risk people to identify symptoms early on, such as elderly adults and neonates. On the other hand, environmental factors can be tracked in real - time to spot and avert dangers and have a significant influence in wellbeing. Doctors can examine both observed data types (physiological and environmental) in order to enhance clinical diagnosis. Since humans spend 90% of their time indoors, indoor air quality (IAQ) is a critical component that must be tracked and managed in real time for ELEs and occupational health. The identification of several circumstances or behaviors that have an impact on wellbeing during an IAQ assessment aids in decision - making regarding potential solutions to increase productivity and a healthy indoor environment.

IoT architectures describe how physical things that have sensory capabilities are connected to the Internet. Through distinctive addressing techniques with interaction and cooperative capabilities, these objects can be accessed. Many other types of devices, including microcontrollers, sensors, actuators, cellphones, and wearables, are included in IoT architectures. To build and create IoT architectures, open - source platforms, hardware, and improved software solutions for data analytics, consulting, management, and storage are necessary. IoT architectures include the users of these IoT devices, who should contribute and work in concert with IoT systems. IoT architectures must therefore be conscious of the human context and view people as a crucial component of the system. Instead of being moved to nursing homes or clinics, IoT can enhance healthcare systems and enable individuals to stay at home and be monitored in real - time. Personal healthcare devices (PHDs) are incorporated into several IoT systems for remote patient monitoring. These systems are portable and provide capabilities that are important for sensing and measuring patient biological signals.

Since there are more PHDs, they must have effective connections for healthcare servers [31]. PHDs are described in [32] and used for fall detection, medicine dispensing, activity monitoring, blood pressure and pulse oximeter monitoring. Healthcare professionals employ these portable devices in IoT contexts to enable patient monitoring at home. Furthermore, PHDs play a crucial role in the design and implementation of healthcare systems. Additionally, some research [3, 14, 15, 24, 46] advocate the inclusion of PHDs in clinical settings. With the use of wearable sensors integrated into devices like smart watches, many monitoring tasks that were previously only possible in hospitals may now be carried out continually. Wearables like smart watches, however, cannot totally replace hospital assessments due to a number of factors, including dependability, precision, and the context of the measurement. Wearable sensors should be used as a vital addition, not as a replacement for human interaction and the doctor - patient connection.

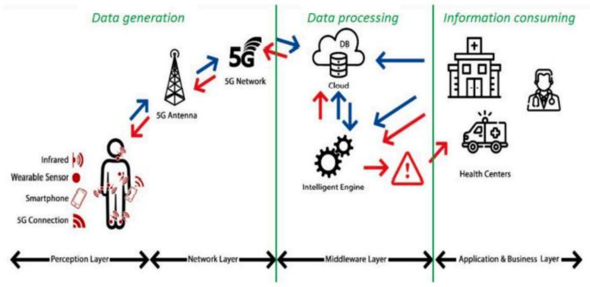

Figure1: Architecture of IoT in health care system

The above figure1 shows the architecture of IoT in health care systems. Real - time monitoring capabilities in healthcare solutions can help prevent unanticipated hospitalizations that incur high emergency expenditures. IoT offers a number of benefits for the planning and creation of healthcare systems. It can offer networks of interconnected devices, Cloud apps, and services to make it easier to transmit and store the patient's monitored data. Remote monitoring, smart homes, wearable technology, and smart medical equipment are just a few of the IoT applications that are directly tied to healthcare systems. IoT interoperability has been the subject of numerous academic and commercial research investigations, and as a result, a number of approaches and solutions to deal with interoperability issues are available in the literature. These techniques put a lot of emphasis on standardizing communication protocols to enable compatibility between various devices, networks, and data structures. As a result, these techniques and technologies can also be used with IoT to give the healthcare industry interoperability. Additionally, a large number of IoT - based healthcare apps have been created, which highlights the pertinent benefits of this architecture to deliver effective and affordable healthcare systems as described in [46].

