https://doi.org/ 10.33472/AFJBS.6.9.2024.1071-1078

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

RFID BASED PATIENT APPOINTMENT BOOKING SYSTEM USING ESP8266

[1] Dr. M. Nasiruddin, [2] Ruhma Aqdas Sheikh, [3] Sana Bano Khan, [4]Awes Quarni

[1] Associate Professor, [2] Student , [3] Student [4] Student

[1,2,,3,4] Department of Electronics & Telecommunication

[1,2,3,4] Anjuman College of Engineering and Technology, Nagpur, India

[1] nasiruddin@anjumanengg.edu.in [2] ruhmasheikh2002@gmail.com, [3] sanabanokhan3@gmail.com, [4] Awesk7532@gmail.com

Article History

Volume 6,Issue 9, 2024

Received:28 Mar 2024

Accepted : 30 Apr 2024

doi: 10.33472/AFJBS.6.9.2024.1071-1078

Abstract

Patient-centeredness is becoming more and more important in the healthcare industry. The growing understanding of the patient's involvement in the planning and delivery of health care is essential to this change. The primary focus of the majority of non-urgent health care services is medical appointment scheduling, which is going through significant advancements to encourage patients' active participation. The project outlines a method for creating a online appointment booking system that gives users or patients a simple way to schedule a doctor's appointment. Patients can get appointment as soon as they enter clinic because a RFID card is registered under their name, selecting their preferred appointment times and have better access when they use the Internet as a medium. Patients just need to scan their RFID cards at certain kiosks or checkpoints upon arrival at the institution to immediately alert the system of their presence. Healthcare practices may save time and effort when scheduling and managing appointments with the help of an automated patient appointment system productivity all around. The proposed work uses NodeMCU and RFID to update the contents in real time [19].

Keywords: RFID , ESP8266, Patient appointment booking.

I. Introduction

The healthcare business is expanding quickly due to the growing population, an increase in infectious illnesses, and a rise in degenerative disorders that are chronic. Over the past three decades, the healthcare system in India and throughout the world has experienced incredible expansion. The primary driver of this industry's growth is the growing population and its corresponding need for healthcare services. Health care systems, therefore, have faced difficulties recently in providing prompt, high-quality care to all patients while working with constrained resources. Quality treatment and patient happiness are critical success factors for any healthcare business. In the very competitive healthcare industry of today, consumers have a plethora of alternatives to choose from. Because there are so many possibilities, quality and service are the two most important factors that affect the decision-making process. Healthcare firms must deal with a number of problems if the quality is not fulfilled, including customer retention, value, safety, litigation, and reputation. In evaluating the quality of healthcare, patient satisfaction has become a more crucial factor. It is believed that waiting times play a significant role in determining patient satisfaction. In the current world, patients seeking medical attention must first register their names in the OPD area and then wait for their turn. A human being is managing this entire process. Currently, at OPD, a man waits outside the doctor's cabin and brings patients one at a time inside for examinations and treatments. It is expected that he will do this on a first come, first served basis, but frequently, due to human error or other factors, the first come, first served criteria crash, leaving patients frustrated and possibly dissatisfied with the care they received. IoT links various devices and appliances so they may communicate with one another. One of the main issues facing humanity is health. Healthy people alleviate the strain on medical personnel, hospitals, and other healthcare providers. Maintaining people's health requires an improved healthcare system (Spyropoulos, 2017). According to Hemalatha and Pavani (2017), the Internet of Things (IoT) is becoming increasingly important in the real world due to its expanded sensory capabilities in the healthcare industry and its ability to create new opportunities for the entire environment, which includes patients, doctors, medical devices, pharmaceutical companies, and so forth. Anyone who is unwell and wants to see a doctor for a checkup must go to the hospital and wait for a doctor who is available. The patient must wait in line to receive an appointment. In the event that the doctor cancels an appointment due to an emergency, it may not be possible to inform the patient of the cancellation until after they have visited the hospital. Since mobile communication technology is advancing quickly, it is possible to employ programs on a mobile device to solve these issues and spare patients from annoyance. The suggested project is an intelligent appointment scheduling system that makes it simple for users or patients to make an doctor's appointment. With the help of this web-based platform, users may manage and schedule appointments in accordance with their preferences. The process of manually scheduling visits for patients based on their availability can occasionally become quite tiresome for the compounder or physician. Thus, this project provides an efficient solution by allowing customers to view available booking slots and choose their preferred time and date. Users of this system are able to cancel their reservations at any moment. The doctor must consistently input his daily profits into the system, and at the conclusion of each month, the system will automatically create a report detailing the total money earned [19].

