

Medical Information System to Improve Quick Access Using Anti-Collision Algorithm

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Abstract. In addition to allowing for real-time monitoring of assets and personnel, Radio Frequency Identification (RFID) technology also facilitates quick, accurate access to patient records for medical providers. Despite optimistic predictions, RFID implementation has lagged significantly. Patient outcomes, operational efficiency, and treatment quality may all be enhanced via the use of RFID technologies in healthcare systems using anti-collision algorithms. The healthcare business is rapidly adopting it as a useful solution since it tackles crucial concerns, including patient safety, asset management, and regulatory compliance. The objectives of improving patient care, increasing operational efficiency, and addressing significant issues within the healthcare system—are congruent with the use of RFID technology in healthcare. The goal is to improve healthcare delivery in terms of efficiency, security, and quality by using RFID capabilities. This research methodology-based literature review examines RFID's potential healthcare uses. The goal is to determine the present possibilities, possible advantages, and hurdles to adoption. According to research, RFID is effective and helpful for asset monitoring and patient identification, as reported by most healthcare practitioners. The high price tag, technical constraints, and patient privacy concerns all work against widespread RFID use in healthcare. Better-built RFID systems are required to boost the adoption and appropriate usage of RFID in healthcare, even though RFID gives healthcare practitioners benefits to enhance clinical practice. The result shows that the Passive tag contains 69% and the active tag contains 31%.

Keywords: Health care, Quick access, Antennas, Medical information systems, Radio Frequency Identification and Anti-collision algorithm

INTRODUCTION

The rapid global spread of COVID-19 was unexpected. The widespread spread of the coronavirus necessitates coordinated efforts from the public and private sectors, as well as educational institutions and charitable groups. It's quite clear that we need technological solutions immediately. In the larger movement toward continuous monitoring and collection of health data, this research is a baby step in the right direction. In this work, we construct networks of intelligent nodes, each of which has a sensor, an RFID tag, and a reduced-function RFID reader. Clusters of intelligent nodes are built on a regular basis [1-2]. The benefits of using RFID technology have been shown. RFID is utilized in a wide variety of operations, from equipment chasing to access panels for cars and people to supply and retail security measures. Optimizing resources, providing excellent customer service, increasing accuracy, and speeding up business and healthcare processes are only a few of RFID's key advantages. RFID may also improve the likelihood of products serving their intended purposes by recognizing relevant information. However, RFID parts require research before they may be used in medical settings. RFID relies on three primary parts: antennas, tags, and readers [3].

Researching these factors illuminates how they function in healthcare settings and how they might be integrated together. Patients' safety is increasingly a major concern in public health across the world, especially for the elderly, who need sophisticated physiological health monitoring systems. In this study, the authors suggest a healthcare monitoring system that makes use of RFID tags and the Internet of Things (IoT). High-frequency body information monitoring is accomplished using RFID dual-band protocols, which are used in approach [4]. Sensors capture and analyze the patient's physiological data to identify them with an RFID tag. Through IoT and RFID technology, individuals of all ages may access their own physiological data. The doctor must be able to access patient health data, and protecting those documents using a signature technique based on a hyperelliptic curve (HEC) is a secondary goal. Medical records for patients of varying durations are also kept secret. The examination demonstrates the optimal healthcare method suggested with various genus curves [5]. There are