IoT must adopt standards, including effective wireless protocols, enhanced mobile and wearable sensors, and affordable and low - power microprocessors, according to [15], in order to enable high - quality healthcare systems. According to a survey [19], there is broad and increasing individual support for IoT advancements. The IoT communication architecture can serve as the primary enabling agent for distributed ubiquitous healthcare applications given the current accessibility of remote wireless medical systems and the growing adoption of electronic healthcare database records.

In addition to reviewing the state of the art, this paper will give an overview of healthcare systems and concentrate on technology, applications, prospects, problems, and open - source IoT platforms and operating systems. In order to enable future research at this point, a thorough understanding of IoT from a healthcare perspective is important. Additionally, this article will provide a thorough study of the primary applications, enabling architectures, obstacles, and prospects for ELEs and healthcare systems. While there are numerous survey papers about IoT for the healthcare domain in the literature and it is clear that IoT platforms have recently proliferated, it can also be shown that most surveys do not concentrate on the analysis of existing IoT platforms and operating systems. This paper's primary innovation is that it does a thorough evaluation of the IoT platforms and operating systems that are now available and makes a recommendation for one of them to especially address solutions for the healthcare domain. Additionally, this publication synthesizes the corpus of information already in existence and identifies gaps and common threads that open up and important future research options for healthcare systems. The study offers several views on healthcare systems while taking into consideration the significance of security, privacy, and quality of service (QoS) open issues in the healthcare area. It is anticipated that the discussion of a number of major future research issues, which have the potential to expedite the development and deployment of IoT in healthcare, will serve as a crucial context for such activities. This review article seeks to be helpful by exposing the subject to healthcare practitioners as well as academics and engineers, which is crucial for the creation of future healthcare systems.

In order to improve access to healthcare and medical information globally, healthcare systems are absolutely essential. Ageing populations can now more easily access healthcare thanks to technological advancements, which also provide new opportunities and approaches for processing and understanding medical data. Despite all the benefits of healthcare systems, there is still a complicated and significant open question about the privacy and security of patient data. Other significant issues facing healthcare systems are described in [18] as normalization, network configuration, business models, QoS, and data security. Mobile and wearable sensors, wireless technologies, and open - source platforms are just a few of the study areas that are pertinent to the design and implementation of healthcare systems. Many healthcare systems use wireless communication technology to transmit data and incorporate wearable and mobile sensors for data collecting used to monitor human physiological status. Additionally, open - source platforms offer a wide range of functionality for device administration and security in addition to supporting data storage, visualization, and analytics.

People are living longer, having higher expectations for their quality of life, improving their lifestyles, and financial development have changed the way healthcare is provided, which has produced a smart healthcare system. Patients' health can be tracked using smart healthcare systems in both routine situations and emergency situations. Since the use of cutting - edge technologies like sensors, actuators, and complex communication networks has grown and their prices have dropped, embedded systems have developed quickly. The healthcare sector is expanding quickly and improving its services and coverage. The healthcare system made it possible for problems with time and space limitations to develop in medical services for health promotion that require a physician to analyze patient bio - signal - related data while facing the patient.

2. Literature Review

Many routing algorithms have been proposed in recent years for IoT - based healthcare systems to pursue particular objectives. Survivable path routing, an energy - efficient inference congestion - aware routing algorithm, was suggested for sensor networks in [11]. The suggested protocol makes use of a criterion that depends on three variables, namely the ratio of signal to link noise and interference, the path's survival from the next - hop node to the destination, and the next - hop node's congestion level.
For peer - to - peer communications in the Internet of Things, a practical energy - aware multi - hop multi - channel routing strategy was put forth in [12]. The suggested approach uses spectral sensors to map the radio environment and record how a spatial - temporal spectrum is being used. The multi - hop routing method also makes use of the radio environment map. The optimal path, the most effective channels at each hop and the right transmission power are all included. A unique method to enhance the IoT's routing quality was put out in [28]. In fact, it is anticipated that layer transfer information will extend network lifetime by reducing energy usage by a significant amount over time. In order to extend the network lifetime and lower the packet loss rate, a fuzzy probabilistic routing protocol was put forth in [43] to regulate path - requesting packet transmission in the IoT. To maximize network performance, the fuzzy controller receives input descriptors in routing criteria.

