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IoT-Enabled Authentic Ration and Material Distribution Systems

Indra Vijay Singh[1,*], Beer Singh [2]

Abstract

A home Ration Certificate is an essential item. The largest retailer system in India is Public Distribution System (PDS). A ration card is provided by the public distribution network, which is run by the state administration. All people have ration cards for purchasing essential consumers material like wheat, rice, kerosene, and oil. The present ration distribution system has many problems such as authentication problems, waste of time in queues, lots of malpractices. The Creation and Implementation of the Project An automated method of distributing goods to verified card holders is suggested by an Internet of Things (IoT) based Authentic Ration Material Distribution system, which also lowers malpractice. The State Government distributes various ration cards, including the yellow, saffron, and white ration cards, based on the family's annual income. India now has the largest distribution network in the world, with 478,000 ration shops spread over the many towns, villages, cities, and other areas of the country. The Department of Food and Supplies distributes ration cards to residents based on their financial situation. We are putting in place an RFID smart card that has all the user's information, including their "AADHAR" number, which is needed for authentication. Lastly, a database is used to keep track of stock details, which are then updated on a regular basis and posted on the government site. Additionally, the database keeps track of transaction details.

Keywords: Public Distribution System (PDS), Microcontroller, RFID Tags, DC Motor and Motor Driver, IoT.

INTRODUCTION

The biggest retail service in India is the public supply system (PDS). During the Second World War, in 1944, PDS is introduced in India. Both the federal and state governments oversee PDS. Depending on the annual income of the family, the State Government gives different ration cards, such as the yellow, saffron, and white ration cards. With 478,000 ration outlets operating throughout the nation's numerous towns, villages, cities, and other areas, India currently boasts the greatest distribution network in the world. Ration cards are distributed to citizens by the Department of Food and Supplies according to their financial circumstances [6, 8].

***Author for Correspondence**
Indra Vijay Singh
E-mail: vijaysinghmgm35@gmail.com

[1,2]Assistant Professor, Department of Electronics and Telecommunication Engineering, SR Group of Institutions, Lucknow, India

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Essentially, there are two kinds of cards: First, below-the-line (BPL) cards second cards with the above poverty line (APL). The determination of the poverty lines is contingent upon the yearly earnings of that specific household. The colour of the ration card is determined by the family income. Ration cards come in three distinct colours: orange (AAY), white (APL), and navy blue (BPL). According to PDS guidelines, a card holder who is below the poverty line (BPL) should receive 35 kg of food grain, and a card holder who is above the poverty line should receive 15 kg. Half a unit of ration

materials is provided for children under the age of twelve, and a full unit is provided for those beyond the age of twelve.

In stores with reasonable prices People nowadays are dealing with a plethora of issues, including improper material distribution, time wastage, and corruption. Here, we suggested automating the dispensing of all materials and maintaining accurate stock records to solve the issue. The Figure 1 shows the top 5 poorest states in India where over 40% of people are Below Poverty Line (BPL):

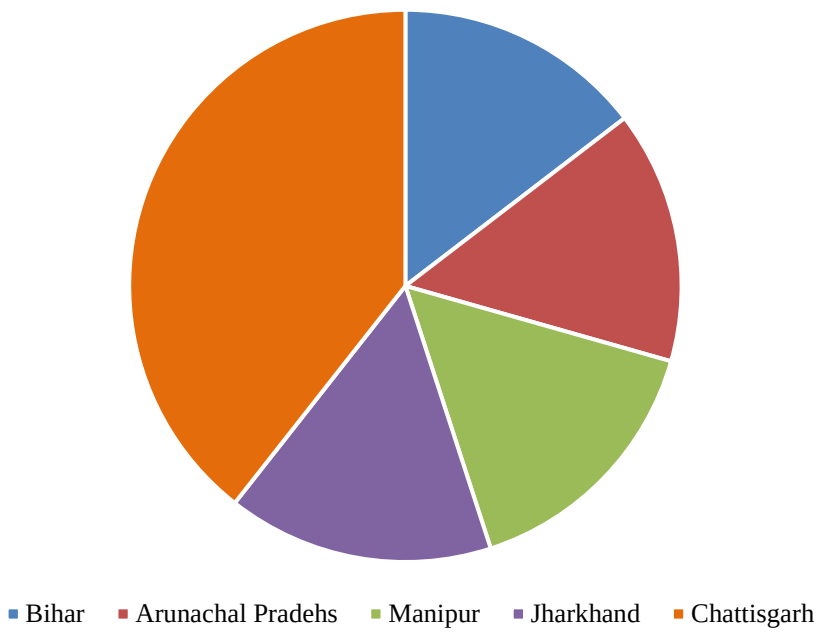

Figure 1. Top 5 States in BPL card in India.

