

RFID Token Based Appointment System

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ABSTRACT: Efficient queue and appointment management is essential in service-based environments such as hospitals, banks, and government offices. Traditional token systems often rely on manual processes, which can lead to long waiting times, crowd congestion, and inefficient service management. This paper presents the design and implementation of an RFID-based token appointment calling system aimed at improving queue management and service efficiency.

Token based appointment calling systems are widely used by doctors, canteens, servicing/repair and similar applications. Manual token calling systems have following issues: 1. There may be mistakes in calling tokens by order of arrival 2. There may be favouring /discrimination by the token caller 3. A dedicated person is always needed to keep it operational Well we here design a fully automated token management system that solves all these issues. The system allows for fully automatic token calling system that can operate without any errors. The system makes use of an ESP 32 microcontroller along with an RFID reader for sensing REID token numbers, a keypad for settings, an LED Display and buzzer for notifying and displaying token number along with basic electronics components and PCB board to develop the system. The system uses the LED display and keypad to interact with the user. It provides to options to user on start: 1. Settings Mode 2. Running Mode In the settings mode the user is allow to adjust some settings. This includes the buzzer On/Off settings and buzzer volume settings. If buzzer is turned off it will not beep when next token number is displayed. When turned on the buzzer will beep with the volume set by user. When the system is set in running mode, it begins operation for token system. We hereby use RFID tokens for demonstrations. The tokens have a number written on them and are kept on desk for customers to pick up when they arrive.

I. INTRODUCTION

Efficient management of queues and appointments is an important requirement in many service-based environments such as hospitals, banks, government offices, and customer service centers. Traditional queue management systems commonly rely on manual token distribution or simple number-based display systems. These methods often lead to long waiting times, overcrowding, mismanagement of queues, and inconvenience for users. As the number of visitors increases, it becomes difficult for staff to manage appointments efficiently, which negatively affects service quality and user satisfaction.

With the advancement of automation technologies, smart identification systems have become widely used to improve operational efficiency. Radio Frequency Identification (RFID) technology is one such solution that enables automatic

identification and data capture using wireless communication between RFID tags and readers. RFID systems provide advantages such as fast identification, contactless operation, improved accuracy, and reduced human intervention.

This paper proposes an RFID-based token appointment calling system that aims to automate the process of appointment registration and queue management. In the proposed system, each user is assigned an RFID card or tag containing a unique identification number. When the RFID card is scanned at the registration point, the system automatically records the user's information and assigns a token number. The system then manages the queue digitally and displays the next token number on a display unit, ensuring an organized and efficient calling process.

II. RELATED WORK

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. 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. 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. 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. The system that is suggested in 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, 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. The authors of 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 . In the field of medical recommendations and protocols, the suggested system in employs and examines the formal procedures. In , 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. The system created in 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

III. METHODOLOGY

Existing System:

In existing systems, tokens are often given manually, and staff members call out the token numbers through microphones or displays.

Drawbacks of the existing system:

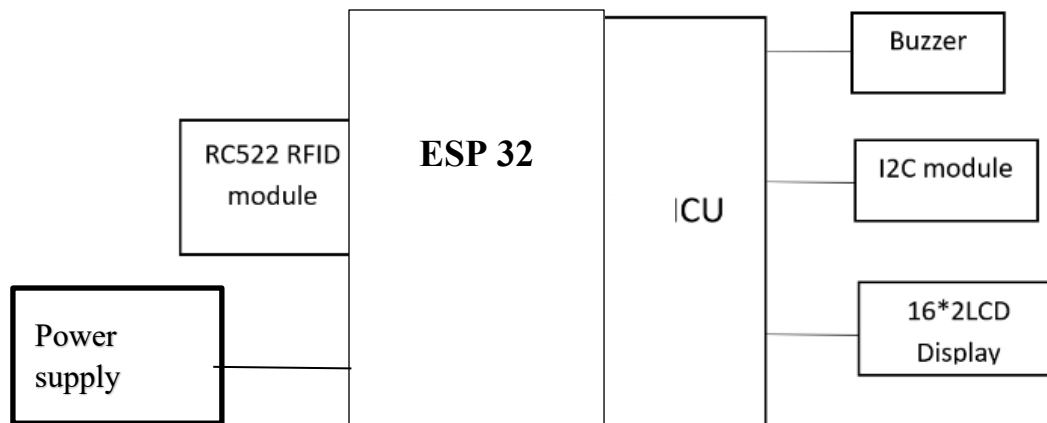
1. Manual operation leads to human error.
2. No proper queue management.
3. Time-consuming process.
4. Confusion among waiting users.
5. Lack of digital record of appointments.