For personal hygiene devices, a dependable oneM2M - based IoT system was suggested in [43]. In addition, a fault - tolerant method for IoT systems was suggested in this study, which connects the gateways of related layers to create a change in fault tolerance at every level.

The protocol described in [35] is based on adaptive fuzzy logic and is inspired by artificial immune systems. It is designed to be used with IoT systems via a wireless sensor network. The suggested method chose a suitable cluster head using an adaptive fuzzy multiple - criteria decision - making methodology. Additionally, to increase reliability, the artificial immune optimization technique was applied to routing. The link state routing (LSR) technique sends patient information via multicast to all of the source node's neighbors. To ensure that the information reaches the access gateway, the nodes that receive the information will multicast it to all of their neighbors. Congestion brought on by information multicast and greater energy usage across the network is the drawbacks of LSR.

An improved variant of LSR is the optimal link - state routing (OLSR) method, which is described in [26]. Similar to LSR, the source node in OLSR multicasts data, and nodes that are on the source node's MPR list are permitted to send data. As a result, each node generates an MPR list. Every node locates its single - hop and double - hop neighbors for this reason. The only way to reach a few double - hop nodes is through a few single - hop nodes that the source node chooses and adds to the MPR list. Every node has an MPR list produced, and information is transmitted between nodes until it reaches the target node. In the maximum allowable number of error burst (MAEB) algorithm, the source node first calculates an equation for every neighbour and then selects a node with a smaller value of the equation as the next hop for information transmission.

The Internet of Things (IoT) depends on a variety of components, network infrastructure, communication protocols, Internet services, and computing technologies

[45]. WSN is one of the key technologies that enable the integration of sensing devices into IoT ecosystems out of the variety of different technologies included in the IoT concept.

[8]Proposed scheme alleviates congestion by a priority - based data routing strategy. Furthermore, this article presents a priority queue based scheduling scheme for better reliability. They analyze the properties of the proposed congestion control mechanism mathematically and validate its performance through extensive simulation and real - life experiments. The application of this work can be used to an early warning system in detecting abnormal heart rate, blood pressure, ECG, EMG in the hospital/home care environment to the state - of - art diagnosis. In [49] the key characteristics, the driving technologies, unresolved conflicts in the IoT context, and research issues were presented. The author emphasized a number of technological concerns, including architecture, security and privacy, hardware, data processing, communication, discovery, data and network management, power, and energy storage. The IoT paradigm's concept was divided into three categories based on its focus on objects, the internet, and semantics. The author anticipated that there would be connectivity between the physical and digital worlds during the phases of IoT technologies' data collection, transmission, processing, management, and application. The industrial domain, the smart city domain, and the health and well - being domain were used to categorize the IoT's potential. Social networks, context - aware computing paradigms, and new potential for developing innovative applications were also covered.

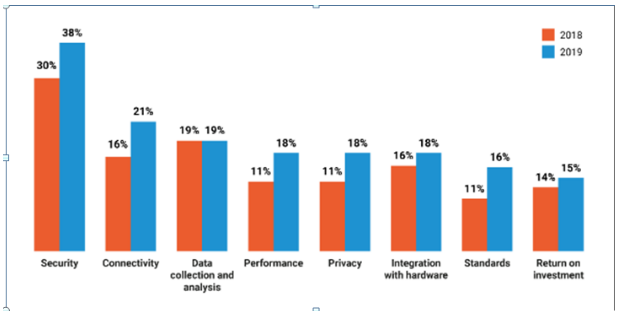

Figure 2: IoT in health care: Benefits, challenges, use cases

[7] Presented IoT research themes, listed current developments, and described IoT diffusion problems. Based on technology, applications, and business models, IoT problems were categorized. Issues related to hardware, software, and architecture was also noticeable. A description of the state of IoT research at the moment and the obstacles to IoT adoption was also provided. To comprehend the most recent advancements and theoretical contributions to the IoT, journal articles, conference papers, and edited volumes were evaluated. It was made obvious how the IoT paradigm depends on a mix of architectures, software, and hardware. Smart infrastructure, supply chains or logistics, healthcare, and social applications were used to categorize IoT application areas. To assure the adoption and spread of IoT, the technological and societal issues were underlined. [4]Propose PEERP: An Priority - based Energy - Efficient Routing Protocol for Reliable Data Transmission in Healthcare using the IoT. We classify health information into two categories assigned corresponding priorities: Emergency Situation and Vital Health Data. The Emergency Situation is the highest priority data and should be successfully delivered as soon as required. The Vital Health data is the data requested by doctors for continuous monitoring of the patients. The direct communication is used for critical data while Multi - hop communication is used for vital health data delivery.