1. *Chhattisgarh:* Chhattisgarh is one of the poorest states in India. In Chhattisgarh, almost one-third of the population is impoverished. The poverty rate in the state of Chhattisgarh is 93%.
2. *Jharkhand:* Jharkhand is the second poorest state in India. This state has a poverty rate of about 36.96%.
3. *Manipur:* Manipur is the 3rd poorest state inIndia. Poverty in Manipur is around 36.89%. The social and economic infrastructure of Manipur is very lowest in India.
4. *Arunachal Pradesh:* Arunachal Pradesh is the 4th poorest state in India. The percentage of people living in poverty in the state at large is 34.67%.
5. *Bihar:* Bihar is India's fifth poorest region. Half of the population of Bihar is living below the poverty line. This state has a poverty rate of about 33.74% [7].

We found several Below Poverty line problems in India. The Public Distribution System is providing food grains to these Below Poverty Line peoples at affordable prices. But this system has many drawbacks such as malpractices, authentication problem, black marketing, over charges, time consuming, corruption and so on. We are putting our system into practice to get around these problems. The objective of this system is to create an automated and user-friendly system that will safeguard the public interest by combating malpractices. The main purpose of this system is to implement an automatic rationing system which replaces the Ration Card with RFID card. It will distribute the product and lastly send the transaction directly to the government. This is reducing the malpractices. Any time customer can buy the retail goods. In the traditional approach, the consumer informs the employee in charge of the ration shop how much and what kind of goods they require. After measuring the product, the employee hands it to the client. Today's ration distribution techniques have several drawbacks, such as incorrect, low quality, and theft of ration substance in ration shops.

LITERATURE REVIEW

Pachangane et al. [1] created an embedded system project where the user enters the quantity needed, and the system will gather that quantity automatically and store it in a container. A smart public distribution system called the E-Rationing System presented by Ashish et al. [2] offered an automated means of distributing goods to cardholders who have been authenticated by fingerprint matching. Additionally, a database holds information about the transactions that have been made. Users can view stock availability in their account by placing their finger on the fingerprint sensor.An RFID & GSM enabled cashless automated rationining system by Valarmathy et al. [3] can be utilised to issue a ration to provide the most accurate, efficient, & automatic way to distribute ration materials. In order to attain PDS transparency, the web-based "public portal" design was suggested by Srinivas et al. [4]. The Central Government oversees acquiring, storing, and transporting grains from purchasing locations to central warehouses, according to Vyas (2005) in [5]. Transporting these goods from the central warehouses and distributing them to customers via the FPS network is the duty of the state and union territory administrations. It is noted that the PDS subsidy is contingent upon the volume of procurement and offtake under the PDS and other programmes. Pedwal et al. [6] suggests replacing ration cards with an automatic ration materials circulation system based on RFID (radio frequency identification) and GSM (global system for mobile) technological advances.

Necessities for the System

The delivery of necessities to a large population is known as a ration distribution system. It is carried out by the state. Everybody has a ration card, which they can use to purchase different goods from the ration shops, such as sugar, rice, oil, kerosene, etc. The government provides essential household goods subsidies to impoverished individuals in developing nations like India, enabling them to meet their necessities. Quantity is measured laboriously in Ration shops due to the current public distribution mechanism. It is also necessary to maintain transaction records for this existing system. One of the more contentious aspects of illicit smuggling of products and corruption is the public distribution system. All of these occur because there are no specialised high-tech tools to automate the human labour involved in any of the ration shop jobs. Ration shopkeepers provide consumption stuff to ration card holders during the first week of each month. Once the items are received from the ration shop, the ration card must be submitted first. Then, the ratio card will be signed based on the materials. The items will then be distributed using a weighted system with human assistance. But it has so many drawbacks are as follows: Most ration shopkeepers carry fictitious ration cards. As a result of these cards, the dealer obtains excess ration from higher authorities and sells it on the open market. If the materials are not purchased before the end of the month, they will be sold to another party without notifying the government or clients. There could be errors in the material's weight. Cardholders are wasting hours in line to pick up their ration. It is challenging for humans to update transactions and maintain data in ledgers [11, 9].

