

RFID Usage in Health Care Management

Praveen Kumar

Garhwal Technical College, India

Abstract

Artificial intelligence (AI) is helping healthcare providers with tasks like data analysis, medical decision-making, and implementing preventive measures in healthcare. Machine learning is used to accurately interpret and predict patient behaviour and respond appropriately. Robotics is being used to automate high-risk tasks such as surgeries to reduce human errors in healthcare. Predictive analytics are being used to identify and respond to the risks and changes in health before they occur, and IoT solutions are helping to monitor the health of patients in real-time. All of these technologies are helping to improve the quality of care that patients receive. It works through the use of an antenna (transmitter) and receiver to transfer information between two or more points. In the logistics industry, RFID tags are used to automate the tracking, sorting, and filing of documents and packages. In retail, RFID tags are used to track stock levels and reduce shoplifting, and in manufacturing, RFID tags are used to track production, slow down assembly line speeds, and improve supply chain performance. In this paper, we explore the benefits and potential impediments of implementing radio frequency identification (RFID) technology in the health care sector. In healthcare, RFID technology has been used to improve patient tracking, medication administration, and asset management.

Keywords: RFID Technology, Healthcare, IoT, AI, Machine Learning, Robotics

Introduction

Productively utilizing resources in healthcare can involve better use of time and resources, such as physicians' time, ensuring that resources are not wasted on inefficient tasks, and providing the right resources for the right situation or task. For example, investing in technologies such as telehealth and artificial intelligence can help reduce administrative tasks and optimize resources, leading to more quality time spent on treating patients. This can also help to improve overall patient satisfaction and reduce variation in care. Additionally, in some cases, productive utilization of resources may involve delegating tasks where appropriate, such as to extenders or other healthcare personnel. This can also improve quality time spent on patient care.

This involves collecting and organizing data from a variety of sources, such as paper-based records, medical images, vital signs, and patient questionnaires. The data must then be securely stored, accurately tracked, and readily available when needed. Healthcare data handling and integration are necessary to ensure interoperability and safe data exchange. It is also essential for providing evidence-based patient care, managing treatment plans, and improving overall healthcare quality.

A typical patient service requires several tasks, including identifying patients, choosing the right service to offer, reviewing the patient's medical history, and accessing patient data. All these activities require access to different sets of data. Additionally, patient data is also required to be managed and maintained accurately. Healthcare data handling and integration ensures that the data is properly organized and stored. It also ensures interoperability among different systems and applications that are used to store, analyze and access patient data. This data can be used for various activities such as decision support and managing patient communication. Healthcare data handling and integration are therefore essential for the delivery of quality healthcare services.

Conventional methods of data handling involve manual oversight and intervention in the process of identifying and managing patient data. The manual process of data handling is labour intensive, time-consuming and vulnerable to human errors. Such errors can lead to a range of adverse outcomes, including incorrect diagnosis and treatment, compromised patient privacy, and miscommunication between providers and patients. In extreme cases, such errors can result in fatal outcomes. To minimize the risk associated with such errors, healthcare providers should make use of modern data handling and integration solutions. This would ensure the accuracy of the data and its safe storage, enhancing the overall effectiveness and safety of healthcare services.

Radio Frequency Identification (RFID) is a widely utilized technology in the health care sector, which can enable the tracking of medical inventory, the identification of patients and the monitoring of staff. RFID technology uses radio waves to remotely identify, track, and manage items in real time. It facilitates the health sector to overcome the complexity of medical billing, purchasing, and medical records management.

RFID technology has the ability to store data in its memory at different levels, which makes it possible to

uniquely identify various items and to track their location. This helps the healthcare sector improve inventory and asset management, automate timesheets, and reduce paper-based documents. RFID makes it possible for healthcare providers to track the movement of equipment, as well as monitor personnel access, helping reduce the risk of contamination or theft.

In addition, RFID technology can be combined with artificial intelligence (AI) to generate real-time, data-driven insights that can help hospitals provide better, more personalized care. This technology can help healthcare personnel optimize the workflow and streamline overall operations, creating the potential for saving time, improving staff morale, and ultimately improving the quality of care. RFID can provide an end-to-end patient flow from registration to treatment and discharge. Moreover, the data collected and stored by RFID systems can be used to produce operational reports such as patient wait times, bed availability, utilization reporting, flow tracking, and so on. Overall, RFID technology provides a great opportunity for healthcare organizations to improve efficiency, accuracy, and patient outcomes. RFID systems are easy to set up and integrate while ensuring security. Moreover, they bring down operating costs by providing real-time data and eliminating paperwork. With the help of RFID technology, effective patient management is becoming much easier and more efficient.

Literature Review

This section provides a summary of the projects, current literature, publications, stages of implementation of RFID, and implementation-related difficulties. paraphrase it.

In summary, RFID implementation in healthcare can provide countless benefits, such as improved patient safety, operational efficiency and cost savings. The process for implementation requires the identification of a need, planning the project, and providing training and education to staff. There are also several challenges associated with implementation such as issues of data privacy, security, and cost. When correctly implemented, RFID technology can provide an efficient patient flow management system, improved operational report production, and visual analytics analysis [1].

Due to its advantages, RFID is gradually becoming a necessary system adopted in many healthcare settings. The application varies from hospital to hospital and is often dependent on the specific needs and culture of the medical organization [2].

The stages of RFID implementation in healthcare usually involve establishing a need, identifying the requirements, more planning, and also offering training and education to the staff. Challenges related to implementing RFID such as data privacy, security and

cost issues are important to be considered in the implementation of RFID [3].