[1] Aims to propose a routing protocol to enhance energy - efficiency, which in turn prolongs the sensor lifetime. The proposed work is based on Energy Efficient Routing Protocol using Dual Prediction Model (EERP - DPM) for Healthcare using IoT, where Dual - Prediction Mechanism is used to reduce data transmission between sensor nodes and medical server if predictions match the readings or if the data are considered critical if it goes beyond the upper/lower limits of defined thresholds. The proposed system was developed and tested using MATLAB software and a hardware platform called "MySignals HW V2. "

[9] Compiled the rules, applications, research, and development plans for the IoT in the Chinese setting. Comprehensive perception, dependable transmission, and intelligent processing were cited as the three main IoT qualities. The links and communications between M2M, including mobile to machine, and human to machine were detailed. The IoT combined the physical and digital worlds by fusing the many ideas and technical elements of device downsizing, pervasive networks, and mobile communication. The explanation also covered the capabilities of IoT applications such location sensing and exchange of location data, environment sensing, ad hoc networking, secure communication, and remote control. IoT standard system was viewed as a fusion of standards for architecture, communication, security, protocol, application requirements, identity, data, information processing techniques, and public service platform. Information sharing, network management, technology multiplexing, and upgrading issues were covered in detail. The areas that needed to be solved by the researchers included low cost and low latency connectivity, low power nodes and computation, self - organized distributed systems technology, identification and locating technologies, and distributed intelligence. [29]Proposing a novel secure and end - to - end energy - aware routing architecture for IoT - based health applications and they have also explained the improvements in the efficiency of healthcare applications. When compared with the existing models, their proposed system is working better in terms of communicational overhead and latency between user and the gateway.

[20] Examined the IoT's advantages, drawbacks, and trials. The physical security of the sensors was discussed in relation to IoT infrastructure issues like denial of service, eavesdropping, and node capture. Node capture attacks, such as physical capture, brute force attacks, DDoS attacks, and node privacy leaks, were also possible against the distributed IoT architecture. The likelihood of a DDoS assault was high because the IoT ecosystem has a large number of linked devices. The scattered organized structure of the IoT system and the dynamic shift in network typology made node capturing another challenge to it. After reading the literature, it is clear that some of the major problems in the IoT environment include IoT standards, security, mobility

support, naming devices, protocols, heterogeneity, energy efficiency, traffic characterization, QoS support, authentication, data integrity, privacy, and digital forgetting. But while considering IoT as a reality, security must be taken into account as the first concern. IoT's anytime, anywhere connection for everybody paradigm promotes adoption and a wide range of use cases. Concerns about the security of data, services, and even the entire Internet of Things system are raised by the same paradigm.

[37] Proposed an application - specific routing protocol for the health care which would ensure the increase in network lifetime while maintaining the maximum throughput in data transmission. The proposed routing protocol has shown an improved performance in terms of metrics like throughput, network lifetime, end to end delay, packet delivery ratio and packet loss while comparing with some of the traditional routing protocols e. g. Routing Protocol for Low - Power and Lossy Networks and Collection Tree Protocol. [34] Raised a number of issues with an IoT system's security. This paper placed a strong emphasis on IoT security since doing so would make IoT more visible to average customers. Nearly half of the study participants believed that IoT had similar security issues as other technologies. It would have been disastrous if sufficient security measures had not been implemented given the growing vulnerabilities in IoT devices. Researchers looked at the rapid development of embedded computing and communications in vending machines, cars, and trains. The research emphasized the problems that the software's embedded nature for enterprise configuration management procedures and vulnerability assessment brought about. The technological effects of IoT on their businesses and the security implications of these technologies were less well understood by many security professionals. The below figure 2 shows the type of health care access in Kerala and Rajasthan. As additional issues in IoT device security, policy formulation, configuration and vulnerability management, data gathering, and performance and status visualization have all been mentioned.

