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The Smart Rationing System Based on RFID

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Abstract: ***Nowadays, ration cards have become essential for every household as they are used for various purposes such as recording family members' details and serving as an address proof. Ration cards enable people to purchase essential commodities like rice, sugar, oil, and kerosene from ration shops. However, the current system has two major drawbacks. Firstly, the weight of the materials provided may be inaccurate due to human errors, and secondly, if customers do not buy the allotted materials by the end of the month, the shopkeepers can sell them to others without informing the government or the customers. To address these issues, an RFID (Radio Frequency Identification) based automated ration system can be implemented, which is similar to the ATM. This proposed system replaces the traditional ration card with a smart card, which can be used to purchase materials from the ration shops. With this system, the manual work involved in the public distribution system can be eliminated, resulting in more accurate and efficient distribution of ration materials.***

Keywords: RFID tags, Rationing, smart card, PIC Controller.

I. INTRODUCTION

Most people obtain essential materials like rice, sugar, oil, and kerosene from ration shops by submitting their ration cards. After submitting the card, the shopkeepers put their signature on it based on the materials issued. The materials are then distributed using a weighing system with the help of humans. However, this system has two significant drawbacks: inaccurate measurement of the materials due to human errors and the possibility of selling unclaimed materials to others without informing the government or the customers.

To address these issues, previous research has proposed automation in ration shops using embedded PLC. However, the previous system lacked the ability to update the government database regarding the stock available and customer details. To overcome these issues, a novel RFID-based automation system for ration shops has been proposed in this research paper.

This automated system can help overcome several challenges that the previous system faced, such as illegal usage, overcrowding, slow processing speed, targeting specific households, bogus cards, hijacking of ration cards, material theft, mixing of products, poor quality of supplies, and charging more than the prescribed rates.

Overall, the proposed system has high social relevance and usefulness as it can help eliminate the manual work involved in the public distribution system and provide more accurate and efficient distribution of ration materials.

Benefits of the Proposed System

- Corruption in the Ration and market sector can be prevented if this system becomes automated
- Cost effective.

- Time saving.
- Helps to maintain the data properly.

II. Basic Principle of RFID

RFID is a type of automatic identification technology that uses radio waves to wirelessly transmit the identity of an object or person in the form of a unique number shown in Fig,.1. RFID technology is used in various applications, including manufacturing, transportation, and logistics.

The primary objective of any RFID system is to carry data in suitable transponders, commonly known as tags, to satisfy particular application needs. The data stored within a tag can provide identification for various objects, such as items in transit, vehicles, animals, or individuals. By including additional data, the system can support specific applications by providing item-specific information or instructions immediately available on reading the tag. For example, the color of paint for a body entering a paint spray area on the production line, the setup instructions for a flexible manufacturing cell, or the manifest to accompany a shipment of goods.

In addition to tags, an RFID system requires a means of reading or interrogating the tags and some means of communicating the data to a host computer or information management system. The system also includes a facility for entering or programming data into the tags, which may be done at the manufacturer's source if required. Antennas are a critical component of RFID systems and are present in both readers and tags, enabling communication between the two.

RFID technology does not require physical contact or line of sight for communication, and data can be read through the human body, clothing, and non-metallic materials, making it a versatile technology for various applications.

