Automated Ration Material Distribution System

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***Abstract*—Ration card is very important for every house and it is used in various fields, it acts as a proof for details of family members, it helps in getting a gas connection, it can be used as a proof of address for various purposes etc. People having a ration card can buy various groceries such as rice, wheat, coconut oil etc. specified for them from the ration shops. Present ration system has two imperfections, one the weight of the material may be inaccurate due to human mistakes and the other one is if the materials are not bought till the end of the month, ration shopkeepers will sell it to others at higher rates without the notice of the customers and the government. In this project, we have proposed an Automated Ration Material Distribution System based on Radio Frequency Identification (RFID) technology instead of traditional ration cards to get ration materials.**

Keywords—Radio-Frequency Identification (RFID), Microcontroller, Solenoid valve, Motor, Load cell, Flow sensor and Mechanical parts.

I. INTRODUCTION

The maintenance of a Public Distribution System (PDS) scheme is not an easy task in countries like India. India has a large number of Fair Price Shops (FPS). The PDS is being maintained and executed by Public Distribution(PD) and food ministry of Government of India [1].The government of India provides a number of groceries such as palm oil, rice, wheat etc. at a much lower rate so that the benefit goes to the poor's. The PDS plays a very important role in food security bill of Government of India. Even after knowing this, our PDS system is affected by ration hijack and corruption etc. [2, 3]. The Planning Commission of India in 2005, in one of the reports it said that many systemic challenges that provoke the PDS system today are "For every Rs. 4 spent on the PDS, only Rs. 1 reaches the poor". The 57% of the PDS food grains (rice, wheat, palm oil etc.) is not received by the people who are supposed to receive. Many systemic challenges that provoke the PDS system today are PDS Wastages, Quantity and Quality of Materials, System Accountability, and long queues. Taking into account the factors mentioned above, it is needed to improve the PDS to make sure there is, efficient delivery of food grains to the right people, adequate supplies and reasonable subsidies [4]. So our system aims at providing solutions to these problems by using RFID cards as ration cards.

System using Radio-Frequency Identification (RFID) technology allows only authorised users to access the ration shops and get materials from it. An RFID system mainly consists of a coil or an antenna and a transceiver with a transponder and decoder (RF tag) which is programmed electronically with information which is unique. RFID systems can be classified in many ways. One is RFID systems are classified depending on their frequency ranges. Most commonly used RFID frequency systems are Low-Frequency system (30 kHz – 0.5 MHz), Mid-Frequency system (0.9 MHz-1.5GHz) and High-Frequency system (2400-2500MHz). The active tags are costlier and heavier than passive tags [5].

In the proposed study, we have designed and implemented an Automatic Ration Material Distribution System based on RFID and Biometric technology. In the proposed system only authorised persons can access the ration materials from ration shops depending on the amount available in the card. The survey of literature is provided in section II. The proposed, developed method and block diagrams are provided in the section III. The result, conclusion and discussion are provided in section IV and V respectively.

II. LITERATURE SURVEY

In Smart Public Ration Distribution System for logging into an account, the identification and verification of user is done by RFID tags and password. For increased security One Time Password (OTP) is used for two-step verification of the user, GSM (SIM-900) module sends this

OTP to the user. This system allows only the specified persons to take the ration [1].

Dr. R.R. Dube, *et al.*, [4], explains a system where the smart card can be used in the place of a ration card. The device is placed at all the ration shops of the country which uses the internet to connect to the server. The user has to login to the system each time before collecting ration materials. The payment for the ration materials is automatic as it is directly deducted from the customer bank account through web once the user enters data in the application. The details of the transaction are sent to the users mobile. This reduces cheating of employees about the rates of materials. The Government can have overall control and monitoring at all the ration shops of the country through the internet. In addition to this features, the customers will get an SMS based alert about the commodities arrival dates. Thus this new ration system, provide accurate information about PDS and reduce all possible human errors at any point.

Vinayak T Shelar and Mahadev S Patil [9], describes a system where the consumer has to scan the RFID tag to the RFID reader, the Microcontroller Unit verifies the data from the RFID tag with the data stored in the database. Once the data is verified by MCU it allows the consumer to enter the quantity and type of materials required through the keypad. Thus the system delivers materials required to the customer and also sends an SMS about the material distributed to the customer as well as the PDS authorities using Global System for Mobile Communication (GSM) technology.

Krithika Patil, *et al.* [6], describes a system where the RFID card is used for the authentication process and the information about the ration material delivered will be directly sent to the Government automatically using Global System for Mobile Communication (GSM) technology. \

In Real Time Automatic Ration Material Distribution System the ration system uses RFID cards for authentication and it is verified with the data in the database once it is verified the user has to input the materials needed through push buttons and keypad the grains start filling in the container the solenoid valve closes once it reaches the required weight and the GSM sends message to the user as well as the PDS authority [7].