II. Literature Review

The application aims to improve overall healthcare accessibility by minimizing waiting times, optimizing resource allocation, and enhancing communication between patients and healthcare professionals. By leveraging technology to streamline the appointment process, the Doctor Appointment App contributes to a more patient-centric and efficient healthcare ecosystem [1]. Keen arrangement framework for can be totally done through a web based planning programming. It insights concerning the medical clinic and data through a single site and gives a simple method to booking an arrangements as per the system [2] . The clinical arrangements were taken by the clinic and holding up in the line up to our turn. Once in a while it gets disturbance to the development of online arrangement framework immortal and medical care With this shrewd we can get crisis medical checkups. Here individuals can pick specialists and in close by medical clinics.[3]. Various academics have examined RFID-based healthcare systems and patient registration systems. A safe and secure patient management system with an RFID foundation is provided by a smart hospital concept system that is explained in [4]. The system that is suggested in [5] makes use of RFID tags to provide dependable access, facilitates effective patient placement, and identifies patients who are unable to interact. In order to improve everyday emergency healthcare operations, [6] implements an RFID-based smart suite to develop a real-time healthcare monitoring system. It also employs an Android-based smartphone to transmit patient alert signals to healthcare professionals. The electronic healthcare smart card (eHC) for patients and the corresponding health professional card (HPC) for physicians and paramedical workers are introduced under the planned system in [7]. The authors of [8] suggest a smart hospital that makes use of RFID identification technology to enhance patient care, maximize productivity, save operational expenses, assist in preventing major errors, and lessen expensive thefts. The possible languages that may be utilized to formally display the extracted health insurance portability and accountability act privacy policies are evaluated by the authors in [9]. In the field of medical recommendations and protocols, the suggested system in [10] employs and examines the formal procedures. In [11], authors build wireless body sensor networks (WBSNs) and confirm security needs of privacy at various levels of abstraction for WBSNs using a first-order theorem proving approach (Event-B). The proposed system uses Z to eliminate any inaccuracies that remain from the early stages of requirements collecting, as demonstrated in the following examples of specifications for an e-Health system presented in [12]. The system created in [19] offers formal, semi-formal, and simulation-based ways for testing and verifying the healthcare system. These approaches uncover a number of unresolved problems and obstacles in the healthcare environment Through the use of RFID, Healthcare institutions can now schedule and manage appointments with ease thanks to an RFID-based technology. Patients receive RFID-enabled cards or tags with their personal identity information on them when appointment systems are integrated with Radio Frequency identity (RFID) technology

Problem Statement

- The paper-based appointment system often leads to long waiting times and confusion among patients and staff.
- Errors in appointment schedules and patient information are common, causing disruptions and frustration.
- Staff members may find it challenging to access appointment.

III. Methodology

A patient must scan a token on the system after picking it up. An inbuilt RFID scanner in the system keeps an eye out for RFID tags. The number linked to the tag is immediately saved in the controller list when the user scans a token. The list is completed with new entries. For token calling, the list tokens are now handled FIFO. The first token to be called is the one that was initially entered into the system. To signify that the current token session has concluded, the operator, doctor, or receptionist must click a button on the keypad before calling the next token number. After then, the called token number is removed from that list. The system calls the newly entered token scans in the same order that they were inserted, therefore continuously storing fresh token scans in a FIFO list. As a result, the system continues to run the appointments automatically and without error or delay. As a result, the system presents an RFID-based automated token calling system that is completely operational. Patients just need to scan their RFID cards at certain kiosks or checkpoints upon arrival at the institution to immediately alert the system of their presence. Healthcare practices may save time and effort when scheduling and managing appointments with the help of an automated patient appointment system. productivity all around. Additionally, RFID technology may be linked with electronic health records (EHR) to give medical professionals easy access to patient data and appointment scheduling information. streamlining the check-in procedure, this automation lowers wait times and boosts it.

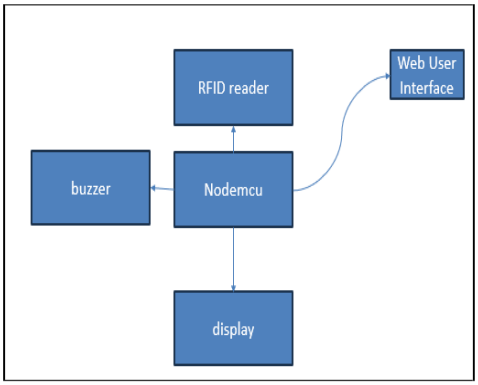

Fig. 1: Block Diagram

By healthcare institutions may streamline the check-in and appointment scheduling procedures, minimize administrative workload, and improve patient satisfaction. Furthermore, the technology may help with real-time patient flow tracking, which will help staff predict and resolve bottlenecks and enhance overall operational performance.

