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Automatic Grocery Vending System

K Aarya Shri[1], Jayalakshmi K P[2], Priya Miranda[3], Rupal D'Souza[4], Deepthi S R[5]

[1,2,3,4,5]Electronics and Communication Engineering, St Joseph Engineering College, Mangaluru, 575028, Karnataka

ABSTRACT

Automatic Grocery Distribution System plays an important role in controlling the malpractices of conventional systems by doing a sequence of tasks automatically with a faster operation rate. The main objective of the paper is to provide technology to prevent illegal usage, corruption and avoid overcrowding. The RFID card is provided to have a unique identity for the user. A webpage is designed to display the information of the user and the commodities. Since there is currently no technology available to automate the distribution of groceries, all operations must be carried out manually, which causes irregularities. The beneficiary, therefore, receives a partial sale of the commodities because of the offline maintenance of the documents of sale. Such a method will result in the misuse of undistributed goods for individual gain. All these practices prevent the beneficiaries from the allocated ratio.An RFID smart card-based system has been designed to address the existing challenges. All userscan be issued this card, which contains a unique ID. The beneficiary must swipe the RFID card against an RFID reader during the authentication process. The system will keep track of the beneficiary's existing subsidies, enabling the user to only purchase items that correspond to the database inventory. The centralized database is updated following each transaction by the beneficiary. With the implementation of this system, it is expected that all such misuse as cited above can be eliminated leading to the achievement of high-level accuracy. The system can be further improved by making the webpage available in regional languages.

Keywords: RFID, Relay, Flow Sensor, Valve, Webpage

INTRODUCTION

The grocery distribution system offers consumers affordable access to basic commodities like rice, sugar, wheat, and edible oil. In the traditional method, the customer request, the amount of the commodity he needs. The employee then weighs the item and hands it over to the customer. In an automatic distribution system, a hardware setup is developed where the customer has to input the amount required and the amount is collected in the container. A webpage is designed for user interface and a database keeps track of the records.

Utilizing radio-frequency identification (RFID) technology, only individuals with the proper authorization can purchase supplies from stores. The RFID card has a special identifying number all its own. The customer should scan the RFID card on the RFID reader during the initial operation. When a customer is authenticated by their password, the system displays the available rations and allows them to choose the type and quantity of product they need. The hardware circuit will be turned on based on the customer's input of the item and quantity.

The controller closes the valve automatically when the measured quantity reaches the entered quantity.
The main objectives of the system are to:
- To use a time-saving approach.
- To keep a high degree of accuracy.
- To reduce manual errors.

The above-mentioned objectives are achieved by using a hardware setup where the quantity needed is entered, automatically weighed, and collected in the container. Consequently, manual laboris decreased.

PROPOSED SYSTEM

Figure 1 shows the connections between various blocks of Automatic Grocery Vending System. The development board Arduino Uno (ATmega328) is used as the heart of the system. Block diagram is mainly divided into two sections namely oil section and grocery section. The oil section consists of collector, relay, solenoid valve, flow sensor and container. The grocery section consists of container, motor, motor driver, collector, and the weighing device. Webpage is designed to display, store and update customer and product details.

RFID Reader is used to gather the information from RFID tag and helps to identify individual user. All transactions are updated in the webpage.Using Radio-frequency identification technique only authorized persons can get the materials from grocery shops. The RFID card has its own unique identification number. The first and main procedure is that the customer should scan the RFID card on the RFID reader. Once the customer is recognized by password, the system shows availability of grocery and asks the customer to select any material and required quantity. Based on the material and quantity entered by the customer, appropriate program and hardware circuitry of liquid or solid section will be activated.

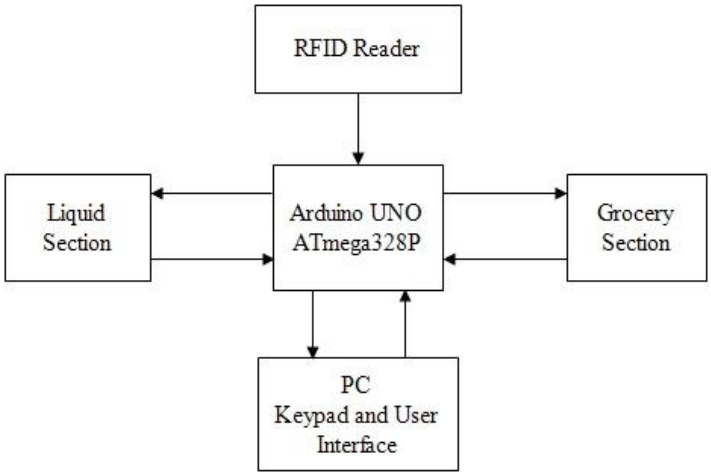

Fig. 1.Block Diagram

A. Liquid Section

When the user enters for the liquid quantity, relay of 5V activates or deactivates the solenoid valve of 12V. When the solenoid valve is activated, the chosen amount of ration is dispensed into container through flow sensor. The output of the flow sensor is sent at each defined interval to Arduino. When the output is matched with the entered quantity, relay is switched off by the Arduino. Hence solenoid valve will be deactivated and stops further flow of liquid. Fig. 2. Shows Liquid section block diagram.