Parvathy A, *et al.* [8], presents an efficient method for the management of examination hall. The system is designed mainly for students to identify the respective examination hall during exams. An RFID card and an RFID reader is used for this purpose. This system helps in identifying the floor or to get directions of their respective examination halls immediately. The card reader is located at the entrance of the building so that the students can identify their respective examination halls while entering the college itself. Thus this system explains the use of RFID technology in the field of education.

III. PROPOSED METHODS

A. Block Diagram

The block diagram Automated Ration Material Distribution System is shown in Figure 1. It consists of many parts such as RFID, Microcontroller, Solenoid valve, DC motor, Load cell, Flow sensor etc.

B. Power Supply

The power supply to the microcontroller and the modules is given from an adapter circuit. AC adapters are usually used with the electrical devices that require power but do not contain internal components to derive the required voltage and power from the mains power. The supply from the mains is too high and is not suitable for consumer electronics. The adapter circuit lowers the voltage to a suitable level. The bridge rectifier does the job of rectifying the stepped down AC input. Reservoir or smoothing capacitor is placed at the output of the rectifier. Essentially it releases stored energy when no voltage is being output from the rectifier. This output is given to IC7812 which is a 12V voltage regulator and can deliver up to 1 ampere current.

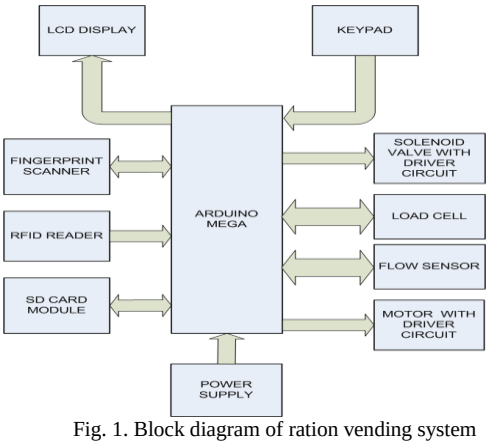

Fig. 1. Block diagram of ration vending system

C. RFID Reader Module

Radio Frequency Identification (RFID) [10] helps in automatic identification of materials or items using Radio Waves. RFID [11] system mainly consists of three components, the transponder, antenna and the reader. The RFID tag consists of the user data which when tagged sends the data to the microcontroller through RFID reader. RFID EM-18 Reader Module is used to scan the RFID tag. Each user has a RFID tag which is authorized. RFID tag is scanned against the RFID reader module. When an RFID tag is scanned against an RFID Reader, it collects the unique tag data (i.e. a combination of digits and characters) from the RFID tag. If the unique code of RFID matches with the code already stored in the database then the remaining process continues else the user will be prompted to scan the RFID tag again.

D. Fingerprint Scanner

Fingerprint Sensor R305 is used to scan the fingerprint of the user. The customer should enroll his fingerprint in order to get ration. When the user newly registers their fingerprint, he/she will be prompted to place a finger on the fingerprint scanner. If the scans are successful then, a message of acceptance will appear and the ID number of fingerprint will be stored and then it will be incremented so

that a new user can register his fingerprint to the fingerprint scanner. To identify that a users fingerprint has been enrolled or not, place the finger on the scanner, if it is enrolled it will display the ID number.

E. SD Card Module

SD card is a storage device of new generation which is based on semiconductor flash memory which has a fast data transfer rate, high memory, good security, and great moving flexibility [12]. The SD card Module is generally used to store the measurement and status data of the electronic home appliances [13]. In this project SD card module is used as a database to store data of the persons who buy ration materials. When an RFID tag is scanned, the microcontroller checks whether the data is present on the SD card.

F. DC Motor

A motor is an electrical machine which converts electrical energy into mechanical energy. The working principle of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field it experiences a mechanical force". Here once the RFID tag is authenticated the process of ration distribution starts. According to the quantity of the ration stored for the user the ration will be given. The motor starts rotating and the shaft connected to it will also rotate to open the container lid as the RFID card is authenticated. After a signal from the load cell, the motor rotates along with the shaft again, but now in opposite direction to close the container lid.

G. Solenoid Valve

Solenoid Valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. The liquid flow is controlled with the help of solenoid valve which opens and closes on instructions from the microcontroller. After the collection of grains, the solenoid valve allows the flow of liquid. Once the specified liquid level is reached, the flow sensor sends a signal upon which the solenoid valve blocks the liquid flow.

H. Load Cell using HX711 Module

A load cell is a transducer that translates force (pressure) into an electrical signal. HX711 is a precision 24-bit Analog to Digital Converter (ADC) designed for weight scales and industrial control applications. The input multiplexer selects either Channel A or B differential input to the low-noise Programmable Gain Amplifier (PGA). When a 5V supply is connected to AVDD analog power supply pin, channel A can be programmed with a gain of 64 or 128, corresponding to a full-scale differential input voltage of 40mV or 20mV respectively. Channel B has a fixed gain of 32. Load cell along with HX711 is interfaced with Arduino to act as a weight sensor. The load cell detects the weights of the ration collected .When the weight reaches the maximum limit a signal is sent to motor to close the valve.