RFID (Radio Frequency Identification) technology is commonly used for identification and tracking purposes. It consists of an RFID reader and RFID tags. When an RFID tag comes within the range of an RFID reader, it transmits data wirelessly via radio frequency signals. The RFID reader captures this data and processes it. When integrating RFID with ESP8266, which is a Wi-Fi enabled microcontroller, the ESP8266 essentially acts as the RFID reader. Here's a basic explanation of how it works:

1. RFID Tags: These are small electronic devices containing a chip and an antenna. Each tag has a unique identifier, which can be read by an RFID reader. RFID tags can be passive (powered by the reader's signal) or active (have their own power source).

2. RFID Reader: In this case, the ESP8266 acts as the RFID reader. It sends out radio frequency signals through its antenna, scanning for RFID tags within its range.

The ESP8266 sends out signals periodically, scanning for RFID tags. When

an RFID tag enters the reader's range, it detects the tag's signal. The RFID tag responds by transmitting its unique identifier back to the ESP8266Data Processing. ESP8266 captures the data transmitted by the RFID tag. It processes this data, which typically involves parsing the unique identifier of the tag. The ESP8266 can then perform various actions based on the received data, such as logging the event, triggering a response, or communicating with other devices over Wi-Fi. Once the ESP8266 receives the RFID tag's data, it can execute programmed actions. This might involve sending a notification, updating a database, or controlling other connected devices. Depending on the application, the ESP8266 may provide feedback to the user or system indicating that the RFID tag has been scanned successfully. Overall, the ESP8266 with RFID functionality can be used in various applications such as access control systems, inventory management, attendance systems, and more, where identifying objects or individuals wirelessly is required.

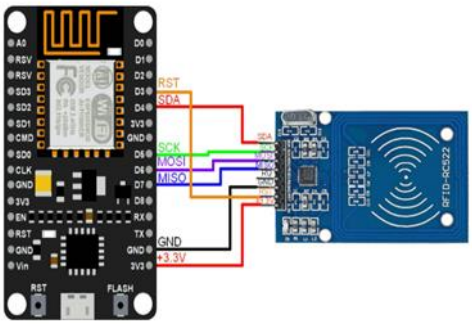

Fig. 2: Schematic Diagram

Patients may schedule appointments online whenever it's convenient for them, doing away with the necessity for phone calls or in-person scheduling, thanks to specialist software or programs. The electronic health records (EHR) system of the practice is usually integrated with the system, facilitating easy access to patient data and scheduling preferences. Automated SMS or email reminders for appointments can lower no-show rates and increase overall appointment adherence. An RFID and NodeMCU based patient appointment system combines RFID technology with Arduino microcontrollers to create an efficient and automated appointment management solution in healthcare facilities. RFID Technology: Each patient is provided with an RFID card or tag embedded with a unique identifier. This RFID tag contains patient information such as name, medical record number, and appointment details. Arduino Microcontroller: Arduino boards serve as the control center of the system. They are programmed to read RFID tags using RFID readers connected to the Arduino. When a patient presents their RFID card/tag, the Arduino reads the unique identifier embedded in the tag. Appointment Database: The Arduino is connected to a database where appointment information is stored. This database contains details such as patient appointments, scheduled times, and relevant medical information.

Appointment Validation: Upon scanning the RFID tag, the Arduino validates the patient's appointment details by cross-referencing the unique identifier with the appointment database. If the appointment is valid, the system proceeds to check-in the patient.

Check-in Process: Once the appointment is confirmed, the system logs the patient's check-in time and updates the appointment status accordingly in the database. This information can be accessed by healthcare staff for real-time monitoring of patient arrivals.

Integration with Other Systems: The Arduino-based system can also be integrated with other healthcare systems such as Electronic Health Records (EHR) or hospital information systems (HIS), allowing for seamless access to patient information and medical history.

Scalability and Customization: The system can be scaled and customized to meet the specific needs of different healthcare facilities. Additional features such as patient self-check-in kiosks, waiting room management, or analytics capabilities can be incorporated based on requirements.

Maintenance and Support: Regular maintenance and updates are essential to ensure the smooth functioning of the system. Healthcare staff should be trained to troubleshoot common issues, and technical support may be required for more complex problems.

IV. Conclusion

Overall, an RFID and NodeMCU patient appointment system offers an efficient and streamlined approach to appointment management in healthcare settings, improving patient experience, reducing administrative burden, and enhancing operational efficiency. n RFID and ESP8266-based patient appointment system leverages RFID technology and the ESP8266 microcontroller to create an efficient and automated appointment management solution in healthcare facilities. Each patient is provided with an RFID card or tag embedded with a unique identifier. This RFID tag contains patient information such as name, medical record number, and appointment details. ESP8266 Microcontroller: The ESP8266 serves as the main controller of the system. It is programmed to interface with RFID readers and communicate with the hospital's local network or the internet. RFID Reader Integration: The ESP8266 is connected to an RFID reader, which is capable of reading the unique identifiers stored on the RFID cards or tags. When a patient presents their RFID card/tag, the ESP8266 reads the unique identified. Recent technological developments have impacted several facets of healthcare with the goal of improving patient care and streamlining procedures. The use of Radio Frequency Identification (RFID) technology into patient appointment systems is one example of such innovation. This article argues that there are several advantages to using RFID-based patient appointment systems over more conventional ones, such as higher accuracy, better patient experience, and increased efficiency. It is clear from a thorough analysis of the advantages and possible disadvantages that implementing RFID technology is a step in the right direction toward improving healthcare delivery. Patient appointment systems with RFID integration provide a smooth and effective way to handle appointments. In contrast to traditional approaches that depend on human input and paper-based documentation, RFID technology streamlines the procedure, diminishing administrative workloads and decreasing mistakes.