The IoT-based authentic ration resource distribution network that has been designed and developed is a sophisticated system that can be used to efficiently distribute rations to genuine individuals. This automated system makes use of a microcontroller (89s52), and instead of using traditional ration cards, we replace them with smart cards or RFID cards that store all of the user's personal information, including their AADHAR number, which is utilised for authentication. Ration stores need customers to present their smart card or RFID to an RFID reader. The scanner will then request an OTP or password before turning on a specific motor that holds the material. Through IoT, a specific message will be sent to the government after material has been gathered. This system displays a person's balance after the user has been authorised. The user must input the kilogrammes that he wishes to withdraw. The grain is given to the customer upon payment. This is the latest technology to transfer data from source to destination. This technology can send data across a network without requiring communication between people or between people and computers [10].

DESIGN OF PROPOSED SYSTEM

The public distribution system's physical labour and unethical practices are to be replaced with the method suggested in this article. Like an ATM, the ration distribution mechanism is automated through

the use of embedded system technologies. This computerized ration system uses RFID/smart cards in place of the traditional ration card system. The microcontroller itself, the RFID card, motor driver, serial connectivity, and other components make up this system. The proposed system provides the grains as well as liquid to the customers. Block Diagram of Proposed system is shown in Figure 2.

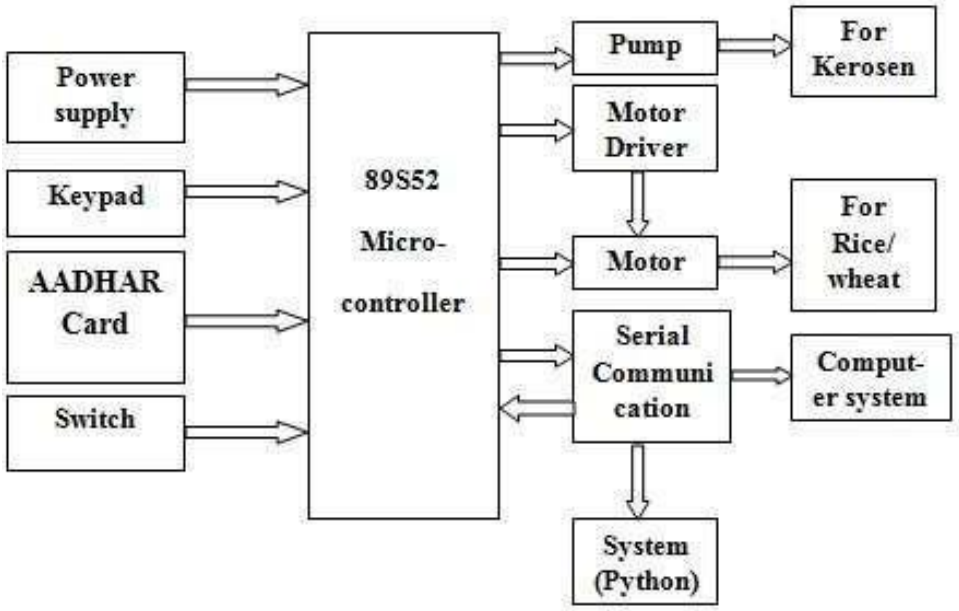

Figure 2. Block diagram of Proposed System.

METHODOLOGY

Corruption and forbidden items smuggling are involved in ration shops. All of this occurs because of the ration shop's reliance on manual labour for all tasks, without precise high-tech tools to automate the operation. This has to do with the unauthorised entering of information about the quantity of goods given to customers into the store's registers. The weight of the items that are provided to the people is the second cause for concern. Furthermore, it is never easy for the people in charge of verification to browse through the goods listed in a register and identify any abnormalities in the stocks that are available. To overcome these problems, we introduce the smart ration materials distribution for Distribute the ration materials automatically without any manpower. Here Figure 3 explains the basic working module of IoT based ration material distribution system.

If a user comes into Ration Shops, they scan their Aadhar number with the help of RFID reader. After that the database provides user's commodities details and available stock details. At that time user select the goods and pay the amount. After payment status verification the microcontroller sends instructions to the hardware components and distributes the materials properly. Lastly, the employee emails the distribution item details to the customer phone and the information about the inventory to the government headquarters.

COMPONENT ANALYSIS

The project module's hardware is made up of various physical components. It consists of several modules, such as circuits for motors and motor drivers, regulators, and processors. System Software requirements are Assembly C (Lower-level language) and Python (Higher level language).

Hardware

Microcontroller 89s52

Comparable to a tiny standalone computer system, a micro-controller is an incredibly potent gadget that can communicate with other hardware components and carry out several pre-programmed

activities. Featuring 8K bytes of internal configurable Flash memory, the AT89S52 is a CMOS 8-bit microcontroller that combines outstanding functionality and low power consumption. Programme memory can be reconfigured in-system or using a traditional nonvolatile memory programmer thanks to the on-chip Flash. The robust Atmel AT89S52 microcontroller offers a very adaptable and affordable solution for a wide range of integrated control-related tasks.89s52 2D image is shown in Figure 4.