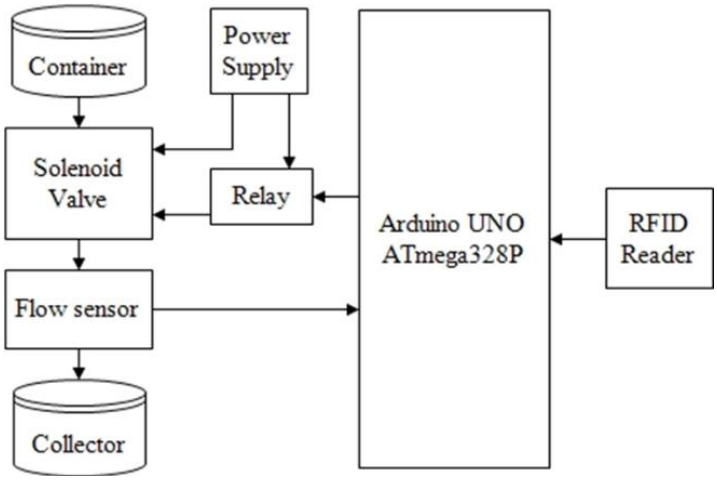

Fig. 2. Liquid section block diagram

B. Solid Section

When the user enters for the rice quantity servo motor and the load cell amplifier are powered by a supply of 5V through Arduino. Ration commodities are stored in the container. When the customer enters the quantity, the control pulse is received by servo motor from Arduino, the duration of each pulse controls the degree of rotation of the shaft. Shaft further controls the movement of plate which allows only required amount of ration to get collected. The weight of the collected commodities is sensed by load cell.

The output of the load cell is in micro volts. Hence HX711 load cell amplifier is used which is a 24-bit delta-sigma amplifier and gives best output from a load cell. The amplified and digitised signal is sent to Arduino. The Fig.3. shows Solid section block diagram.