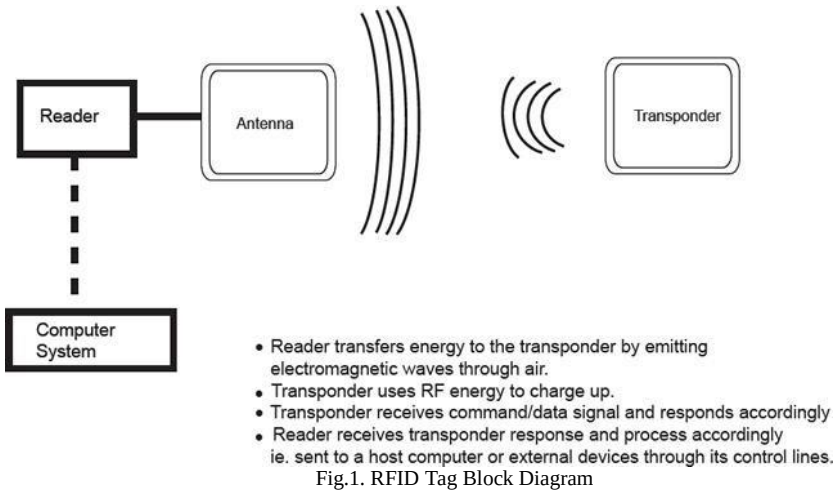

Fig.1. RFID Tag Block Diagram

Fig.2. Different Types of RFID Tags

1.1RFID Tags

There are three types of RFID tags: passive, active, and battery-assisted passive (BAP). Passive tags are cheaper and smaller because they have no battery; instead, they use the radio energy transmitted by the reader. Active tags have an onboard battery and periodically transmit their ID signal. BAP tags have a small battery onboard and are activated when in the presence of an RFID reader. Tags may be read-only or read/write. Read-only tags have a factory-assigned serial number used as a key into a database, while read/write tags allow the system user to write object-specific data into the tag. Field programmable tags may be write-once, read-multiple, while blank tags can be written with an electronic product code by the user. To interrogate the tag, an RFID reader transmits an encoded radio signal. The RFID tag receives the message and responds with its identification and other information, such as a unique tag serial number, stock number, lot or batch number, production date, or other specific information.

However, the tag's lifetime is limited because it cannot function without battery power. Active tags are typically more expensive, often costing $20 or more each. They are physically larger, which may limit their application. Moreover, the long-term maintenance costs for an active RFID tag can be greater than those of a passive tag if the batteries need to be replaced. Battery outages in an active tag can also result in expensive misreads. Fig.3 shows pictures of different RFID tag.

TABLE I: Frequency and its applications

Frequency Band	Characteristics	Typical Application
Low 100-500 kHz	Short to medium read range inexpensive low reading speed	Access control Animal identification inventory control car immobilizer
Intermediate 10-15	Short to medium read range potentially inexpensive medium reading speed	Access control smart card
High 850-950 MHz 2.4-5.8	Long read range High reading Speed line of sight required expensive	Long read range High reading Speed line of sight required expensive

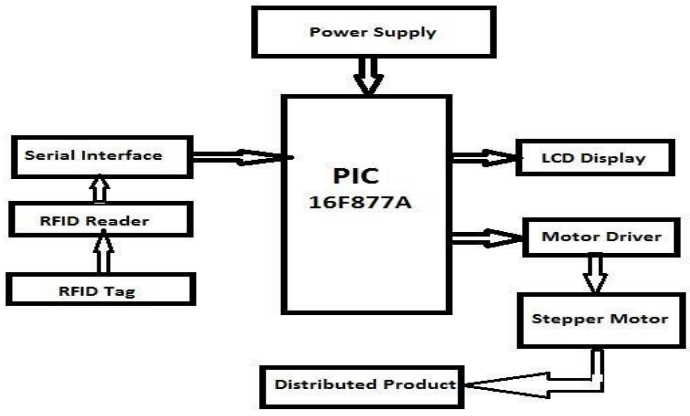

Fig.3 Block diagram of RFID based rationing system

The proposed RFID-based smart rationing system has a significant social relevance and usefulness. It aims to prevent irregularities and corruption in the public distribution system (PDS) by replacing the conventional ration card with a smart card that contains all the user details, including their Aadhaar number for user authentication. The system provides transparency in

the distribution of essential commodities, and there will be direct communication between people and the government block diagram shown in Fig.3.

The system uses RFID technology, which ensures accurate and fast identification of the user and the available stock at the ration shop. The system also has a micro-controller, motor driver, solenoid control circuits, and other essential components that work together to automate the ration shop's operations.

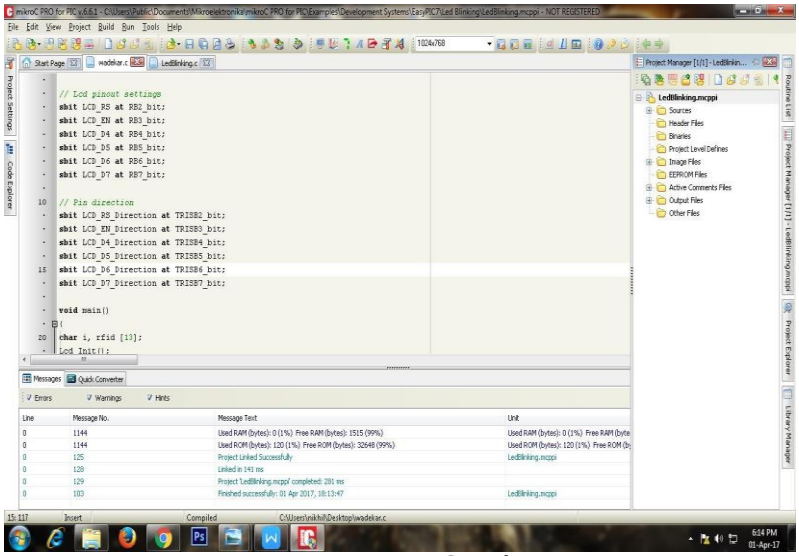

Fig.4 Micro-C simulator Run

The system's usefulness is that it eliminates the need for manual intervention in the distribution process, which reduces the chances of irregularities and corruption. The system automatically updates the government database about the stock available and the customer details, which ensures transparency and accountability in the distribution process.