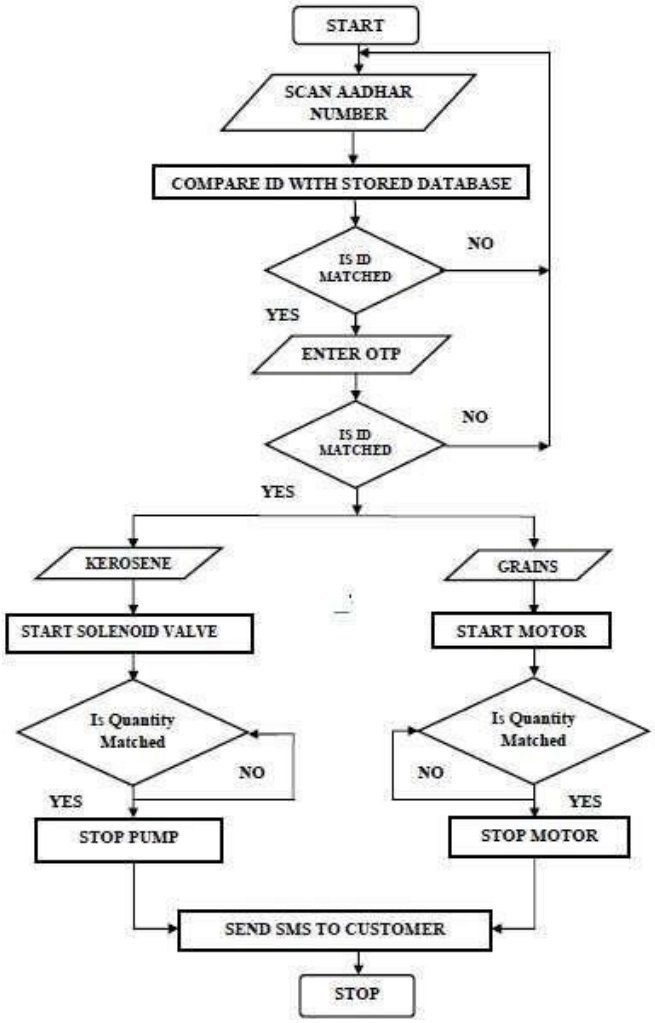

Figure 3. Flow chart of the system.

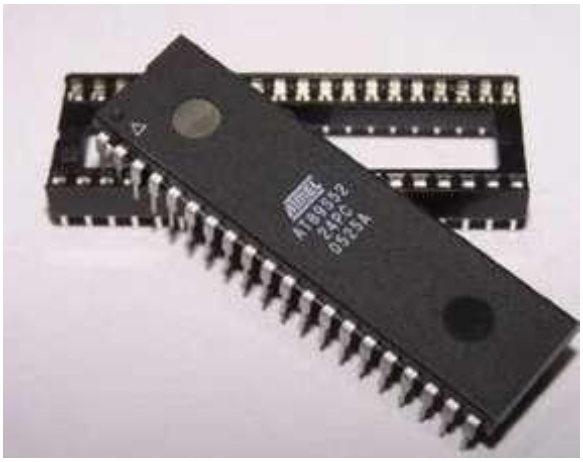

Figure 4. 89s52 Microcontroller.

RFID

The portable utilisation of electromagnetic fields for data transfer to recognise and monitor tags attached to devices is known as radio frequency identification, or RFID. The tags hold information that has been electronically stored. Some tags draw energy from magnetic fields created close to the reader, known as EMF. Certain varieties function as passive transponders by gathering energy from the radio waves they are probing. Some varieties can function hundreds of meters away from the reader and have a local power source, like a battery. In contrast to a bar code, the tag can be embedded in the monitored object and is not limited to being in the reader's line of sight. One technique for tags that has been employed in numerous sectors is RFID.RFID Reader Module image is shown in Figure 5.

Figure 5. RFID Reader Module.

RFID Tags

An RFID tag is made up of a single integrated circuit, also known as a chip or IC, connected to an antenna which has been manufactured, etched, pressed, or vapor-deposited onto a backing material, which is typically PET or paper. RFID tag types:

1. Passive
2. Active

Passive RFID Tags

These tags as shown in Figure 6 don't require batteries. Rather, the reader's radio wave serves as their source of energy. Using its antenna, the reader sends a low-power devices wireless signal to the tag, that accepts it and uses it to supply electricity to the computer's integrated circuit (chip).

