

Automation in Government Ration Distribution System using Atmega32 and RFID

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Abstract – The advancement has now become ubiquitous in multifarious fields that has led development to proliferate on a colossal scale. Ration Distribution System, in India, is one of the biggest public schemes aimed to provide food safety for people below poverty line, implemented by Directorate of Food and Civil Supplies. Public Ration Distribution system, each month, for smooth functioning of supply chain, coordinates not only with different agencies but also carries out monitoring on daily basis. Government provides ration card to people below poverty line which they can use to buy essential stuffs like Wheat, Rice, Fuel, etc. But conventional system has many loopholes, to exemplify, it does not provide centralized database to monitor the activity of any distribution shop at any given instance, add on to this, there is also corruption involved in some areas which results in deserving people not getting the commodities which they are supposed to get.

We have proposed the system in which Ration card will be replaced by RFID card and whole buying procedure is automated using Microcontroller and relevant data is stored in Centralized Database which can be only accessed by Officials for monitoring purposes. This system mitigates the corruption involved, because it records all the activity of customer and end sellers in digital form. This system will improve the transparency in this sector so that deserving people can get the stuffs allotted to them by Government.

Key Words: AVR ATMEGA32 Microcontroller, RFID, Centralised Database, Flow Sensor, Embedded System, Motor Driver L298, Ration Distribution, Automation

1. INTRODUCTION

Public Ration distribution in India, was established by Indian Government under the department of Ministry of Consumer affairs, Food and Public distribution to distribute essential food and fuel items to people living below poverty line at highly subsidized rates. This scheme was first introduced in February 1944, and was relaunched in current form in June 1947, just before the formation of independent India. Commodities distributed generally includes food grains, such as Wheat, Rice, Sugar, Lentils, and also essential fuel items like Kerosene, Oil, etc. These materials are distributed through a wide network of Public Distribution Shops also known as Ration stores in several states across the country.

Conventional Ration distribution system, however, includes several structural shortcomings including:

- 1.) Many Fair price shop keepers do malpractice, illegal diversions of the commodities for poor people, black marketing because of their low wages.
- 2.) Unavailability of ration in some areas, and lack of communication and transparency between shopkeepers and Govt. Officials.
- 3.) In traditional system, all the records are in paper form which can be changed easily, and also some people tend to get fake ration card through which they buy more than necessary ration at very lower rate when compared to market price. This results in poor people missing the ration that they are entitled to get.
- 4.) No centralized database to monitor the activities of the ration shops and customer's buying behaviour in any area at any given instance.
- 5.) Shopkeepers sometimes tend to forget the expiry of the ration available in their shop. This may result into serious health issue for the person who may consume these expired food items.

In this paper, we have proposed the system using RFID authentication, and having centralized database to overcome the shortcomings of the existing system. In our prospective system, only customers with valid RFID cards will be able to get the ration from the ration shops, meanwhile, all the transactions will be recorded in digital format at the terminal and same can be accessed by Govt. Officials from anywhere. We have achieved this total automation using Embedded and IOT technologies. This system will replace the paper Ration cards with RFID cards which will make the system secure, transparent, efficient, and easy to use.

1.1 Why need automation?

- To reduce the waste in Ration
- To make sure entitled customers get their ration
- To mitigate the corruption involved
- To escalate efficiency
- To reduce the wastage
- To observe buying behavior for future improvements

2. Working Principle

Automated ration system will be installed at the ration shops. Detailed working along with necessary components, block diagram, description of major components, flowchart, and detailed working is elaborated below:

2.1 Components

- AVR ATMEGA 32 16-PU Microcontroller (40 Pin)
- Solenoid Valve or Submersible Motor 12V
- 12V Relay
- Flow Sensor YF-S401
- Soldering Iron
- +5V & +12V Power Supply
- RFID EM-18 Module
- RFID Tags
- USB to TTL Converter (232R-FTDI)
- Terminal
- 12V-30RPM DC Motor
- L298 Motor Driver Circuit
- 16x2 LCD Display
- 4x4 Matrix Keypad
- Personal Computer
- Transformer
- Wires

2.2 Block Diagram

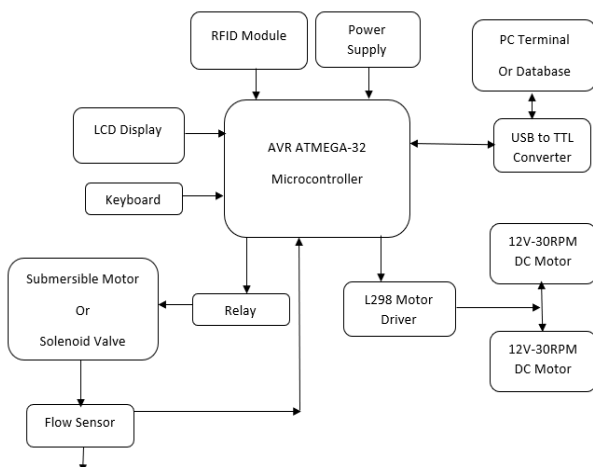


Figure 1 Block Diagram

A. Power Supply

All electronic circuits have power input connection, which receives power from a source, and give power to one or more output connections that deliver current to the load. The power supply is essential to operate any electronic circuit. In our system, mainly +5V and +12V power supply is developed to give power to components Atmega32, Flow sensor YF-

S401, L298 Motors, Drive circuit, EM-18 RFID module, 4x4 Keyboard, LCD display.