The proposed RFID-based smart rationing system has immense social relevance and usefulness as it aims to improve the public distribution system's transparency and accountability. It is a step towards ensuring that essential commodities reach the intended beneficiaries, and the system's automation eliminates the chances of corruption and irregularities.

Core Simulation

The core simulation provided by micro-c is a powerful tool for debugging programs using a PC and device simulation drivers. It not only simulates the instruction sets of microcontrollers but also simulates the entire target system, including interrupt, startup code, on-chip peripherals, external signals, and I/O.

The core simulation includes several important functions, including:

- Instruction simulation: This function simulates the exact effect and timing of microcontroller instructions. By simulating the execution of instructions, developers can better understand how the code will behave on the actual hardware.
- Interrupt simulation: This function simulates the cause and effect of system or peripheral interrupts. Developers can use this function to test the behaviour of their code when interrupts are triggered, allowing them to ensure that their code will respond correctly in real-world scenarios.
- Peripheral simulation: This function simulates the effect of on-chip peripherals, including special function registers. This allows developers to test how their code interacts with the peripherals, ensuring that their code is functioning correctly.

- Debugger functions: The debugger functions provided by the core simulation allow developers to expand the command scope of the debugger and create responses to stimulate. This enables developers to debug their code, identify and fix any issues, and ensure that their code is running as expected quickly and efficiently.
- In summary, the core simulation provided by micro-c is a comprehensive and powerful tool for debugging programs, simulating the entire target system and providing a range of useful functions to help developers test and debug their code efficiently. Run for simulation shown in Fig.4

III. ALGORITHM

The algorithm for smart rationing using RFID technology can be summarized as follows:

1. Start the program.
2. Initialize ports.
3. Display "RFID Tag Reader" on the LCD.
4. Wait for an RFID tag to be detected.
5. If an RFID tag is detected, compare its number with the number stored in memory.
6. If the number matches, display the tag number and information on the LCD.
7. Use the motor to distribute the products according to the information stored in memory.
8. If the number does not match, display "Invalid card" on the LCD.
9. Continue the process.

The algorithm essentially waits for an RFID tag to be detected, reads the tag number, compares it with the stored number in memory, and distributes the products accordingly. If the tag number does not match, the system displays an error message. The algorithm can be implemented in a microcontroller or a computer program, using appropriate programming languages and tools.

IV. LIMITATION OF RFID

i. The initial cost of implementing an RFID system can be high, including the cost of purchasing and installing the necessary hardware and software.

ii. The use of RFID technology raises privacy concerns, as it allows for the tracking and monitoring of individuals and their activities.

iii. The technology is still developing, and there may be future compatibility issues between different RFID systems.

iv. The system may be vulnerable to hacking or other security breaches, potentially compromising the sensitive information stored on the RFID tags.

v. The system requires reliable power sources to operate, and power outages or failures can cause disruptions in the system.

vi. The use of RFID technology may require significant changes in existing processes and workflows, which can be difficult and time-consuming to implement.

vii. The system may be subject to errors and inaccuracies, such as misread tags or incorrect data input, which can lead to incorrect rationing and other issues.

viii. The system may not be suitable for use in areas with a high density of people, such as in crowded cities or refugee camps, where it may be difficult to accurately identify and track individuals.

ix. The system may not be easily accessible to people with disabilities or those who are illiterate or unfamiliar with technology.

V. CONCLUSION

In conclusion, while RFID technology has many potential benefits for a smart rationing system, there are also several limitations and challenges that must be addressed for it to be effective. These limitations include the lack of standards, short range, cost, problems with certain materials, potential for tag failure, longer printing and programming times, difficulty reading tags installed in liquids or metal products, interference from nearby devices, weaker signals or interference in certain areas, the possibility of tags not being read, the need for every person to have an RFID tag, high initial implementation costs, privacy concerns, compatibility issues, vulnerability to hacking and security breaches, power requirements, changes in processes and workflows, potential errors and inaccuracies, unsuitability for high-density areas, and accessibility challenges for certain populations. By addressing these limitations and challenges, it may be possible to develop an effective and efficient smart rationing system using RFID technology.

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