several ways in which the IoT may improve patient care. When it comes to IoT and healthcare, RFID is the gold standard. The number of reported instances of the newly discovered coronavirus Disease 2019 (COVID-19) skyrocketed in 2020. Here, IoT-Health facilitates remote and efficient patient access to medical services and offers health monitoring by doctors, physicians, and nurses over the web. Wireless communication across the channel raises security and privacy issues in RFID-based IoTs-health systems [6]. There is significant potential for leaks of personal information, medical records, and other data pertaining to patients. To fix these problems, a secure and dependable RFID authentication protocol based on the Digital Schnorr Cryptosystems for use in IoT-Health applications related to the treatment of COVID-19 patients. The security analysis and performance assessment of proposed protocols show that they incur minimum computing overheads and offer resilience to several common security threats when compared to comparable existing protocols. [7]. The Problem statement is discussed below. The issues related to the simultaneous identification and tracking of several RFID tags inside a healthcare context are the focus of the problem statement for an RFID system with an anti-collision algorithm. Several RFID tags on patients, medical supplies, equipment, etc., may need to be scanned simultaneously in a healthcare context. This can result in collisions when multiple tags reply simultaneously. Since collisions can lead to lost or erroneous readings, finding a way to reduce collisions is essential for precise and effective data collection.

The work contributions are as follows: Patient safety is aided by increased pharmaceutical accuracy, fewer medication mistakes, and improved supply chain visibility. The anti-collision algorithm facilitates the real-time tracking of the condition and movements of patients. Quick reactions to crises prompt treatments and better patient outcomes with efficient real-time monitoring. The anti-collision algorithm tackles issues with data errors resulting from collisions between RFID tags. Increase data integrity and accuracy, guaranteeing that the data gathered from RFID tags is trustworthy and suitable for use in making decisions. All these efforts result in a healthcare system that is more accurate, patient-centered, and efficient. The effective use of an RFID anti-collision algorithm solves problems in the medical field, leading to observable enhancements in asset management, patient care, and overall operational efficiency.

The following section will be a literature survey discussed in section 2. After that, the proposed system is discussed using an Anti-collision algorithm for the healthcare system in section 3. Then, the Results and discussion are discussed for the given dataset to improve the quick health data access in section 4. Finally, the conclusion provides the overall performance of the medical information system and future work.

LITERATURE SURVEY

The public's focus on healthcare after the COVID-19 epidemic has prompted the development of cutting-edge health monitoring tools. In this context, many people are interested in IoT because of the benefits it offers in terms of pervasive connectivity and sensing. RFID is growing as a sensing technology that may lessen the costs and complexity of data collecting, making it a vital part of IoT in its efforts to overcome obstacles in passive communication and identification. As there are several sensors used in health monitor systems that might be combined with RFID for smart sensing and monitoring, it is beneficial to introduce RFID sensor technologies in this area. However, there are difficulties in creating efficient RFID sensors for human health monitors in terms of transmission and sensing because of the peculiarities of the human body [8]. The most significant difficulties in a typical IoT health monitoring applications include the following: RFID sensors are typically attached to the objects being measured in order to perform identifications and parameters sensing; as a result, (1) energy problems, including the efficiency front-end energy harvesting and powers conversions; (2) communications problems, including the great heterogeneity of RFID sensors' basic technology in terms of antennas, integrated circuits functions, sensing element, and data protocol; and (3) performances stability and sensitivity problems. However, in real-world contexts, these might be impacted by the surrounding environment. This study discusses the opportunities and threats that the Internet of Things healthcare sector faces considering recent developments in RFID sensor technology. Also, examine the advanced health monitoring sensors and their potential for usage with RFID and IoT. The path forward for healthcare research and monitoring system development in the future is outlined [9].

Better patient care and safety may be achieved via the widespread use of Radio Frequency Identification (RFID) technology in healthcare systems. However, there are security flaws in these systems that put patients' personal information and credentials at risk. This paper's focus is on improving existing methods by creating more private and secure RFID-based healthcare solutions. To protect patient privacy in domains, offer a lightweight RFID protocol that uses pseudonyms instead of actual IDs to establish encrypted connections between tag and

reader. The proposed protocols have been subjected to extensive testing, and those tests have shown that the protocol is safe against such assaults. This article presents high-level overviews of RFID technology's use in health care systems and compares the obstacles these systems confront to industry standards. The paper then examines the benefits, drawbacks, and alternatives of the currently proposed RFID authentication methods for IoT-based healthcare systems. To solve the problems with anonymity and traceability that plague current solutions, we presented a new protocol. Also, the suggested protocol required less computing power to implement while providing higher levels of security. Suggested lightweight RFID technology also preserved patient privacy by employing pseudonyms rather than genuine IDs, making it resistant to known assaults [10].