B. Atmega32 Microcontroller



Figure 2 Atmega32 Microcontroller

Atmega32-16pu is the 40-pin microcontroller which combines 32 general working registers with a rich instruction set. All 32 general purpose registers are directly connected to ALU. This microcontroller is having speed of 16MHz and requires power supply of 4.5V-5.5V. This microcontroller is main component of the system as all the data will be processed here.

C. USB to TTL Converter

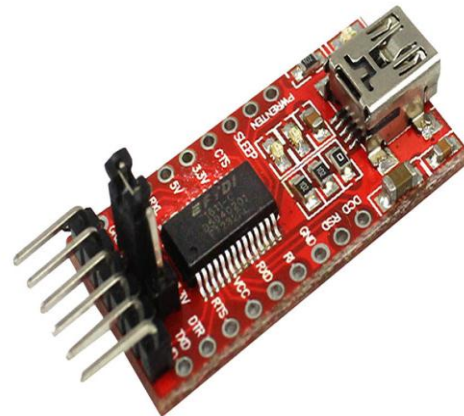


Figure 3 USB to TTL

USB to TTL converter provides on board single chip USB to asynchronous serial data transfer interface. This chip provides a 6-pin UART header that is compatible with other breakout board. This converter chip has a microUSB connector along with another circuitry to get the IC quickly running. In sort this chip is used for communication between other devices and microcontroller. In our system, this circuit's (Tx) pin is connected to (Rx) pin of microcontroller. Data will be sent to computer for record through this IC.

D. RFID Module



Figure 4 RFID EM-18 Module

Radio frequency Identification (RFID) system consists of an antenna and coil. RFID tags have unique number in it, stored in a chip or coil. When EM-18 module, which consists of antenna, energizes the coil, coil transfers the unique number already preprogrammed in it to the EM-18 module. Dataset with RFID tags can be created on server side, and if and only if card number, received in EM-18 module, matches the number in dataset, then only further access will be given to the user.

E. Liquid Crystal Display (LCD) & Keypad

In our system, 16x2 LCD is interfaced with the microcontroller. This LCD will act as a User Interface where customer will be able to see the information such as Product Key, Instructions, etc. Also, 4x4 matrix keypad is interfaced serially with Atmega32. User will use this keypad to enter the command and information such as Product Key for Ration, Quantity required, etc.

F. Motors with Driver Circuit

We have used two 12V-30RPM DC motors for unique products (example, Motor1 for item1 and Motor2 for item2). We have used L298 Driver circuit for these motors. Motors will drive either conveyor belt or mechanical assembly which will push the packets of packed ration.

G. Flow sensor YF-S401



Figure 5 Flow Sensor

We have used high-precision hall effect flow sensor consisting of PVC body, a water rotor, and a hall-effect

sensor. Fluid flowing inside the sensor will turn the rotor, speed will be proportional to the rate of flow. Hall-effect sensor give corresponding output pulse as a result. This flow sensor requires 5V to work.

2.3 Flowchart and Working

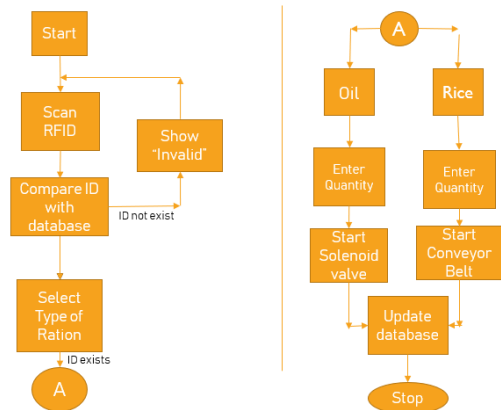


Figure 6 Flowchart

Working:

1. Customer who is already provided RFID card will scan their card at EM-18 module.
2. RFID number will be verified with the Dataset of Government. If the number matches with the number in database and customer have enough balance in their account then they will be promoted to selection step.
3. If the card is not valid then "Invalid/Not valid" message will be displayed on the LCD screen and they will not be given access to the next step.
4. If the card is valid then "Valid User" message will be displayed on the LCD and they will be asked to enter the product key of ration they want (e.g. 1. Wheat, 2. Rice, 3. Fuel)
5. All the customers will have by default maximum monthly spending limit to ensure that everyone gets the fair chance.
6. Based on the material that customer enters further action will be taken. If customer enters the solid ration such as wheat or rice then conveyor belt will be rotated.
7. If fuel item is selected then submersible pump or solenoid valve will pump the liquid through the flow sensor and to the customer's bottle or container, here we have fixed the price of fuel per liter, so whatever quantity customer takes will be measured by flow sensor and displayed on LCD. Preset amount will be multiplied with the quantity that customer will take.
e.g. price for 1-liter fuel = 120rs, then (Look at the table)

QUANTITY TAKEN	PRICE
500ml	60rs
750ml	90rs
2L	240rs

- Once the customer exceeds the limit of maximum allowed purchase for month, then they will not be able to buy anything else for that particular month, they will have to wait for next month.
- After the transaction is complete, database will be updated accordingly.

