



Development of a Smart Food Service Management System Using RFID and IOT

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The Internet of Things (IoT) is revolutionizing different sectors of the economy through the connection of different items to the web. The connection of smart devices, software, and sensors can enable the automation of canteen services through IoT. The use of this cutting-edge technology can help in the automation of food ordering and delivery in different places such as schools, hospitals, and workplaces. The use of traditional manual systems can be replaced through the integration of IoT and RFID technology to help in the management of large numbers of users and to promote the use of e-cash. The integration of these technologies can help in the management of data and increase transparency to the management. The paper shows how IoT can be used to revolutionize canteen management systems.

I. INTRODUCTION

A canteen management system is another facility offered by different institutions such as colleges, schools, and companies to their students and employees. In such cases where the number of users is high, it is difficult to handle the canteen management manually. The existing system involves cash transactions and record maintenance. The system is time-consuming and results in delay in services. The customers have to pay the exact amount and wait to receive their change. To avoid such problems, the proposed system focuses on increasing efficiency. The system is designed to handle important areas such as canteen management, food items, sales records, and customer information such as students and employees. The system can handle the resources and stock of the canteen through facilities such as adding, updating, and modifying records. The system can also handle sales records in an organized way.

This system can be implemented in various places, such as educational institutions and corporate offices. The users should register with this system to access it.

The structure of this project is divided into various sections. Section II is based on the research papers that were used during this project. Section III is based on the basic concept of this project, in which the block diagram and flowchart of this project are explained. Section IV is based on the methodology and working of this system, in which the working of this system is explained in detail. Section V is based on the working flow



of this system, in which an explanation of how this system works is given. Section VI is based on the results, and finally, Section VII is based on the conclusion of this project, in which how this project can be improved in the future is discussed.

II. LITERATURE SURVEY

The paper titled "Smart Canteen Management System Using RFID" (2020) presents a sophisticated solution for canteen management using RFID technology. In this system, students are given RFID-enabled ID cards. These ID cards can be used to identify students and track their activities. This will help in reducing billing and increase efficiency in the process.

Additionally, in this system, students can use a mobile app for advance ordering and can track their expenses. In terms of management, many useful features are available in this system, such as inventory management, sales tracking, etc. In addition, tests for this system are performed by conducting feasibility analysis and gathering feedback from users, which proves that this system is efficient.

The proposed solution for the management of the canteen reduces the time spent, minimizes errors, and gives a better user experience. The system provides many benefits, including identification, advance order, and tracking, which can be useful for the management of the canteen. The system works efficiently, as demonstrated by the authors with feasibility analysis and user response.

The next project is "Canteen Management System" (2021). The idea behind this project is to develop a simple and effective system for managing day-to-day activities in the canteen. The project provides many features, including menu management, ordering, billing, and tracking. The main idea behind this project is to make the process of the canteen smooth and efficient. The project aims to achieve this by reducing manual work and increasing accuracy.

The project "Canteen Management System" was created in 2022 by Bidesh Chanda, Ganadhish Navelkar, Atish Gracias, Vaibhav Sharma, Valerie Menezes, and Basil Jose. The main aim of this project is to efficiently manage various activities in a canteen in an organized manner. Various features are provided in this project, including managing orders, payments, and stocks. Besides these features, other features are also provided in this project. The main aim of this project is to provide efficiency in canteen operations and enhance user experience. Various other features are also provided in this project, and its main aim is to provide efficiency in canteen operations and enhance user experience.

The "Cashless Canteen Management System" project, presented by M. Ambika, Sandhya S. Nair, Ranjith Kumar, and S. Saravana Kumar in 2020, is a project in which the process of carrying out cashless transactions is explained. The process is such that the user is able to register and conduct the transaction digitally, i.e., without the need to physically use cash. The process is error-free and speeds up the process of the transaction. The idea behind this project is to keep the process simple and efficient in the management of the canteen through the use of software technology.

The project titled "Integrated Cafeteria Management System Using RFID," proposed by Manali Chaudhari, Amol Shelke, and Aayushi Vyawahare, uses RFID technology. In this system, the identities of the users are confirmed through cards based on RFID technology. The system tracks the purchases made by the users automatically. The cost of the items purchased is deducted from the users' accounts. The system has additional features such as registering users and orders. The basic idea behind this project is to reduce the use of cash, avoid errors, and increase efficiency through the use of software and technology.