RFID and sensor technologies will play a significant role in the next generations of IoT. It is anticipated that advancements in RFID and sensor technology will lead to a rise in IoT applications, particularly in healthcare, as compared to currently available systems. This study provides a concise overview of RFID technology based on IoT. This article critically examines RFID sensors by categorizing them as either near-field or far-field readers. The mechanism of operation of the two classes is then compared. Adopting RFID tag sensors for healthcare applications is examined in this work because RFID sensing through tags equipped with chips is now a sophisticated technical device with a growing presence on the market and in a variety of application scenarios. Several RFID setups based on the IoT are discussed, along with their benefits and drawbacks in the medical field. Furthermore, the best use cases for RFID sensors are summarized using examples. Finally, the most successful machine learning (ML) approaches to RFID antenna design are discussed in detail [11]. The widespread uses of RFID technology in healthcare settings have increased the technology's profile as a useful component of the IoT. RFID identification systems, however, have been under increasing scrutiny due to security and privacy concerns. A concern with existing RFID protocols is that they often rely on a backend server to maintain the specifics of the tagged items, which might be compromised if an attacker were to launch a successful assault on the server. This research presents a security-improved RFID authentication protocol for healthcare environments by using indistinguishability obfuscation, which stops private information from leaking out of the server. Meanwhile, adapt the protocol to work in a cloud setting, where the data from the tags is kept in an off-site location. In the world of RFID authentication systems, protocols are the first to be aware of the use of indistinguishability obfuscation. Protocols are both practical and scalable, and they have been thoroughly examined to meet most of the RFID security requirements [12].

In the aftermath of catastrophes, the difficulties experienced by mainstream healthcare are likely to worsen and become more prevalent. Consequently, there is a pressing need to use technological means to aid healthcare and disaster management in making sound choices among the chaos and quick alterations that characterize crisis circumstances. The purpose of this study is to determine how RFID technology is used in healthcare preparation, response, and recovery operations throughout the disaster management cycle (DMC) [13]. This study used the use of a Delphi panel. A panel of specialists was polled twice using questionnaires to assess the current and future healthcare RFID uses inside DMC. Since collisions can lead to lost or erroneous readings, finding a way to reduce collisions is essential for precise and effective data collection. Collisions might cause data inaccuracies because the integrity of the information gathered is compromised because the RFID reader might not be able to discern between overlapping tag replies. Put systems in place to guarantee precise and trustworthy data collection, especially when there are several RFID tags around [14]. The efficiency and throughput of RFID scanners can be greatly impacted by collisions, which can cause delays in the collection and processing of data. Creating an anti-collision algorithm that optimizes RFID reader performance, reduces latency, and guarantees prompt information retrieval. It is crucial to have the ability to promptly and precisely track the whereabouts of patients and vital resources in emergency scenarios. Collisions may make it more difficult to monitor in real time. Put in place an anti-collision system that facilitates real-time monitoring and guarantees quick emergency reactions without compromising accuracy [15].

PROPOSED SYSTEM

RFID has been found to be used in many different medical settings. Five groups of systems functionalities—tracking, identifications, verifications, sensing, intervention, and warnings and triggers—were identified to determine the most innovative hospital applications. It was necessary to conduct separate analyses for certain studies since they documented multiple uses. The most popular application in healthcare facilities is tracking. In 120-bed acute-care hospitals in Boston, USA, RFID tags were used to track commonly lost medical items like infusion pumps, beds, and wheelchairs; in First Health Moore Regional's Hospitals, North Carolina, USA, RFID-based robots were deployed to track valuable assets; and in Hartford Hospitals, Connecticut, USA, passives RFID

