International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-61, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

A Study on Secure Wireless Mobile Data Exchange System in Healthcare Using RFID (Radio-Frequency Identification)

Dr. Elkhatim Abuelysar Elmobarak[1], Zakareia A. Aljedania[2]
[1,2] Department of Computer Science and Engineering, College of Computer Science and Information Technology, Albaha University, Saudi Arabia

ABSTRACT: IoT provides a unified framework for coordinating the use of diverse real-world and digitally- enhanced healthcare assets. Telemedicine is appealing in poor countries because of a lack of access to healthcare services, an aging population with chronic diseases, rising healthcare expenditures, and a need to monitor patients remotely. The Internet of Things can provide individualized health services that enhance people's quality of life while also reducing the burden on public health infrastructure. Therefore, the purpose of this work is to catalog, compare, and categorize previous research into Healthcare IoT (HIoT) systems. In order to better understand the backdrop, we looked at research articles on RFID-based Secure Wireless mobile data exchange systems in healthcare. There was also discussion of other crucial issues including security and interoperability. At the conclusion of this report, we briefly discuss the main advantages and disadvantages of each study. Lastly, there is a dearth of research into the security and interoperability concerns of IoT design in healthcare. Important outcomes of IoT in healthcare include improved information sharing, shorter hospital stays, and lower overall healthcare expenses. IoT in healthcare faced major obstacles due to concerns over patient privacy and data security.

KEY WORDS: Internet of things (IoT), Healthcare, e-health, Radio Frequency Identification (RFID)

1. INTRODUCTION

IoT is a global network of physical objects, intelligent objects, and appliances that enables data collection and exchange between these things via actuators, RFID tags, and intelligent objects. By 2030, there will be more than 60 billion intelligent Internet of Things devices in use, according to the most recent reports [1].

The security features of these devices also grow at the same rate as the number of devices. IoT technology are widely used and integrated into a variety of healthcare services, increasing medical amenities and enabling people to live longer, healthier lives.

The Telecare Medical Information System (TMIS) has considerably improved or replaced out- of-date medical services by allowing patients to access the hospital information system online and obtain doctor telemedicine services. These arrangements save medical expenditures and handling time while boosting patient and physician confidence in the treatment plan [2]–[4]. However, the TMIS database system houses a substantial amount of private data. Numerous negative effects would result from malicious access to or disclosure of the medical data kept in the database. Therefore, the TMIS-based healthcare system's storage, transmission, and accuracy of information are crucial components. The loss of data and the failure of the data node are crucial risks that must be protected against [5]. The TMIS-RFID system's design enables it to verify the visitor's identification and authenticate it. Numerous safe data transmission protocols are developed in literature to ensure WSN and IoT are secure. The improvements in health and IoT enable highly secure sending of data or contact between the sick person and clinicians in remote locations. With these developments, doctors can use embedded and smart gadgets to continuously check on their patients' health. These gadgets are worn by disease patients who are impacted by them. The conditions of the patient, including their heartbeat, respiration, and many others, are sensed and analyzed by these devices. The information is then transformed by the use of wireless communication. Private patient data is kept and delivered to the server throughout this data sharing, which is done by the use of an open route [2], [6].

As a result of the invention, RFID is widely used and many applications domains prefer it, particularly for object identification and wireless information exchange. RFID and IoT integration are more pervasive than ever, and both technologies are equally supportive of one another [3] [7]. Wireless Sensor Networks (WSNs) often contain a large number of micro nodes in order to collect environmental data from the field. RFID protects private medical data and verifies user identity using smart cards and other smart devices. RFID networks improve monitoring, identification, validation, and alert creation etc. RFID tags are employed in this

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-61, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

process to track things as they are shipped, delivered, and used inside the countries of the customers. These days, optical barcodes with autonomous data reading capabilities are also employed for object identification in the real world. However, RFID tags are more cost- effective than bar codes.

Rarely has a review been conducted to identify, categorize, and evaluate the current remote patient monitoring approaches. The increased interest in IoT in healthcare makes it crucial to look at a study plan for a Secure Wireless mobile data exchange systems in healthcare that use RFID. This research is being conducted with the aim of identifying, categorizing, and evaluating the current remote patient monitoring approaches that use RFID. This can be achieved by providing insight into current RFID adoption in the healthcare sector and to review existing RFID technology literature. Also by looking into the problems, obstacles, and issues that the healthcare industry faces when implementing RFID in their organizations.