I. Flow Sensor

Water flow sensor consists of a water rotor, a hall-effect sensor, and a plastic valve body. When there is flow of water through the rotor, rotor spins. The speed of spin changes with different rate of flow. The corresponding pulse signal is outputted by the hall effect sensor. Depending on the pulse signals received the amount of water owed or collected is calculated. Once the solenoid valve allows the flow of liquid through it, the flow sensor starts detecting the amount of flow. It sends a signal when the specified liquid level is reached, thereby making the solenoid valve to block the flow of liquid.

J. Display

A 16x2 LCD display is used in this project. Liquid Crystal Display (LCD) screen is a very basic display module which is electronic. It has a wide range of applications in the field of electronics. In this project it is used to display welcome message, details of user, weight of grains, liquid quantity and balance amount in the card.

K. Keypad

Keypad is a great way to let a user interact with a project. It is usually used to navigate menus, enter passwords, and control games. In this project keypad is used to switch between entering the amount into the card, ration or check balance and exit. It is also used to update the update the balance in the RFID card. This project uses a 4x3 keypad. A 4x3 keypad consists of 4 rows and 3 columns. Beneath each key is a membrane switch. Each switch in a row is connected to the other, in a row a conductive trace underneath the pad. Each switch in a column is connected in a similar way. Finally each row and each column is brought out to a single path, which makes it 7 pins in total.

L. Microcontroller

Microcontroller used in the proposed system is Arduino Mega2560. Figure 12 shows the image of the microcontroller used. It is the heart of the system. It is the main component of the system which assigns and handles all the works performed by the different modules.

IV. RESULT and DISCUSSION

In the Automatic Ration Material Distribution System all the users of ration will be provided with RFID cards. Each RFID cards will have a fingerprint match stored in the database. The data of the user will be stored in the SD card database along with the balance for the respective RFID cards. Each RFID card has a unique number which makes it easy to differentiate users and each RFID card is associated with fingerprint of the user.

Initially the RFID card will be scanned against the RFID reader which sends the RFID card data to the controller which in turn checks whether the RFID data is present on the SD card database. If found a match it will ask for fingerprint of user, else it will display an error message. Once the user is authenticated the DC motor rotates the shaft there by opening the valve of solid materials. The Load cell continuously detects the weight

and it sends a signal if the desired weight is reached. Once microcontroller receives signal from the Load cell it sends a signal to the DC motor to close the valve. After this the Solenoid valve triggers and liquid content starts to flow through the Flow sensor to the beaker. Flow sensor sends a signal to the microcontroller once the desired quantity of liquid is flowed through it. The microcontroller then sends a signal to the Solenoid valve to close the opened valve. At the end the amount will be deducted from the user card and remaining balance will be updated in the database.

RFID tags are used to differentiate different ration users. Each user will be given a RFID tag. The user can buy ration with the help of the RFID tag. A message is displayed before scanning the RFID card which tells the user to scan his RFID tag against the RFID reader. Figure 2 shows the message displayed on the screen before scanning RFID tag.

RFID tag is scanned to identify user and send the message to microcontroller. Microcontroller is used to authenticate RFID tag. Once authentication is done details of the user stored in database is displayed on LCD screen. The details of the user displayed as shown in Figure 3.

If an unauthorised person tries to access the ration with a RFID tag which is not enrolled in the database an error message "Invalid Card" will be displayed on the LCD screen and the system does not allow access to the ration materials. Display message is as shown in Figure 4. If a valid finger access the system then the message "Access Granted" will be displayed on the screen and the ration will be given to the user. Figure 5 shows the message displayed on screen if there is a fingerprint match. Weight sensor detects the amount of weight on it and sends the information to the microcontroller. The microcontroller displays the weight on the LCD screen in terms of kg as shown in Figure 6.

Flow sensor detects the amount of liquid flowed through it and sends the information to the microcontroller. The microcontroller displays the liquid quantity on the LCD screen in terms of millilitre as shown in Figure 7.

Fig.2. Initial display message

Fig. 3. Details of user

Fig. 4. Unauthorised access

Fig .5. *Authorised access*

Fig .6. Weight sensor display message

Fig. 7. Flow sensor display message

After giving ration to the user the system updates the local database by deducting the amount for the ration taken from the current balance and displays the available balance to the user after deduction. The display message of balance is as shown in Figure 8.

Figure 9 shows the final model of the ration vending machine. Using this machine the users will be able to get the ration automatically without the help of middlemen.

Fig.8. Balance in card


Fig. 9. Ration vending machine

V. CONCLUSION

In the proposed paper, an Automated Ration Material Distribution System based of RFID technology instead of present ration cards is implemented and tested. Automated Ration Material Distribution System allows people to collect their ration without the involvement of middleman, thus eliminating corruption and malpractice. And for this to happen the users fingerprint should be enrolled to the database and the RFID cards should be provided to the user. Once this is done, the user can easily collect his/her ration from time-to-time in a very simple way. The proposed system is simple, very accurate, and low power consuming system which can be used for real time applications.

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