tags were used to track telemetry transmitters. Increased usage of infusion pumps was one of the results of evaluations of infrared/RFID equipment tracking systems at a tertiary care hospital conducted by Reference. Misidentification, a common cause of medical mistakes, may be mitigated with the use of RFID technology. A smart patient bracelet may be used in positive patient identification (PPI) applications to expose data about the patient, such as their names, date of birth, admitting order, insurance information, and surgery sites, when scanned by an RFID reader with an Anti-collision algorithm. The University College Hospitals in Galway, Ireland, has deployed and assessed a patient identification system to improve security for patients. Figure 1 shows the system architecture of the proposed system.

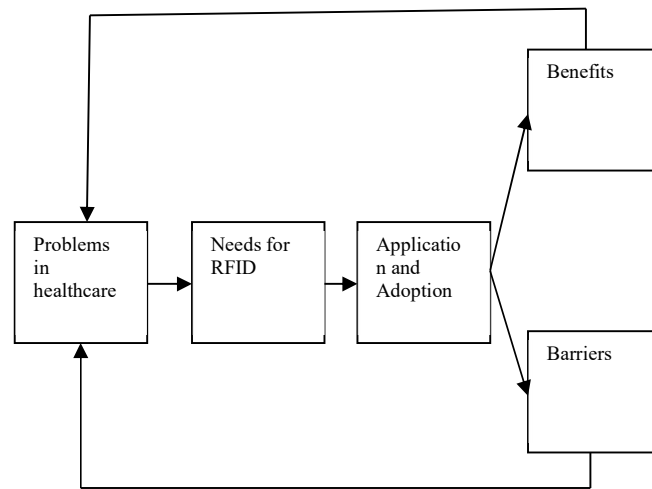


FIGURE 1. System architecture of the proposed system

It may also help nurses save time and effort by facilitating shift swaps. Additional uses for PPI include verifying the identities of newborns and identifying disaster victims (DVI). The Austrian DVI team demonstrated in early 2005 in Thailand that it was feasible to implant the RFID chip into the bodies of victims. The bar code, passive RFID, and active RFID were shown to operate effectively together in pilot research conducted by Beth Israel Deaconess Medical Center for patient identification. Additionally, an RFID tag implanted into a person's molars may be utilized for access control and security purposes. Using the RFID tag's interface capabilities with a sensor, data may be collected and computations performed. RFID has several sensing uses, including chemical and physical sensor integration for logistics data recording and gas sensor integration for food logistics. Other examples include humidity sensing, chemical sensing, and temperature sensing. Temperature sensing in hospitals is very useful for keeping tabs on potentially contaminated blood, which is just one way that chemical sensing may assist cutting-edge medical monitoring and help keep hospitals' blood supplies safe. RFID tags will be used in an unprecedented manner as environmental sensors soon.

Automatic care, enhanced current processes, route guidance, automatic data capture and cooperation, and so on are only some of the benefits of RFID-enabled treatments. To begin, automated care is beneficial for patients at home, such as a self-dispenser to aid patients in taking their medication securely and assisted living systems to support daily tasks for individuals who are visually impaired or have suffered brain injuries. Second, RFID intervention may aid in modifying present practices and automating manual processes in hospitals, for instance, automated determination of patient release time. In addition, RFID makes it feasible to provide comprehensive care in a single visit, beginning with patient registration and continuing through diagnosis, treatment, prescription, and appointment scheduling. Warnings and activators: Patient safety is the primary goal of alerting and trigger applications used in the operating room, the pharmacy, and other clinical settings. In the United States, it is estimated that 1,500 items, mostly sponges, are left within patients' bodies after surgery each year. It was suggested to utilize portable wand scanning equipment to locate sponges within a patient's body, and a comparable experiment was accomplished with a detection accuracy of 100%. Additionally, gauze sponges tagged with passive RFID tags were tested on animals and shown to be effective. The use of RFID in surgery is being researched as a potential means of improving patient safety.