The remaining work are arranged as follows: Section 2 provides background, while Section 3 covers the reviews and surveys that are most pertinent to the topic at hand: Secure Wireless mobile data exchange systems employing Radio Frequency Identification (RFID) in the healthcare sector. Section 4 details the procedures used in the study. Section 5 discusses the State of art of IOT in healthcare. Both existing issues and future trends are discussed in Section 6 while Section 7 provides a conclusion of the work.

2. BACKGROUND

This section provides a quick explanation of what IoT is and how it relates to healthcare. To begin, the fundamentals of the IoT in the healthcare sector are laid out. Then, the Healthcare IoT (HIoT) architecture is outlined, which consists of several layers. Important terms in this field are finally defined.

2.1. Healthcare

Due to the present global condition, the transmission of the pandemic and contagious diseases like coronavirus, and some factors like cost, distance, and confinement at this crucial time, it can be hard or even impossible for some people to get to medical centers [12] [13]. This is particularly true for the old and disabled, since majority of them have a minimum of one persistent health problem. Long-term care and remote medical monitoring required practical, all-encompassing computer-aided technologies to meet patient needs while reducing budgetary strain [14] [15]. By analyzing big data and integrating many IoT devices to collect real-time physiological data from patients, IoT has revolutionised the health care system. The major objective is to offer people cutting-edge medical services including ongoing illness monitoring and early disease identification. In fact, the IoT may support the healthcare sector in situations like remote clinical monitoring, supported living, illness management, and preventative care. The integration of IoT and healthcare systems has made it possible to manage healthcare operations intelligently, engage in self-care, detect certain events, such as seizures and falls to help with Parkinson's gait disruption, stroke rehabilitation, and decrease medication and human error. However, there are still additional obstacles to overcome before effective and safe healthcare apps can be developed, including those related to self-improvement, self-learning, hardware systems (such as wearables and implantable sensors), privacy, security, and standardization. To safeguard data from attacks or threats, there are many security protocols available today, such as authentication, encryption, public-key cryptosystems, k-anonymity, etc [16] [17].

2.2. Application area of IoT in healthcare

IoT technology will be heavily utilized in the healthcare sector in the upcoming years [18]. Since the healthcare industry is always looking for new ways to provide services, reduce expenses, and improve the quality of care, it will depend more and more on IoT technology [19]. Through the use of these technologies, patients are given the ability to practice self-care, which improves self-management and the efficiency of healthcare services. Additionally, IoT- based devices can be utilized to remotely monitor patients who require ongoing care's physiological status [18] . Recently, the convergence of multiple IoT designs has made it possible to construct smart healthcare systems [20]. IoT-based solutions may be able to help build a system that connects different kinds of objects so that doctors can get a full picture of a patient's health. The primary IoT applications for healthcare are listed in this section.

2.2.1. Home healthcare

Based on a report by the World Health Organization on aging and disability, life expectancy has gone up and most people in every country will live past age 60 [21]. Older people have higher rates of hospitalization, chronic diseases, and disabilities [14]. Every aspect of a patient's life has been touched by the technological revolution, including telemedicine, medication administration, vital sign monitoring, and crisis management in an emergency [18].

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-61, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

One of the promising responses to the problems caused by population aging is IoT-based home healthcare [22]. Two social phenomena that will significantly alter people's lives in the coming years are the Internet of Things (IoT) revolution and the aging of the population [23]. Home monitoring, which makes use of a variety of sensors to identify human behavior, is one of the greatest applications of Wireless Sensor Networks (WSN) [24]. Additionally, technological advances and "smart" items like near-field communication (NFC), RFID, and video-based technologies enable efficient communication between patients, objects, and the objects themselves as well as simplify telemonitoring procedures in home healthcare [18].

2.2.2. Mobile Health and Electronic Health

The proliferation of communication devices like smartphones and the incorporation of various types of sensors into these devices demonstrates the expansion of IoT technology. Software programs capture physiological data from the human body using a variety of wearable sensors. These signals are then safely transmitted to medical facilities. Depending on the situation, signals in the form of brief messages may warn medical staff of medical emergency facilities and assist them in taking the necessary actions [25] [26]. The Internet of Things (IoT) has made it possible for the next generation of mobile health solutions to provide care in a more individualized manner. To put it another way, this technology aims to define more efficient patient-tailored therapy methods and cutting-edge patient and physician communications tactics [27]. The likelihood that healthcare quality will improve is increased by quick access to medical information, which also raises patient satisfaction and enables quick intervention. How healthcare is delivered and pertinent data are acquired will also undergo fundamental change as a result of the growth of e-health and self-management of medical problems [28]. For a variety of telehealth services, such as telemonitoring, geriatric patient supervision, teleconsultations, and robotically assisted surgery, medical devices are connected to the internet in the e-health sector [18].