References

[1] L. S.Tsay,A.Williamson, and S.Im, "*Framework to build an intelligent RFID system for use in the healthcare industry*," IEEE Conference on Technologies and Applications of Artificial Intelligence, pp.109-12,2012.

[2] M. A.Saghar, M. K, and T.Farooq, "*Application of formal methods for validation and verification of embedded system communication protocol*," In 13th IEEE International BhurbanConference on Applied Sciences and Technology, pp. 385-390, 2016.

[3] Mahmood, N., A.Shah, A.Waqas, Z.Bhatti, A.Abubakar, and A.M. Malik.H, "*RFID based smart hospital management system: A conceptual framework*," IEEE 5th International Conference, InInformation and

Communication Technology for The Muslim World(ICT4M), pp. 1-6, 2014.

[4] Prathiba, S.A., and D.Jain, "Hospital Management System Using RFID," InternationalJournal of Advance Research in Computer Science and Management Studies, 2015.

[5] Chen, C. C., and Y. F.Chang, "*Smart healthcare environment: design with RFIDtechnology and performance evaluation,*" Journal of Medical and Biological Engineering, vol. 33(4), 427-432, 2013.

[6] Mauro, C.,A.Sunyaev, J. M. Leimeister,A.Schweiger, and H.Krcmar, "*A Proposed solution for managing doctor's smart cards in hospitals using a single sign-on central architecture,*" In proceedings of the 41st Annual International IEEE Conference on SystemSciences, pp. 256-256,2008.

[7] Fuhrer, P., and D.Guinard, "*Building a smart hospital using RFID technologies: use cases and implementation,*" Department of Informatics-University of Fribourg, 2006.

[8] Florentino, G. H., C. A. P.de Araújo, H. U.Bezerra, B. D. A .Helio, , M. A. Xavierde, V. S., Souza, and G. B.Brandao, "*Hospital automation system RFID-based:Technology embedded in smart devices (cards, tags and bracelets)*," In 30th IEEE Annual International Conference of the Engineering in Medicine and Biology Society, pp. 1455-1458, 2008.

[9] Kumar, K. M., and R. S.Venkatesan, "*A design approach to smart health monitoring using android mobile devices*," IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), pp. 1740-1744, 2014.

[10] Youjun, X., H.Jialiang, W.Jian, and W.Dongxing, "*Enhance Patient Medication Safety With A RFID-based Authentication Scheme*,"In International Journal of u-and e-Service ,Science and Technology,vol. 7(4), pp. 85-94, 2014.

[11] D.Richard, Chandramouli, K. R., and R. W. Butler, "*Cost effective use of formal methods in verification and validation*," 2002.

[12] Kuhn, D. R., and J. F. Dray, "*Formal specification and verification of control software for cryptographic equipment*," IEEE sixth Annual Computer SecurityApplications Conference, pp. 32-43, 1990.

[13] H. Afzaal, and N. A. Zafar, "*Robot-based forest fire detection and extinguishing model*," In IEEE 2nd International Conference on Robotics and Artificial Intelligence (ICRAI), pp. 112-117, 2016.

[14] A.Gawanmeh, "*An axiomatic model for formal specification requirements of ubiquitous healthcare systems*," IEEE 10th Consumer Communications and Networking Conference (CCNC), pp. 898-902, 2013.

[15] Mohd Helmy Abd Wahab, Norlida Hassan "*A WebBased Appointment System through GSM Network*", Computer Science Education, 2008.

[16] Collins Jr., Donald A. "*Queue management system and method*", United States Patent 8068600.

[17] Alejandro Backer, Timothy Ross Mccune,"*Electronic queuing systems and methods*." WO 2012170958 A1.

[18] Samuel F. Fomundam, Jeffrey W. Herrmann, "*A survey of queuing theory applications in healthcare*" ISR Technical Report 2007-24.

[19] Dr. M. Nasiruddin et.al, *A Review On Different Technologies Used For Appointment Systems And Queing Techniques"*, Industrial

Engineering Journal: ISSN 0970-2555
Volume: 53, Issue 4, April: 2024.