RESULTS AND DISCUSSIONS

Researchers in fields as varied as medical informatics, computer sciences, industrial engineering, electrical engineering, etc., have taken an interest in RFID because of its potential uses. In research facilities and medical clinics, cutting-edge software has been developed and tested. Asset and equipment monitoring is the most popular use case since it addresses an urgent requirement in healthcare settings without raising any ethical or social concerns. Applications that keep tabs on assets may help cut down on theft, maximize the use of resources, and save you money. Several hospital-based pilot programs and preliminary studies corroborated these findings. Patient monitoring and other applications involving human beings are more difficult because of the need to protect individuals' privacy. Because it has the potential to greatly minimize medical mistakes related to the medication-taking procedure, patient drug compliance is a major area of study. Most medication administration systems are still in the prototype stages and have not yet been approved in hospitals, even though they may assist in enhancing patient safety. Hospitals will soon implement patients-related apps to decrease medical mistakes and increase patient safety after social and privacy problems are resolved by better technology and harmonized regulation. An anti-collision algorithm with RFID is used for the technology below, shown in Table 1.

TABLE 1: Comparison of Wireless Technologies

Technology	Data Rate	Latency	Frequencies	Range	Battery life	Network topology	Network node
Bluetooth	0.1–3 Mbps	Up to 3 s	2.4 GHz	1–10 m	5–10 days	Star	7+1
Zigbee/802.15.4	20–250 kbps	30 ms	868 MHz, 915 MHz, 2.4 GHz	1–100 m	Longer than one year	Mesh/Star	Unlimited
Passive RFID	868 kbps	Up to 0.1 s/read	860–960 MHz, 13.5 MHz	0.01–3 m	N/A	Multipoint (1-way)	One tag/one time
Active RFID	10's of Mbps	Less than 1 ms/ read	433 MHz	0.01–100 m	Up to 100 days	Multipoint (2-way)	1000+tags/one time

RFID provides digital infrastructures that modify the method in which care is delivered and has the potential to radically alter the healthcare system. RFID's automated data gathering allows for ubiquitous hospital data collection, strategic patient-centered recording service, and the use of these medical records in collaborative care. When RFID is combined with an existing Hospital Information System (HIS), its full potential becomes apparent. Using the latest medical research may assist in process-integrated decisions. Additionally, it may use patient data extensively for healthcare research and reporting. Researchers have speculated on the potential benefits of RFID and wireless technologies in creating the "smart hospital" of the future. The elderly and other vulnerable populations will profit from this. Patient safety and the reduction of medical mistakes are seen as the primary advantages. In addition, healthcare workers may avoid wasting time during their regular routines by not having to hunt around for necessary medical equipment. In addition, they can concentrate on their work since they have instantaneous access to information on their patients. Money saved, better medical procedures, and happier patients are further bonuses. RFID is predicted to aid in decreasing costs and enhancing patient safety as the healthcare sector invests more money and effort into technology. However, RFID implementation faces special obstacles in the healthcare sector. Exorbitant prices, technical constraints, and privacy concerns are named as major obstacles to RFID implementation. Hope that these guidelines will help those involved in the healthcare industry successfully adopt RFID technology. Before committing to an RFID project, stakeholders should do thorough and transparent study. Figure 2 shows the Healthcare Asset Management market size and forecast for 2030, and Figure 3 shows the US RFID tags market size and forecast for 2030.