2.2.3. Hospital Management

Responsibilities in hospital administration have been specified, including managing emergency circumstances, creating a comprehensive plan for patient education, preventing hospital infections, and logistical systems [18]. Sensors, ZigBee, RFID, and other IoT-based technologies can provide helpful solutions to overcome obstacles in hospital logistic management. By judiciously connecting people, processes, and data, this revolution can improve supply chain management in hospitals. For instance, IoT technologies can support the vaccine distribution system technically and have an impact on how vaccine supply chain executives obtain the data they require to enhance their offerings [29]. In addition, thorough planning for post-discharge care is crucial in hospital management. The whole movement of patients from admission to healthcare facilities till discharge depends heavily on thoughtful planning and the establishment of an appropriate decision-making framework. IoT technologies offer adequate, ongoing, and efficient patient telemonitoring solutions to address this dilemma [18]. [30] presented a system for accurate identification of patients and their matching medication based on RFID for IoT application in hospital administration. This model dramatically reduces medication and human error. IoT technology can also be used for post- discharge planning. In a feasibility study for remote patient monitoring following colorectal surgery, Bragg et al. [31] presented their findings. These technologies offer appropriate responses and may aid in the early detection and management of post-discharge problems.

2.3. IoT Technologies

The whole IoT vision is being shaped in a significant way by smart devices. In reality, continual advancements of IoT in healthcare over the next several years will be guaranteed because to aspects like low cost, shrinking size, and lower energy consumption rates. These qualities make this technology advancement potentially fundamentally revolutionize healthcare operations [68]. The ensuing subsections provide a quick overview of these technologies.

2.3.1. RFID and NFC

The foundation for the long-term expansion of the Internet of Things is perception and identification technologies. It is in charge of gathering environmental data and events, realizing awareness, recognizing the informational environment outside of oneself, and resolving the information access issue [32]. It is retrievable and unambiguously identifiable when a Unique Identifier (UID) is assigned to a related entity. Every resource in the healthcare ecosystem, including a hospital, an emergency room, a rehabilitation clinic, and carers, is linked to a digital UID [33]. A communication method called radio-frequency identification aims to deal with short-range communication. In RFID, signals are received and transmitted using communication between a tag and a reader. Electronic product codes make up the bulk of the data stored on RFID tags used in IoT applications (EPC). The Electronic Product Code is used for unique product identification. These tags allow us to guarantee that every object in the IoT environment has a

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-61, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

unique identity [34].Today, RFID technology is aviable option for IoT because of its distinctive qualities, such as affordable and reliable tags and tracking capabilities [35].

2.3.2. Wireless Sensor Networks (WSN)

A number of sensors are used by wireless sensor networks to track the state of the physical world. This approach relies on three crucial elements: nodes, routers, and a gateway—to gather data from the environment. Wearable and implantable WSN systems fall into these two types. To monitor patients' symptoms, these sensors are often used in home automation and healthcare. WSNs are utilized in disaster management, military operations, animal tracking, and healthcare monitoring systems due to their wide coverage, low installation costs, and real- time data collection. Physiological data must be collected using sensing technology [18]. In healthcare facilities, point-of-care parameters are primarily measured by sensors for uses like medical screening and diagnosis. Biomedical signal capture enables novel sensors with wireless connectivity, opening up new opportunities for continuing patient state monitoring. More people are becoming interested in employing sensors that could check cholesterol levels, detect food allergies, monitor pregnancy, and do electrochemical tests based on deoxyribonucleic acid (DNA). Additionally, judgments about the situations of patients can be made using the data collected by such sensors [36].

3. RESEARCH METHOD

Several disciplines, including computer science, healthcare, and medical informatics, have conducted research on Internet of Things technologies and architectures. As a result, academic articles that have been published are dispersed over many different databases. In order to compile a comprehensive bibliography for a research paper on healthcare IoT designs, we have suggested many widely used electronic resources. We combed through IEEE, Springer, Wiley, Science Direct, Emerald, Google Scholar, PubMed, and Scopus, to name just eight of the many online resources we consulted. RFID, IoT, smart hospital, home healthcare, m-health, remote healthcare monitoring, and their consequences were also used to retrieve relevant studies from the databases. In order to identify the best studies, we read each paper from beginning to end. Papers that were more likely to answer our study questions were selected using inclusion and exclusion criteria. Therefore, we established criteria for including only the most relevant articles in our review. At the end, the information was extracted from the publications. Article titles, publication dates, key concepts, evaluation methods, tools, and environments, as well as positive and negative outcomes were collected for each work.

