

Automatic Rationing System Using PLC SCADA

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Abstract

The Ration Dispensing System (RDS) plays an important role in distribution of food. The limitations of conventional ration shop system are due to the manual measurements & the users are not able to get the accurate quantity of material. There is also a chance for the illegal usage of the products in the conventional system due to which a large amount of government money gets wasted. The processing speed of conventional system is low which results in crowding of people in the ration shop.

In this paper we are presenting a solution for all these problems by automizing the system as well as we are maintaining the database at the control station. We replace the conventional ration card by a RFID based smart card with a unique number which is used for authentication and the automatic distribution is done with the help of PLC. For updating, a GSM module is used.

Keywords: PLC, SCADA, Automation, Proximity Sensor, Rationing, Solenoid Valve.

1. INTRODUCTION

Automatic Ration Dispensing System (RDS) presented in this paper is an advanced system useful for efficient way of ration distribution. This project is basically designed to minimize the manual intervention in the process of ration distribution, so as to make the system more transparent & efficient. Our project focuses on design and implementation of Automation of Rationing System. We have designed the hardware for three commodities - one liquid & two solids. These commodities are stored in tanks where they are measured and supplied to the user as and when required. For the measuring purposes, we use load cell & these parameters are controlled by the PLC DELTA DVP-64EH.

RFID tag is used for authentication purpose. Grains are automatically distributed. Solenoid valve is used for opening and closing of container. Two Relays controls the solenoid valve each for movement in each direction. Database is stored in SCADA software at ration shop.

The paper is presented into several sections. Section 2 describes about the hardware of project and its selection criteria. It is subdivided into four parts as power supply, controller, input section and output section. In section 3 the software logic behind the operation is presented. Section 4 gives future scope of implemented system. Section 5 enlists the advantages and disadvantages. Applications are listed in Section 6. Results of the project are shown in section 7. And the section 8 represents conclusion.

2. BASICS OF AUTOMATIC RATIONING SYSTEM

2.1 COMPONENT SELECTION

1) Power Supply

- O/P Voltage: 24 VDC
- O/P Current: 5Amp.
- The regulated power supply is used to power up the
- PLC, sensors and solenoid valves.

2) Controller

PLC: Delta DVP-64EH.

This PLC is selected based on

- No. of inputs and outputs.
- Fast Speed.
- High Reliability.

The dedicated software for this PLC is Delta WPLSoft 2.30 and is programmed using ladder language.

3) Input Section

The input section includes:

Proximity Sensors-

Inductive type proximity sensors are used to sense the presence of the container.

Sensors are selected based on

- Operating voltage
- Output voltage
- Range

4) Output Section:

The output section includes:

A] Gear Motor: DC Gear motor is used to operate the disc.

Specification

Power: 12V

Speed: 30 RPM

B] Solenoid Valves-

One solenoid valve is mounted in a particular design and operated with specific logic so as to maintain the constant pressure within the piping which otherwise may differ the quantity of product passed.

2.2 BLOCK DIAGRAM DESCRIPTION

1. RFID Reader:

When a user swipes the RFID tag, and provides the password to the system, the RFID tag reader (electronic device) detects and reads the RFID tag & forwards the details to the interfaced PLC controller for further processing. The RFID tag reader is interfaced with PLC & a PC. The RFID based smart-card reader is connected to microcontroller and PC via RS232.

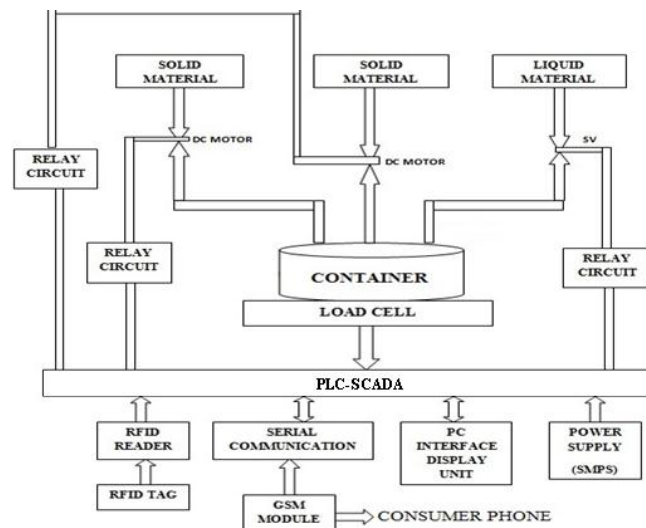


Fig1. Block Diagram of Automatic Rationing System.