Figure 6. Passive RFID Tags.

DC motor

Three DC motor systems are used to open and close the valves for automatic distribution of rice, sugar, and oil. The initial valve arrangement is made to prevent the fall of grains and oil. The three DC motors, each having specifications 12V, 60 RPM and 0.37 A are used for this purpose. Any electromagnetic equipment that transforms direct current electrical energy into mechanical strength is

known as a DC motor. The most often used kinds depend on the forces generated by magnetic fields. The inner mechanism of almost all DC motor types, whether electromechanical or electronic, allows the motor to periodically reverse the direction of the electrical current in a portion of the motor.2-Dimensional View of DC Motor is shown in Figure 7.

Figure 7. DC Motor.

Water Pump

It is used to suck kerosene from the tank & then that kerosene is provided to valve for the controlling & dispatching purpose. A 230V residential pressure pump is utilised if you need to run numerous taps at once (high pressure), have multiple stories (high head), or need to constantly pump for longer than fifteen minutes. This little pump is fully submersible and can also be used 'in- line'. These small pumps as shown in Figure 8 deliver over 1000 liter/hour. While they are recommended for recreational vehicles, campervans, or boats, they are rated for "continuous use".

Figure 8. Water Pump.

MAX 232

To interface microcontroller with PC, we need serial communication to change the voltage levels. We analysis this data and transmit this data to thesystem using serial communication IC MAX232. It is a dual driver/receiver that normally transforms RX, TX, CTS, and RTS impulses from/to TTL levels (5 v) and the PC's serial port (which can go up to 25 v). It's simple to link between your microcontroller and PC with a MAX232 IC. Either a serial to USB conversion.MAX 232 2-D view is shown in Figure 9.

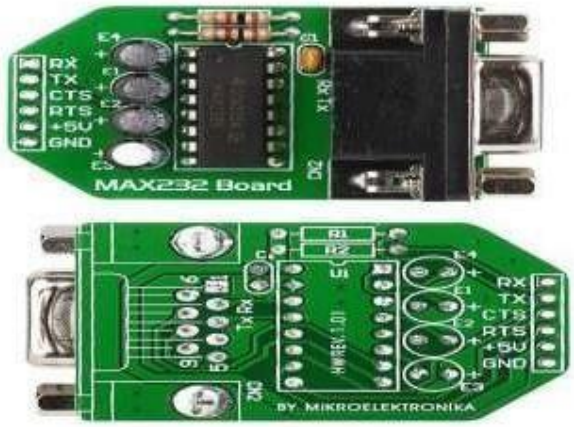

Figure 9. MAX 232.

Power Supply

Power supply converts 230 v to 5vdc.We are using transformer and regulators to create this power supply.

Software

Assembly C (Low level language)

The C programming language is platform-neutral and offers portability. It is C's greatest benefit, and because of this feature, individuals are powerless to utilise C. The code which was written in c could be easily reused on a different platform; besides it Assembly does not provide the portability and source code specific to a processor because assembly instruction depends on the processor architecture. Software built in assembly outperforms software written in C. 2.2.

Python: Python is a robust and easily learned programming language. Its object-oriented programming methodology is straightforward but efficient, and its high-level data structures are efficient. It is simple to add new functions as well as information types to the Python interpreter that are implemented in C or C++ (or other languages that may be called from C). Python is a good language to use as an extension for apps that may be customised.

Proposed System Advantage

- Maintain data properly.
- Reduces paperwork.
- Time saving approach.
- Cost effective.
- User friendly.
- Access to Authorized person only.
- Reduce corruption.

RESULT AND CONCLUSION

Internet of Things-Enabled(IoT) Authentic Ration Distribution System with an RFID smart card with user information is far much beneficial and effective with regards to it's applications as compare to traditional technology involved in ration detection system .The current system has flaws, such as the possibility of human error causing weight errors and the possibility of materials being sold to third parties without notifying the government or customers if they are not purchased by the end of the month. The suggested approach can address the issues. Under this approach, ration supplies (such as rice, sugar, oil, kerosene, etc.) are dispersed automatically and without the assistance of people. The government receives the items and sends information on them. This technique can offer a public distribution system

that is efficient, safe, and secure. With this cutting-edge approach, we can better manage the distribution of rations. The applications that operate in real time rely on the highly accurate system. Therefore, based on a review of the literature and an analysis of the current system, we have concluded that the suggested system will benefit authentic peoples as well as government agencies and contribute to the digitization of the current framework.

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