4. GAPS, IMPLICATIONS FOR FUTURE RESEARCH AND LIMITATIONS

Few studies have focused on healthcare interoperability problems. There is a wide variety of suppliers in the healthcare industry, each offering their own unique products, tools, and protocols. They are under no legal need to comply with standards. There are several interoperability problems due to the constant evolution of protocols and standards. For this reason, when attempting to establish any kind of consensus, it's crucial to take into account a wide range of factors, including device, networking, application, data, and semantic level. There is also no proof of the technical interoperability of the various pieces of software and hardware that were deployed, despite the fact that they use different communication protocols. However, study of semantic interoperability in IoT for healthcare is just getting started. Important health data standards include the read codes, logical observation IDs, and systematized nomenclature of medicine (SNOMED) (LOINC). These interoperability standards were not employed in any of the included studies of healthcare IoT architecture. Technical and semantic interoperability are dependent on one another in the healthcare sector, and the interoperability process itself involves re-engineering work processes to make full use of electronic technologies. Even so, the complexity of standards is increased by the ongoing growth of IoT applications. None of the papers we looked at provided any conclusive data on these fronts. Therefore, extensive research is required. The medical records of a patient can be found in a number of different places. In order to cope with the ever-increasing number and complexity of health data, effective strategies for integrating disparate data sets must be developed. The ability to draw conclusions from these datasets is crucial to the provision of patient-specific treatment. Further, it is common for healthcare interactions and information flows to involve many groups of healthcare professionals spread out over a large geographic area. To properly integrate the Internet of Things, a comprehensive picture of the situation must be provided. However, none of the research we looked at described a data model that might provide such a bird's-eye view. In this light, it is imperative that healthcare institutions implement efficient systems for managing data and identifying and integrating data sources. There is no cost analysis of the new devices introduced in the models in any of the studies included in this systematic review. Given the flexibility of the IoT architecture to accommodate both high- and

low-priced technologies, it is crucial to develop a reliable yet inexpensive method of collecting and storing patient health records. Energy usage evaluation and power management are also uncommon. More research is needed to collect reliable data on how much power healthcare IoT devices use, how long their batteries last, and how they generate their own electricity. Relationships need to be constantly repaired in order for IoT to be used in patient monitoring. The need of such monitoring, especially for patients with chronic disease, has not been stressed in many of the publications included in this review. There are gaps in this study. First, most of the papers were presented at conferences and, as such, did not include specific criteria in their descriptions. Second, certain healthcare IoT research was not found despite a robust search technique.

5. CONCLUSION

Different facets of IoT in healthcare were explored in our research. Concerns about IoT's potential in the healthcare sector and the interoperability of its various parts have been addressed. Research articles on RFID-based Secure Wireless mobile data exchange systems in healthcare were reviewed to glean additional context. Other important topics, including security and interoperability, were also covered. The primary benefits and drawbacks of each study are outlined at the end of this report. Overall, it is intended that the findings of this study would be useful to researchers, policymakers, and healthcare providers working in the field of the Internet of Things in healthcare. Making healthcare more interconnected, networked, and data-driven is important to the future of e-health because of the Internet of Things' disruptive potential. Healthcare planners, managers, and policymakers increasingly rely on information technology infrastructure to increase patients' access to timely, relevant information and empower them to make better decisions about their care. With the use of Internet of Things (IoT) infrastructures, patients can take an active role in improving healthcare and extending their lives through selfmanagement of their health and wellbeing. To properly use these phenomena in healthcare, it is crucial for stakeholders to keep track of this quickly developing technology and to communicate their perspectives, insights, and experiences. This will give them the foundational knowledge they need to move from pilot projects to full-scale rollouts. To be widely used, IoT in healthcare must, however, triumph over a number of obstacles. The key challenges to the general expansion of IoT in the healthcare business are interoperability, standardization, and security concerns. The key element determining the widespread adoption of IoT is whether or not user needs are met. Because Internet of Things (IoT) is a relatively new technology, there is a demand for education regarding its functions and applications. As a result, the system needs to be intuitive and easy to use so that patients can engage in active learning. Potential user participation throughout all stages of system development is one approach to addressing the identified problems. Health policymakers and government administrators will benefit from this research since it will provide them with information on how to best invest in and utilize IoT technologies. In addition, the Internet of Things (IoT) is used as a tool in the fight against hospital readmissions and the promotion of self-management of chronic conditions. Deploying IoT in health has the potential to increase productivity, boost quality of life, help reduce poverty, and eliminate health disparities over time.