III. IMPLEMENTATION

The Canteen Management System is a new and efficient technology designed for the automation of the canteen in a college or company. The CMS is helpful in keeping track of the activities related to the food services, like employee/student order management, and is useful in keeping track of the consumption in a daily and monthly manner.

There are a number of companies that provide canteen facilities to their employees for their food requirements. In these cases, the role of the Canteen Management System using RFID technology is significant in order to conduct transparent operations. The CMS is useful in maintaining proper communication between the company and the canteen staff/users, and it is useful in keeping track of the meals consumed in an accurate manner.

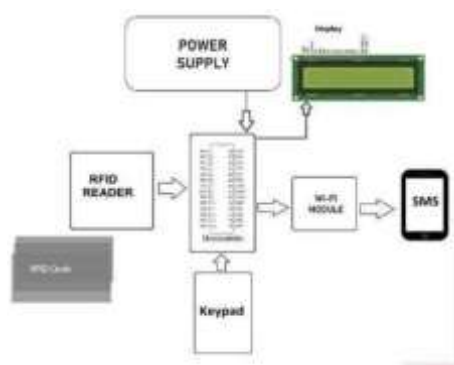


Fig.1 Block Diagram

A. ESP32



The ESP32 is a system-on-chip (SoC) microcontroller that is used for modern embedded system applications. It is popular for its low power consumption and communication features. The microcontroller also supports both Wi-Fi and dual-mode Bluetooth connectivity. This makes it highly suitable for Internet of Things (IoT) technology-based applications.

The ESP32 works on a range of 2.4 to 2.5 GHz for its Wi-Fi frequency. It also adheres to the IEEE 802.11 b/g/n standards. This allows it to easily connect devices to wireless networks and facilitate efficient data communication. The features are integrated into this microcontroller, which makes it cost-effective and efficient for system development.

B. RFID Reader





RFID stands for Radio Frequency Identification. It is a technology that is used for automatic identification of objects. The RFID system is composed of a wireless and non-contact system that makes use of radio frequency electromagnetic waves to transfer information. The RFID system consists of tags that carry information. The information can be read without any contact or line of sight.

RFID system: The RFID system is composed of three important components. The components of the RFID system are tags, antennas, and readers. The tags carry information. The antennas help to transmit information. The readers read the information. The RFID system is used to collect information in a faster and more accurate way.

C. Matrix Keypad



A matrix keypad is used to feed input to the system. The most commonly used matrix keypad is of size 4×4. It means it has 16 keys arranged in 4 rows and 4 columns.

A matrix keypad works on the principle of sending the status of each key to the microcontroller. The matrix keypad is normally of the same shape as a telephone keypad. There are some function keys as well. The matrix keypad can be connected to the microcontroller through an 8-pin connector.

D. LCD Display



LCD stands for Liquid Crystal Display. It is a flat-panel display device. It is commonly used in electronic devices. 16x2 LCD means it can display 16 characters per row and has 2 rows. It uses liquid crystals to display text and other symbols.

These displays are commonly used in electronic devices like mobile phones, TVs, computer monitors, and other electronic instruments. These LCD modules are available in various backlight colors like blue, green, white, yellow-green, amber, and red.



E. *RFID Card*



An RFID-enabled card utilizes radio frequency identification technology. Instead of using a magnetic stripe, the card utilizes radio signals to transfer data wirelessly. It enables the card to interact with the payment terminal without the need to physically touch the card.

The technology enables the user to tap the card or bring it close to the payment terminal. It enables the user to make payments easily, as it is fast, convenient, as well as more secure than the magnetic stripe card.

F. *PCF8574T I2C I/O Extension Board*



The PCF8574T is a dedicated chip that can be used to extend the number of available input/output ports for a microcontroller device, such as Arduino, ESP32, or Raspberry Pi, via the I2C protocol. The chip is used when you need to add more ports than the microcontroller physically provides.

G. *IIC/I2C Serial Interface Adapter Module*



The I2C Serial Interface Adapter is a small device that is intended to make it easier to connect a microcontroller, such as Arduino or ESP8266, to an alphanumeric display. Instead of having to use many different connections to connect the display to the microcontroller, this adapter makes it possible to communicate through the I2C protocol. The I2C protocol only requires a few pins to connect to the display. The display that this device is commonly used with is 16×2 or 20×4 LCD displays.