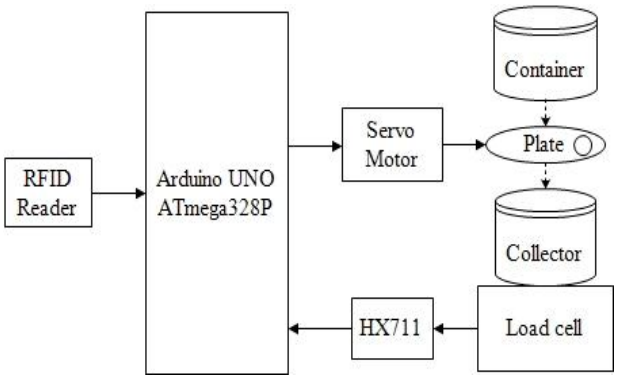

Fig.3. Solid section block diagram

C. Implementation

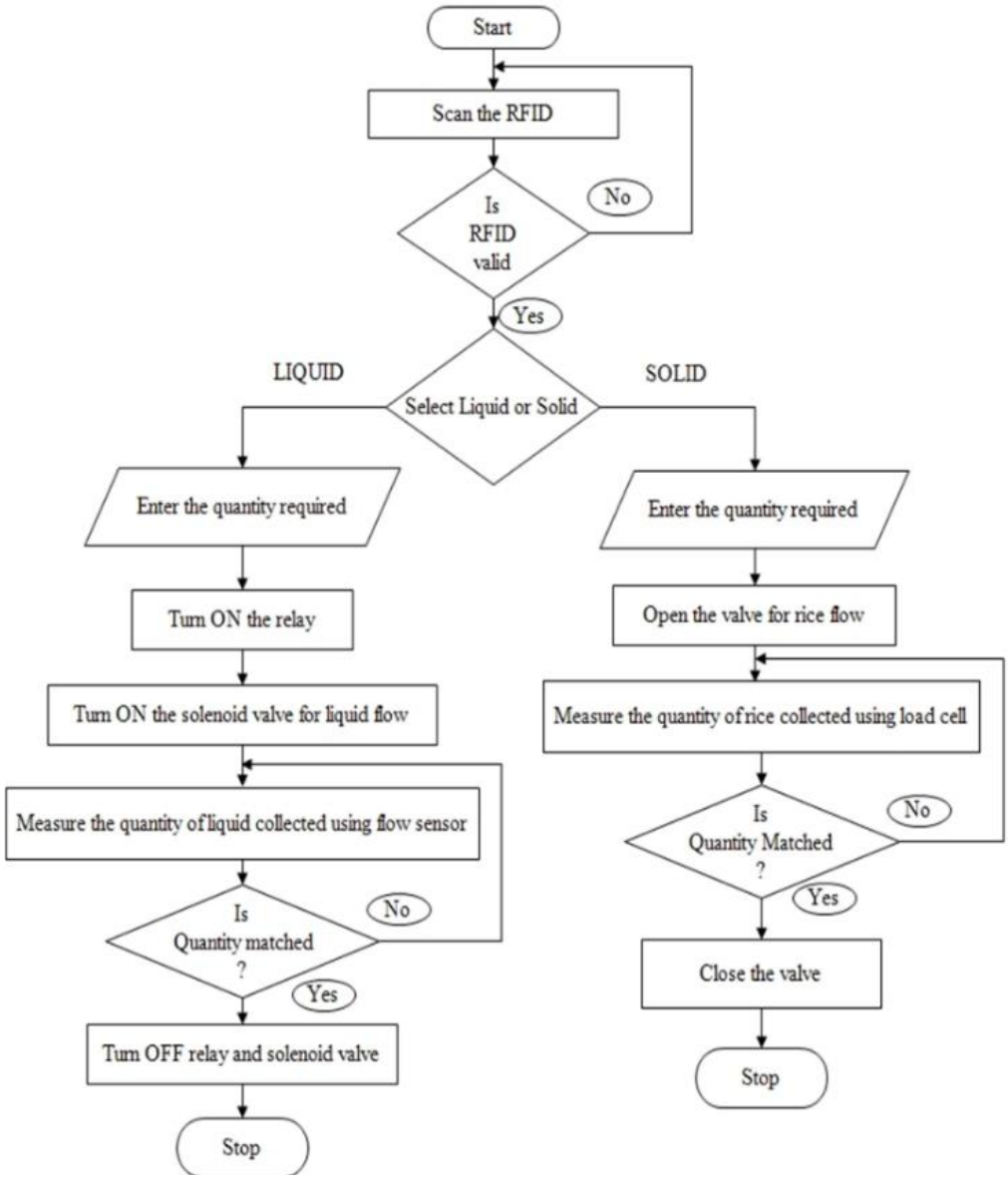

Fig. 4. Flow Chart

Algorithm according to the flow chart shown in Fig. 4 is:

1. Customer should scan the unique RFID card given.

2. If RFID card is valid, then the customer is granted access to be webpage or else it will go back to the Step 1.
3. In the webpage customer gets an option to select between liquid and solid.
4. If the customer selects liquid
   a. Enter the required quantity for liquid.
   b. Once the quantity is entered, the relay is activated.
   c. Relay is turns on the solenoid valve and the liquid flow is initiated.
   d. Now the liquid collected is measured by the flow sensor.
   e. If quantity is not matched liquid flow is continued or else relay and solenoid valve are turned off.
5. If the customer selects solid
   a. Enter the required quantity for rice.
   b. Once the quantity is entered, the servo motor is turned on which rotates the plate, thus opening the valve for rice flow.
   c. Once the valve is opened, rice starts to collect in the container.
   d.Load cell measures the quantity of the rice collected in the collector.
   e. If the collected quantity matches with the quantity entered by the customer, the servo motor rotates the plate to the original position, thereby closing the valve or else rice flow is continued.

RESULTS

Step 1: The message “Insert your RFID” is displayed on the screen once the local server is connected to the network. Customer is required to scan the RFID tag. The RFID card is scanned as shown in the Fig 5.

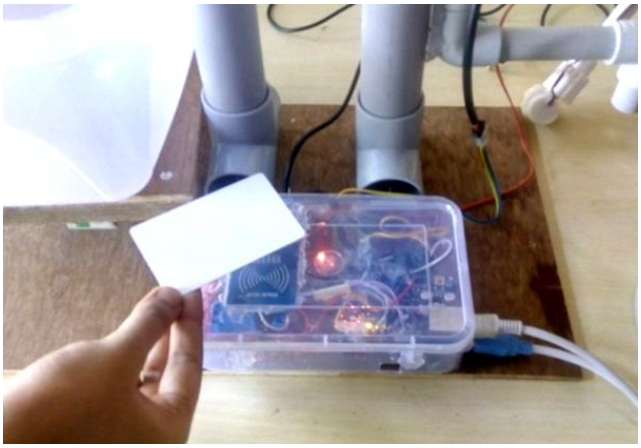

Fig. 5. User swipes the RFID tag

Step 2: If the authentication is validated, a webpage will be displayed which displays user information and commodities allocated for the user. It also provides provision for the user to enter the quantity of oil and rice required. The webpage to enter the quantity is shown in Fig. 6.