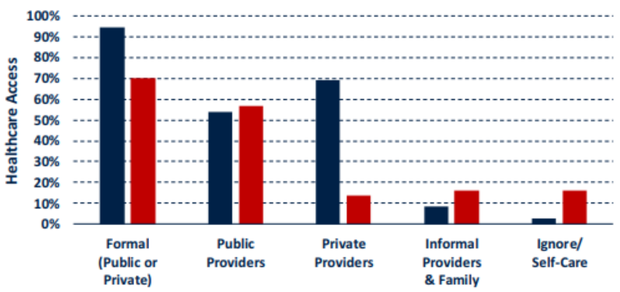

Figure 3: Type of health care access in Kerala and Rajasthan

IoT research issues were highlighted by [44], who also foresaw the changes that the technology will bring about in the far future. Cyber - physical systems were thought to have as its foundational technologies machine learning, real - time computing, security, signal processing, privacy, and big data. The main research areas in the IoT environment included knowledge creation and big data, huge scalability, openness, architecture and interdependence, robustness, human - in - the - loop, privacy and security. For defining, identifying, and resolving dependencies across apps, a thorough research methodology needs to be created. Additionally, the researcher envisioned a world where the IoT, mobile computing, pervasive computing, and WSN domains worked together to create a smart world. The authors attempted to increase awareness across diverse research communities by highlighting important research needs for upcoming IoT systems. [20] Examined the protocols that are still in use, discussed the safeguards for IoT communications, and discussed open research questions. The solutions for secure communication in the IoT context using several IoT communication technologies were analyzed by the authors. At the physical and (MAC) layers, IoT communications security was explored. As security measures intended to safeguard communications, confidentiality, authentication, non - repudiation, and integrity of the information streams were taken into consideration. The MAC layers were in charge of controlling processes like physical channel access, frame validation, guaranteed time slots, network beaconing, node association, and security. AES security at the link - layer offered a way for defending against security risks to neighbor finding and mesh routing mechanisms.

[38] Provided a thorough analysis of the IoT and its different technologies. IoT was to be realized by the integration of RFID technology, Wireless Sensor Networks, Big Data, Ubiquitous Computing, and Cloud Computing. The authors also raised a number of unanswered concerns about IoT that would be useful in understanding the difficulties and potential areas for future research. IoT use cases for disaster management, smart cities, patient monitoring, smart transportation, and automatic status updates on social media platforms were detailed. Open problems were identified as standardization, addressing, power storage and utilization, data processing, search, and discovery. Security issues such as authentication, data integrity, privacy, and digital amnesia were considered.

[16] Discussed his concern on the evaluation of security issues in an IoT setting. The researchers conducted a thorough review of the problems and difficulties with IoT security and described the elements of an IoT network. This paper emphasized IoT attack surfaces, forensics, security concerns, threat models, requirements and obstacles, and security and privacy concerns. The needs, problems, risks, and potential solutions for the security of IoT devices were summarized. Hardware, software, and network security restrictions were separated into different categories. Information level, access level, and functional security were taken into consideration when listing security needs. [20] Talked about a variety of security - related problems. It was proposed to design the security architecture with the user's confidentiality and privacy in mind. The authors emphasized the importance of giving IoT security top priority. There were developed security infrastructure protocols that could handle the problems with IoT scalability, availability, and security. The authors highlighted the IoT security research accomplishments and the requirement for the extension of security solutions to satiate the data - hungry devices of the future. Techniques for intrusion detection, risk analysis, and authentications were also taken into account.

[39] Discussed potential security issues and different strategies for a protected network. The fundamental IoT problem was thought to be the interoperability of connected devices with privacy and security concerns. The sensor layer, transportation layer, and application layer of the IoT architecture were described. It was also detailed what services each layer and the gadgets connected to the sensors offered. Authentication, integrity, availability, anonymity, confidentiality, resilience, privacy, liability, non - repudiation, and trust were mentioned by the authors as the IoT security concerns. To protect against a Denial of Service (DoS) attack, encryption, decryption, and security protocols, key systems, and end - to - end authentication were all required.