Limitations of existing system

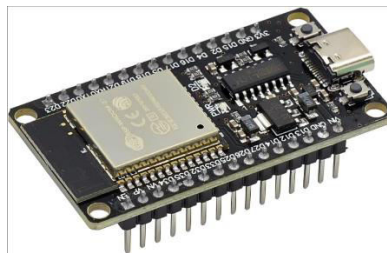
1. No automation is available to manage or display the next token number.
2. Long waiting times occur due to inefficient queue management.
3. There is no digital record of appointments or customer data.
4. Chances of human error such as skipping or repeating token numbers.
5. Lack of real-time updates, so users cannot know their position in the queue.

IV. PROPOSED SYSTEM

Block diagram and hardware description



A. ESP32 Microcontroller



The ESP32 is the central processing unit of the proposed system. It is a low-power, high-performance microcontroller with built-in Wi-Fi and Bluetooth capabilities, making it suitable for Internet of Things (IoT) applications.

The ESP32 operates at 3.3 V logic level and provides multiple communication interfaces such as SPI, I2C, UART, and GPIO, which allows easy integration with peripheral devices like RFID modules and LCD displays.

In this system, the ESP32 receives RFID data from the RC522 module via the SPI communication protocol, processes the tag information, and displays the authentication result on the LCD. Additionally, it controls the buzzer to indicate system status.

B. RC522 RFID Module



The **MFRC522 RFID module** is used for wireless identification of RFID tags or cards. The module operates at a frequency of **13.56 MHz** and communicates with the ESP32 through the **SPI interface**.

When an RFID tag is brought near the reader, the module reads the **unique identifier (UID)** stored in the tag and sends it to the ESP32 for verification. Based on the verification result, the system either grants or denies access.

C. 16×2 LCD Display with I2C Module



A 16×2 LCD display is used to display system messages and user authentication results. To reduce the number of GPIO pins required, an I2C interface module is used with the LCD.

The I2C interface converts the parallel communication of the LCD into serial communication, requiring only two signal lines.

D. Buzzer



A buzzer is used to generate audible alerts during system operation. It indicates successful or unsuccessful RFID authentication.

E. Power Supply



All system components are powered through the ESP32 development board, which provides regulated 3.3 V and 5 V outputs. Proper grounding is maintained across all modules to ensure stable communication and reliable system performance.

F. Connecting Wires (Jumper Wires)



Jumper wires are used to establish electrical connections between the ESP32, RFID module, LCD display, and buzzer on the breadboard. These wires are essential for signal transmission and power distribution.

The following types of jumper wires are used:

- **Male-to-Male (M–M):**
Used for connections between breadboard rows and GPIO pins of the ESP32.
- **Male-to-Female (M–F):**
Used for connecting modules (such as RC522 and I2C LCD) to the breadboard or directly to the ESP32 pins.
- **Female-to-Female (F–F):**
Occasionally used for direct module-to-module connections if required.

G. RFID Card/Tag



The system utilizes a passive RFID card/tag operating at 13.56 MHz, which is compatible with the MFRC522 RFID reader module. Each RFID card contains a unique identification number (UID) that is used for authentication.

The RFID card does not require an external power source; instead, it is energized by the electromagnetic field generated by the RFID reader through inductive coupling. When the card is brought within the reader's range (typically 2–5 cm), it transmits its UID to the reader module.

H. Light Emitting Diode (LED)



A Light Emitting Diode (LED) is used in the system to provide visual indication of the authentication status. LEDs are simple, low-power semiconductor devices that emit light when current flows through them.

Typically, two LEDs can be used:

- **Green LED:** Indicates successful authentication (**Access Granted**)
- **Red LED:** Indicates failed authentication (**Access Denied**)

V. CONCLUSION

In this paper, an ESP32-based RFID authentication system has been successfully designed and implemented. The system integrates the RC522 RFID reader, ESP32 microcontroller, LCD display, LED indicators, and buzzer to provide a reliable and efficient access control mechanism.

The proposed system demonstrates accurate and fast identification of RFID tags by reading and verifying the unique identification number (UID) of each card. The use of visual (LED and LCD) and audible (buzzer) feedback enhances user interaction and improves system usability. Experimental results show that the system operates with high accuracy, low power consumption, and stable performance, making it suitable for real-time applications.

Although the system is effective, it has certain limitations such as limited reading range and basic security features. These limitations can be addressed in future work by incorporating advanced security mechanisms, cloud connectivity, and biometric authentication systems.

Overall, the proposed system provides a cost-effective, scalable, and efficient solution for applications such as smart attendance systems, access control, and security management, and serves as a strong foundation for further development in IoT-based authentication systems.

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