Fig. 6. Webpage to enter the quantity

Step 3: If user selects liquid section and enters the required quantity then the relay activates solenoid valve, liquid starts flowing in the collector and flow senor measures the liquid flow. Once the measured quantity matches the quantity entered, relay and solenoid valve are turned off and liquid flow is stopped. Fig. 7 shows the flow of liquid.

Fig. 7. Flow of liquid after user enters the quantity

If user selects liquid section and enters the required quantity then the relay activates solenoid valve, liquid starts flowing in the collector and flow senor measures the liquid flow. Once the measured quantity matches the quantity entered, relay and solenoid valve are turned off and liquid flow is stopped.

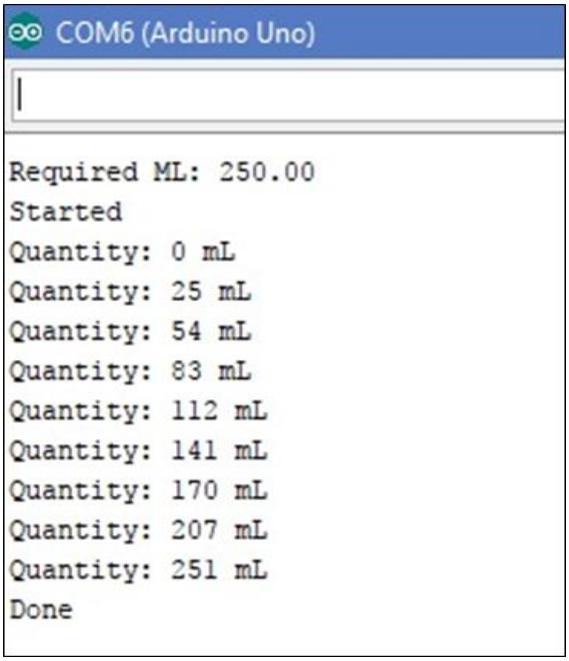

Fig. 8.Sequence of liquid flow detected by flow sensor

Fig. 8 shows the result for opting 250 ml of oil by the customer. Output quantity obtained at successive interval is displayed on the screen/monitor. It can be seen that consecutive/successive measurements are shown at every 22 to 25ml. (resolution). An output of excess +1ml is obtained which is due to the delay involved in the signal flow from flow senor to Arduino and then to relay.

Step 4 : If user selects solid section and enters the required quantity then servo motor opens the valve, rice starts flowing in the collector and load cell measures the rice quantity collected. Once the measured quantity matches with the quantity entered, servo motor closes the valve and rice flow is stopped. The quantity collected is deducted from the beneficiary's monthly limit. Accordingly, the remaining quantity will get updated in the respective database.Fig. 9. Shows the flow of rice after entering the quantity required

Fig. 9.Flow of rice after entering the quantity required

Fig.10 shows the result for opting 100g of rice by the customer. Output quantity obtained is displayed on the screen/monitor. An output of excess +0.lg to +0.4g is obtained which is due to the delay involved in the signal flow from load senor to Arduino and then to servo motor.

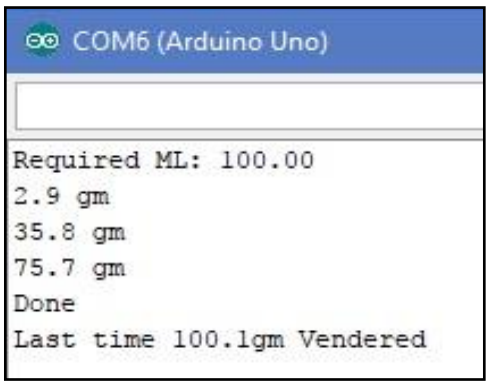

Fig. 10.Quantity of rice measured by load cell

The allotted quantity of rice and edible oil which is 10.00 kg and 5.00 Ltr respectively. For 250ml of oil and 100g of rice withdrawn by the customer, the remaining quantity for rice and oil updated are 9.90 kg and 4.75 Ltrrespectively which is shown in Fig. 11.

Fig. 11.Quantity displayed after collecting rice and oil

CONCLUSION

A safe, secure, and effective method of distribution can be offered by the Automatic distribution system. It resolves the issue with the grocery distribution system's manual method.The database may be kept up-to-date without engaging in any illegal activity. As a result, the grocery distribution system is managed better. It is transparent, and it aids in reducing corruption and modernizing traditional rationing.

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