3. CIRCUIT DIAGRAM

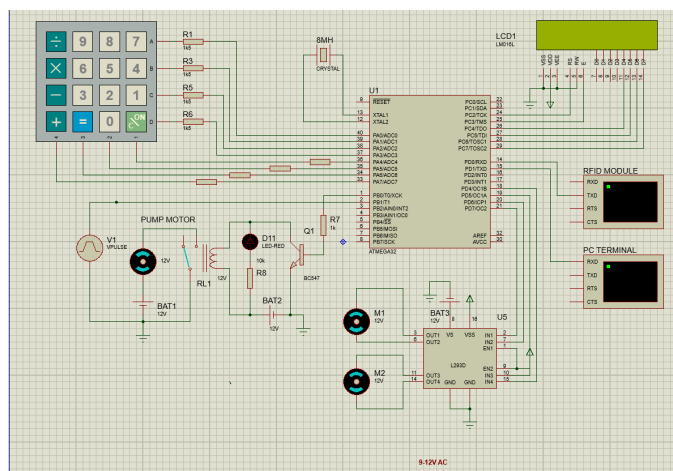


Figure 7 Proteus Circuit Diagram

Interfacing of all the components with microcontroller AVR Atmega-32 is shown above. 40-pin microcontroller is used by considering the plausible future upgradation.

Full working of system is shown in figures below:

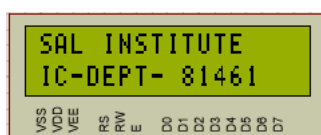


Figure 8 Main Screen

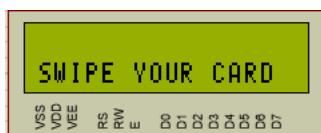


Figure 9 Swipe your RFID card

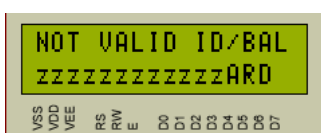


Figure 10 If card is Not valid/No balance

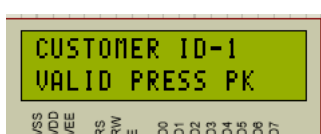


Figure 11 If card is valid

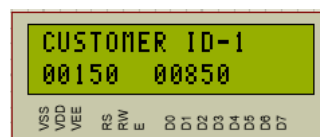


Figure 12 Item-1 Selected

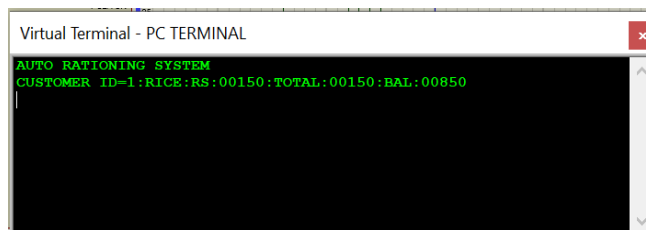


Figure 13 Updated database

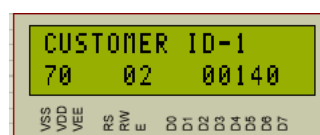


Figure 14 Fuel Item

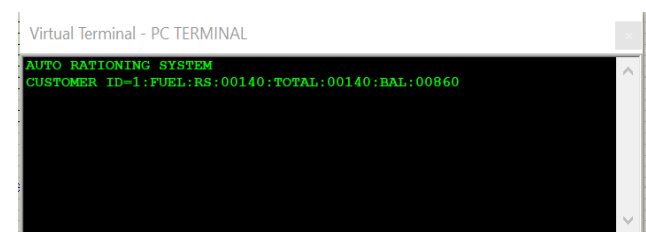


Figure 15 Updated Database

4. CONCLUSION

Automation in ration distribution system, if implemented properly, will greatly benefit the Government and poor people. This system almost eliminates the other human interventions and directly deals with the end consumer, as all the transactions will be recorded and can be easily crosschecked, not only this, real time available stock in the shop can be known just by few commands. This system also ensures safe, efficient, reliable, and trustworthy transactions and at the same time it will greatly mitigate the corruption/black-marketing/ stocking as well as it can also stop mala fide behavior of devious people. This system can also be used to check the buying behavior of customer, and by using artificial intelligence algorithms orders can also be placed automatically. As a result, deserving people will end up getting their ration as well as subsidies directly. For future scope RFID system can be replaced by biometrics and LCD can be replaced by touch screen.

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