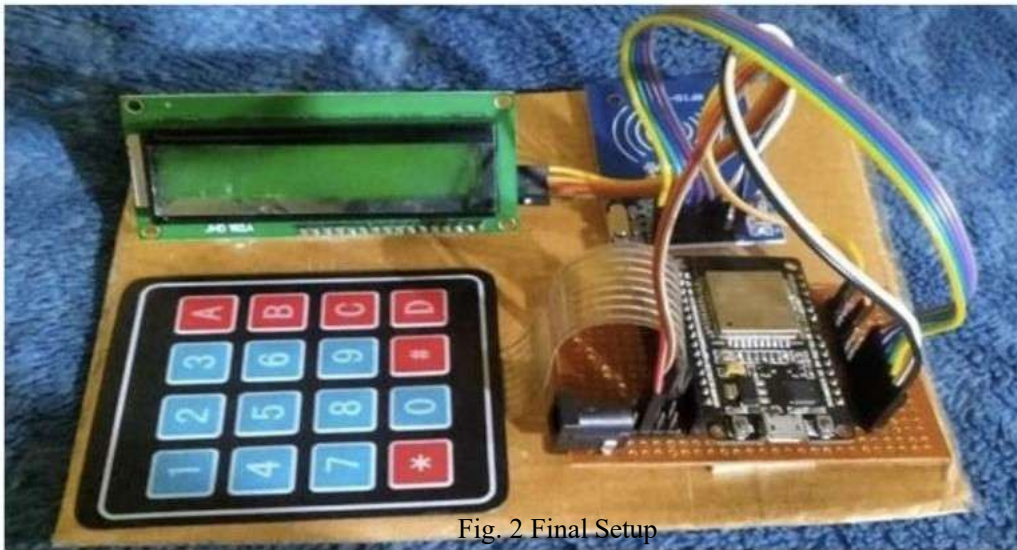


Fig. 2 Final Setup

WORKFLOW

Administrators have to register first to get an account by providing their own unique ID and password. The information is then used to identify and authenticate users when accessing the system.

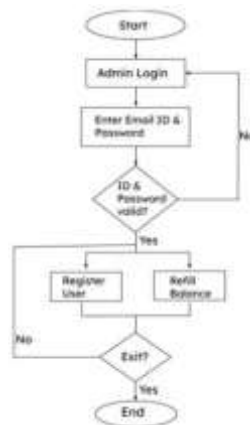


Fig. 3 Flowchart

If the credentials are incorrect, the admin is redirected to the login page. In case the admin forgets their password, they can reset the password and generate a new one to access the system again. Once the credentials are verified correctly, the admin can access the system. From here, they can view the user balance and recharge balance as required.

IV. RESULTS

The admin can view the details of the customers, including the account balance, email ID, unique identification number, and order history. In case any wrong information is available, the admin has the option of updating or modifying the details of the customer.

The users are also notified, and they can check the details of the balance and order history. They can also recharge the amount if required. The above details have been summarized in the following table: Table 1.1.



Student ID	Name	Email ID	RFID Card No.	Mobile No.	Balance	
1	Riya	rlya002@gmail.com	rfid004	8420672598	2000	Edit
2	Tej	teju477@gmail.com	rfid009	7836423789	1500	Edit

Table 1.1 Customer Details

The canteen management system can help reduce the use of paper. The system can help reduce the use of paper because it can store information digitally. The system can help reduce the need to have extra personnel manning the billing counter. The system can also help store past information that can be retrieved later.

V. CONCLUSION

An IoT-based Canteen Management System using RFID technology can be developed for cafeterias, food courts, and canteens to make their daily operations easier. The system can help the administrators of such canteens to efficiently manage the activities of their customers by storing information related to their accounts balance, order history, identification number, and contact information. The use of electronic payment systems can also help to make the management of the canteen easier. The customers can also benefit from this system because they can easily add money to their accounts and can get notifications related to their accounts balance or order history through SMS or email. The use of IoT technology can help to make such service-based businesses more profitable. The challenges faced in traditional canteen systems and the development of this project to make it easier to overcome those challenges is discussed in this project.

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