Thus, with the proper implementation of RFID technology, healthcare organizations can increase efficiency, accuracy, and patient outcomes, as well as reduce costs. In sum, this technology can provide an end-to-end patient flow management system from registration to treatment and discharge, with improved operational reports production and visualizations available for easy analysis [4].

RFID technology enables hospitals to quickly identify and locate patients and equipment, which reduces the likelihood of adverse events and ensures that people and equipment are properly handled [5]. This can also help in reducing operating costs, such as by automating tracking processes that would otherwise be manually performed. By providing data in real-time, RFID systems can provide visibility and understanding of movement patterns, patient locations, and equipment availability, increasing efficiency and quality in patient care. As hospitals continue to explore how to best optimize their workflow processes and maximize patient safety, the use of RFID technology will continue to play an increasingly important role [6].

IoT technology combines sensing, data capturing and analysis along with connectivity & communication capabilities, thus drastically bringing process and efficiency to healthcare sector. The utilization of IoT in healthcare facilitates streamlined medical processes, better and faster patient care & monitoring while reducing the cost of healthcare [7]. A few applications of IoT in healthcare are remote patient monitoring, improved care coordination, medical adherence, inventory and asset management, real time tracking of medical supplies, and healthcare information systems. With the help of advanced technologies, accurate and timely health data can be accessed and diagnosed at remote locations, which enable remote patient monitoring and intensive care. IoT further improvises connected devices and analytics to manage individuals' health data for personalized delivery of healthcare services [8].

RFID tags can be installed on medical supplies, instruments, drugs and devices to accurately track their locations. In addition, IoT enabled wearables such as smartwatches, activity trackers and patches allow individuals to monitor their own health trends and share vital health information with the care team in near real time. With the help of sensors, these technologies can collect and transmit data such as heart rate, respiratory rate and blood pressure. All these data points can be used for health care analysis, further making the process of treatment and diagnosis more efficient [9].

The availability of real time patient data allows the healthcare providers to keep a close eye on the patient's progress, which in turn helps in timely detection of any

change in health conditions. This helps in timely decision making, leading to swift and better treatment. IoT enabled medical records management offers the healthcare providers flexible access to comprehensive longitudinal medical record of a patient, which helps to support enhanced care coordination [10].

The implementation of IoT in healthcare facilities leads to better collaboration between all stakeholders such as payers, providers, medical staffs and patients. It allows faster communication, reduces errors, improved data accuracy and helps in efficient payment systems [11]. IoT devices provide new channels for healthcare marketing that make it easier to connect with the target group and customize services in the blink of an eye. IoT technology provides with opportunities to deliver evidence-based care and personalized services to the patients in optimal time [12].

With RFID technology, every item within the hospital or clinic can be accurately tracked and monitored. This would ensure that all instruments and medical supplies are in good and safe condition when they are being used [13]. RFID tags can help hospitals to reduce their wastage cost significantly, mainly by tracing and eliminating misplacement or loss of supplies[14]. RFID technology can also be used for patient safety and monitoring, as it enables quick detection of any changes in patient's vital signs or health condition and reduces the risk of incorrect medication delivery. Moreover, RFID tags and IoT enabled wearables such as smartwatches, activity trackers and patches allow patients to monitor their health trends and share vital health information with their care team in near real time [15].

Issues with RFID Implementation in Healthcare Organizations

1. Limited range of RFID tag readers: There are distance and environmental restrictions when it comes to the range of RFID tag readers. This can limit the effectiveness of RFID for tracking patient information, medical equipment, and hospital personnel.
2. Costly to implement: RFID systems are relatively expensive to install and maintain, making them cost-prohibitive for some healthcare organizations.
3. Technology Compatibility: For RFID to be effective, healthcare organizations must ensure that the systems being used are interchangeable and compatible with the other technologies being implemented.
4. Security Issues: If the security protocols used to protect patient information and data are not handled correctly, there is a risk that sensitive information could be accessed by unauthorized users.
5. Privacy Concerns: Privacy is always a concern when collecting and sharing personal patient data. Healthcare organizations must be aware of applicable privacy

policies and make sure they are complying with them when using RFID technology [16].

Futuristic Approach

However, its effectiveness can be limited due to certain factors. Some of the important limitations of RFID technology include the limited range of RFID tag readers, cost of implementation, tech compatibility issues, security issues, and privacy concerns [17]. To overcome all these limitations, organizations must ensure that they are using proper protocols and security measures that are compatible with existing technologies being used. Organizations should also consider using encryption and other measures to protect sensitive patient data.

In the future, RFID technology will likely become even more widely used in the healthcare industry. RFID tags can be used to help track vital equipment and medical supplies, helping to ensure that hospitals and clinics always have the resources they need [18]. Additionally, RFID technology could be used to track patient movement through hospitals, reducing the time it takes for a patient to receive care and improving timeliness [19]. Furthermore, RFID could also be used to facilitate communication between patients and healthcare providers, allowing a more streamlined experience for both. In the future, RFID technology could also be used to enhance patient outcomes, allowing healthcare providers to quickly access detailed medical records and quickly implement the most appropriate and effective treatment options [20].

Conclusion

The healthcare industry will be able to benefit from RFID by tracking, managing, and recording patient information and medical history in an efficient and secured way. By having manageable storage for all patient records, health care professionals would be able to access information quickly and accurately resulting in more effective treatments and better patient outcomes. Long-term, RFID can revolutionize the way health care services are provided and drive effective patient health care outcomes, with cost savings benefits over the long-term.

In this paper, we discussed the features of Radio Frequency Identification (RFID) technology and the current challenges that exist in health care when trying to implement it. Through our discussion, we shed light on the uses of RFID for tracking assets and for managing patient data, as well as how these features can be used to improve patient outcomes, reduce costs and enhance patient experience.

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