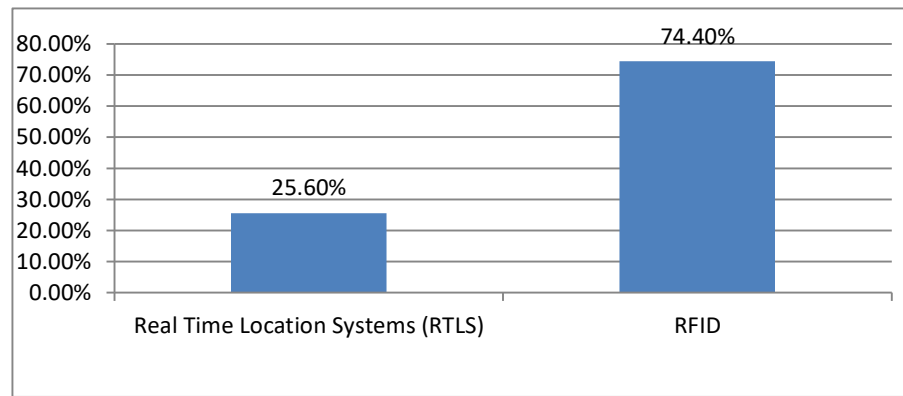


FIGURE 2. Healthcare asset management market size and forecast to 2030

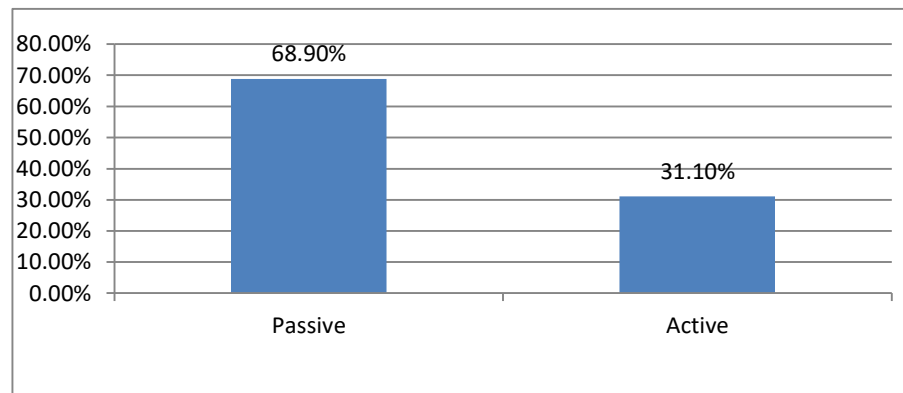


FIGURE 3. US RFID tags market size and forecast to 2030

The primary concern is weighing the overall savings from adopting RFID against the price of deploying the system. There are several factors that may contribute to a more efficient workflow, fewer medical mistakes, and lower costs, all of which add up. It is important to gauge both patient contentment and staff efficiency. Second, it is important to rule out technical issues by testing RFID functioning in healthcare facilities. RFID signals have been found to cause potentially life-threatening interference with medical devices in several investigations. In addition, RFID is not a foolproof technology. Fixes for these issues, including adding middleware to enhance data quality or using several readers to boost data accuracy, may help the system function better. Third, education regarding the advantages and potential privacy risks of RFID technology for patients and medical staff is essential. Patients would be more receptive to wearing RFID tags and less concerned about their privacy after they learn how this technology may boost their security and cut down on medical mistakes.

CONCLUSIONS

The product is a healthcare system that uses RFID technology in conjunction with an anti-collision algorithm to provide patient-centered, accurate, and more effective treatment. The favorable consequences lead to better patient safety, more efficient processes, and increased operational efficacy in healthcare institutions. Future work in healthcare systems using RFID and anti-collision algorithms will include integrating cutting-edge technology, solving new issues, and further refining the system to achieve better performance. Future research on RFID-enabled anti-collision algorithms for healthcare systems will take a multidisciplinary approach, combining data science, user experience design, healthcare administration, and technological innovations. In these areas, researchers, practitioners, and industry partners may expand the potential of RFID technology to improve patient outcomes and healthcare delivery. Since hospitals might differ greatly in terms of location, age, size, etc., technology manufacturers should take proactive measures to tailor RFID systems to hospitals' requirements and make them

compatible with current HIS. Bar codes and the current wireless networks may be integrated with RFID technology to save expenses; RFID systems should be built with the flexibility to add or remove services in the future to accommodate changing needs.

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