Physical security, network security, data security, operating system security, and server security were the categories used to classify security in the IoT environment. In order to prevent security breaches that lead to IoT data theft and misuse, software protection methods for small devices, effective and scalable encryption algorithms, and analysis of fine - grained data packet loss for sensor networks are necessary. Properties including confidentiality, integrity, authentication, authorization, availability, and privacy must be guaranteed for the entire IoT system in order to secure IoT data.

IoT involves connecting an increasing number of devices in order to detect and gather environmental data. While some of these gadgets employ potent processors, others make use of low power micro - controllers with less processing capability. Every day, these gadgets produce 2.5 quintillion bytes of data. The administration and security of this vast volume of data raise various issues. Additionally, dangers including information manipulation, denial - of - service attacks, disclosure assaults, and others are highly prevalent in the IoT environment's communication channels. Therefore, the acquired data must be encrypted to stop someone listening in on the communication channel from learning the data. But in order to secure IoT data, IoT devices struggle to implement difficult cryptographic algorithms. The encryption methods had to be as "little" as feasible due to the extremely low numbers of logic gates and the extremely low amounts of energy present in such devices. Therefore, the cryptographic methods utilized in the IoT environment must be specifically "lightweight" constructed.

The measures used to optimize any technique to be lightweight include memory usage, the speed or throughput of the primitive, and the size of the implementation. Additionally, any cryptographic method implementation may involve a trade - off between cost, performance, and security. In order to offer better trade - offs, lightweight algorithms for the IoT environment must reduce the complexity of hardware implementation. The use of IoT in the healthcare industry is a significant current research trend. Some of the problems seen in the healthcare sector include patient mobility, dependable patient communication, and energy - efficient routing. However, implementing any new technology in a hospital setting without taking security into account might seriously jeopardize patient privacy. Additionally, a patient's physiological data are quite sensitive. Data security is therefore a crucial necessity for IoT healthcare apps to protect patient privacy when the patient has a public illness. In order to better comprehend the data security challenges in IoT healthcare, this section presents the relevant literature.

A thorough review of a cutting - edge, IoT - enabled, personalized healthcare system was published in [6]. The lack of affordable, precise smart medical sensors, the heterogeneity of connected wearable devices, the multidimensionality of the data generated, the use of non - standard IoT system architectures, and the high demand for interoperability are just a few of the PHS problems that the researchers highlighted. Key enabling technologies for IoT - enabled PHS were discussed. Successful case studies in healthcare and the main IoT enabled applications were highlighted.

[2] Developed the Medical Home healthcare management system with an emphasis on geriatric patients. Even though the elderly patients were alone, the proposed solution offered complete protection. With the updating of real - time health status, real - time ECG, BP, automatic wheel chair access, medication reminder, glucose level and temperature monitoring, panic switch facility, and automatic ambulance summoning facility were offered.

Because body motions are most closely associated to the sleep - wake cycle, are particularly focused on them while they are sleeping. 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 define the differences in body movement during sleep in normal children and those with ADHD in order to prove the validity of the proposed approach. Body movement data derived by difference image processing were compared with the sleep stages recorded by PSG.

[40] Introduced a brand - new brain - computer interface (BCI) technology intended to treat youngsters with attention deficit hyperactivity disorder. In a series of feedback games, it makes use of the P300 potential to enhance the subjects' attention. To identify the disorder, they used a support vector machine (SVM) that applied temporal and template - based features.

The principles of IoT, as well as its history, various comprehensions, important technology, and applications, are summarized in [24]. [30] Concentrated on the ease of use of IoT devices and how technologies help to increase interoperability amongst IoT devices. The envisioned platform technology enables semantic interoperability of IoT devices as well as semantic - based IoT information services. This service platform can be used for several semantic IoT services, including the collection of unseen information in physical environments by smart devices and the provision of smart living services through participation, sharing, and distribution of open sensing data.