REFERENCES

1. B. Chander and K. Gopalakrishnan, ‘A secured and lightweight RFID-tag based authentication protocol with privacy-preserving in Telecare medicine information system’, *Comput. Commun.*, vol. 191, pp. 425–437, Jul. 2022, doi: 10.1016/j.comcom.2022.05.002.
2. S. Chandra, S. Ray, and R. T. Goswami, ‘Big Data Security in Healthcare: Survey on Frameworks and Algorithms’, in *2017 IEEE 7th International Advance Computing Conference (IACC)*, Hyderabad, India, Jan. 2017, pp. 89–94. doi: 10.1109/IACC.2017.0033.
3. A. K. Singh, A. Anand, Z. Lv, H. Ko, and A. Mohan, ‘A Survey on Healthcare Data: A Security Perspective’, *ACM Trans. Multimed. Comput. Commun. Appl.*, vol. 17, no. 2s, p. 59:1-59:26, May 2021, doi: 10.1145/3422816.
4. R. Baashirah and A. Abuzneid, ‘Survey on Prominent RFID Authentication Protocols for Passive Tags’, *Sensors*, vol. 18, no. 10, Art. no. 10, Oct. 2018, doi: 10.3390/s18103584.
5. S. Shukla and S. J. Patel, ‘A novel ECC-based provably secure and privacy-preserving multi- factor authentication protocol for cloud computing’, *Computing*, vol. 104, no. 5, pp. 1173– 1202, May 2022, doi: 10.1007/s00607-021-01041-6.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 02 February 2023
DOI: 10.47191/ijcsrr/V6-i2-61, Impact Factor: 5.995
IJCSRR @ 2023
www.ijcsrr.org

6. P. K. D. Pramanik, G. Pareek, and A. Nayyar, 'Chapter 14 - Security and Privacy in Remote Healthcare: Issues, Solutions, and Standards', in *Telemedicine Technologies*, H. D. Jude and V. E. Balas, Eds. Academic Press, 2019, pp. 201–225. doi: 10.1016/B978-0-12-816948-3.00014-3.
7. K. Abouelmehdi, A. Beni-Hssane, H. Khaloufi, and M. Saadi, 'Big data security and privacy in healthcare: A Review', *Procedia Comput. Sci.*, vol. 113, pp. 73–80, Jan. 2017, doi:
8. 10.1016/j.procs.2017.08.292.
9. K. Ashton, 'That "Internet of Things" Thing', p. 1.
10. M. H. Kashani, 'A systematic review of IoT in healthcare: Applications, techniques, and trends', *J. Netw. Comput. Appl.*, p. 41, 2021.
11. B. Farahani, F. Firouzi, V. Chang, M. Badaroglu, N. Constant, and K. Mankodiya, 'Towards fog- driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare', *Future Gener.*
12. *Comput. Syst.*, vol. 78, pp. 659–676, Jan. 2018, doi: 10.1016/j.future.2017.04.036.
13. M. Sheikh Sofla, M. Haghi Kashani, E. Mahdipour, and R. Faghih Mirzaee, 'Towards effective offloading mechanisms in fog computing', *Multimed. Tools Appl.*, vol. 81, no. 2, pp. 1997–2042, 2022, doi: 10.1007/s11042-021-11423-9.
14. R. P. Singh, M. Javaid, A. Haleem, and R. Suman, 'Internet of things (IoT) applications to fight against COVID-19 pandemic', *Diabetes Metab. Syndr. Clin. Res. Rev.*, vol. 14, no. 4, pp. 521– 524, Jul. 2020, doi: 10.1016/j.dsx.2020.04.041.
15. P. Kaur and M. Sharma, 'A Smart and Promising Neurological Disorder Diagnostic System', in *Intelligent Data Analysis*, John Wiley & Sons, Ltd, 2020, pp. 241–264. doi:
16. 10.1002/9781119544487.ch12.
17. A. Marengoni *et al.*, 'Aging with multimorbidity: A systematic review of the literature', *Ageing Res. Rev.*, vol. 10, no. 4, pp. 430–439, Sep. 2011, doi: 10.1016/j.arr.2011.03.003.
18. M. Nasajpour, S. Pouriyeh, R. M. Parizi, M. Dorodchi, M. Valero, and H. R. Arabnia, 'Internet of Things for Current COVID-19 and Future Pandemics: an Exploratory Study', *J. Healthc. Inform. Res.*, vol. 4, no. 4, pp. 325–364, Dec. 2020, doi: 10.1007/s41666-020-00080-6.

Cite this Article: Dr. Elkhatim Abuelysar Elmobarak, Zakareia A. Aljedania (2023). A Study on Secure Wireless Mobile Data Exchange System in Healthcare Using RFID (Radio-Frequency Identification). International Journal of Current Science Research and Review, 6(2), 1428-1433