Ontology is used as the foundation of the unified semantic knowledge base for IoT that was proposed in [41]. The majority of the IoT ontologies now in use concentrate on resources, services, and location data. They expanded upon the most recent state - of - the - art ontology to offer contextual data and a set of rules for service delivery. A knowledge base includes various ontologies, including those for resources, places, contexts and domains, policies, and services.

[22] Presented a system for remote health care monitoring, with the neighboring gateway receiving the combined medical data from biomedical sensors for additional processing. Data transmission contributes significantly to transmitter power consumption and an increase in network traffic. The degree of power conservation and decrease in network traffic are the indicators discarded for performance analysis. The suggested rule engine significantly lowers the amount of network traffic and energy used.

In order to monitor patients in smart Intensive Care Units who are in danger, [10] built a generic architecture for a healthcare system. In order to take preventive action, the system advises and warns the doctors and medical assistants in real time about the mutable of vigorous restraints or the mobility of the patients. It also informs them to significant changes in environmental parameters. To store and analyse IoT data, [48] presented a semantic data model. Then, to increase the availability of IoT data resources, a resource - based ubiquitous data accessing technique is created to collect and use IoT data globally. Finally, they demonstrated how to gather, integrate, and interoperate IoT data by presenting an IoT - based system for emergency medical services. [11] Presented IoT architecture for individuals with disabilities that is expected to describe, find further acceptable IoT technologies, and include international standards throughout its design. They focus in particular on the IoT's potential for empowering people with impairments. They finally took into account two use cases that were previously implemented for this demographic. For the early diagnosis of heart problems, [23] presented an IoT architecture with a machine learning algorithm. It uses three - tier architecture to gather sensor data from wearables, store it in the cloud, and create a regression - based model for heart disease prediction. For cloud storage and data analytics, this proposed system is constructed utilizing Apache HBase and Apache Mahout. The results of this study allow for the comprehensive early detection of cardiac problems by patients.

[33] Created for tracking a patient who has arthritis and making an early diagnosis. Three levels make up the proposed design framework, with the first level gathering data from sensors. The data is kept in the cloud at the second level. The third level, which incorporates data on edema and uric acid, is utilized to optimize the information gathered (UA). Putting this suggested approach into practice using Openstack and Apache Redshift. [17] Created and plotted the sensor devices in the context of a typical home, using the living room and other rooms as the patients' regular living spaces. This experiment does not process real - time data, and the procedure is expensive. To lower the cost of the total procedure, the method's architecture can be taken into account and a sensor employed in place of a camera.

The Ant Colony Optimization (ACO), decision tree, and fuzzy rules are combined to create the Temporal Fuzzy Ant Miner Tree (TFAMT) classifier, which is used to categorize medical records in [5]. With regard to the prevalence of age - related illnesses and prescription requirements, this study is used to assist the elderly. Real - time data is gathered from sophisticated sensors as part of the Internet of Things, and health issues are found by examining behavioural and physical trends in houses.

A limited amount of study has been done on monitoring and assisting older individuals using IoT devices [17, 42, 47]. The socializing platform's senior monitoring services are one of its modules, and they may be efficiently watched over using IoT devices. Elderly persons frequently experience falls, which can be fatal if they last a long time. A fall detection algorithm was suggested to detect the persons who fall on the designated region in order to avoid this unclear situation. RFID data and location identification information are present in the designated area. Determine the seniors' whereabouts in the designated area based on the information. These studies enable elderly people to remain in their own homes, where they can feel secure and at ease. They also efficiently monitor them for medical needs and warn hospitals and family members in the event of an emergency.

3. Conclusion

There is a wide range of analysis on academic and commercial books on routing in health care systems using IoT. To comprehend the concerns and problems in directing the healthcare IoT environments, each study is examined. According to the literature, the system lifetime can always be directly impacted by the adoption of effective routing for reducing packet loss rate and enhancing reliability in healthcare. With the aid of the literature, it is possible to state that security and dependability are the two main issues in IoT - based healthcare systems. Choose an ideal reliable route and a backup reliable route for transferring packets in order to achieve reliability.

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