2. RS232:

This protocol provides the required interfacing between RFID reader and PLC, also it is the required interfacing between GSM module and PLC.

3. GSM module interfacing with PLC:

Here the GSM module is used to exchange the information in form of SMS between PLC controller and central database provided by the Government. This exchanges the information which is required for user authentication as well as for other details.

4. Load cell:

In our system load cell is used to measure the weight in the sense of its resistive principle. Load (weight) of materials like sugar, rice, etc. are detected by the load cell.

It converts the electrical signals & interfaces with the PLC which controls or sense all the activities occurred under the load cell.

5. Solenoid valve:

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. This valve openings are controlled by relay cards which is interfaced with PLC. This controller controls the solenoid valves using relay card. Solenoid valves opens when only it has energized otherwise it is in closed position.

6. SCADA:

It is used to enter the details of the storage and retrieval. In our project we have used Ellipse since it is easy to operate. RS-232 is used for serial communication.

7. PLC:

The PLC is the brain of the system.

The inputs & outputs of the PLC with their address are shown in the table below:

Table 1: I/O of PLC

Sr. No.	INPUT	INPUT ADDRESS	OUTPUT	OUTPUT ADDRESS
1	User1	X0	Solenoid	Y0
2	User2	X1	Rice Forward	Y1
3	Container Sensor	X2	Rice Reverse	Y2
4			Wheat Forward	Y3
5			Wheat Reverse	Y4

3. SOFTWARES USED IN AUTOMATIC RATIONING SYSTEM**1. WPLSoft 2.30**

WPLSoft 2.30 is the software dedicated to the PLC used in project. One of the simple

programming languages 'Ladder Diagram' is used for programming the PLC.

Features of WPLSoft 2.30:

- Simulation can be possible without connecting to the hardware.
- The WPLSoft 2.30 is easier than ever to program for simple timing, counting or logic functions, as well as complex systems using high-speed count, PID control or sequencing.

2. Elipse SCADA

- Connection to most devices (PLCs, RTUs) in the market.
- Less time required for developing and maintaining applications.

Algorithm-

1. Government provides every customer with a unique identification tag like RFID tag.
2. When the ration is to be distributed at the ration shops, first the verification of RFID tag takes place.
3. Verification is done with help of databases stored by the Government.
4. After completing of verification process, consumers are ask for the type of material and quantity through the real time SCADA access .
5. The solenoid valve and motors works accordingly based on the type of goods asked.
6. The appropriate quantity is properly provided with the help of the load cells .
7. Solenoid valve and motors gets deactivated after the required quantity is filled in the container.
8. GSM will send data related to the transaction in form of SMS to consumer.

4. FUTURE SCOPE

- The same system with existing components can also be used for keeping employees record in multibranch organizations.
- It can be also carried out for various remote security database for multibranches. Application as hardware requirement is same, the difference is that some relay and sensors need to be attached.

5. ADVANTAGES AND DISADVANTAGES

1) ADVANTAGES

- i. Corruption in the Government and market sector can be prevented if this system becomes automated.
- ii. Increased adulteration in consumables can be prevented.
- iii. Bring transparency.
- iv. This system helps to maintain the data properly.

2) DISADVANTAGES

- i. It requires skilled knowledgeable & experienced engineer.
- ii. Requires timely maintenance & upgradation.

6. APPLICATIONS

- **Replacement for existing PDS:**

It can replace the existing Government Of India's Public Distribution System (PDS) which is responsible for distributing essential commodities to a large number of people through a network of FPS (Fair Price Shops) on a recurring basis.

- **Retail Market Sector:**

It can be used in retail market sector such as in Shopping Complexes, Supermarkets, Ration Shops to automate the process and to sell items without human intervention.

- **Large Scale implementation:**

If implemented on large scale it can be used in ration processing factories and organizations for simultaneously weighing and packaging of items which are intended for selling.

7. RESULT**Table 2: Results**

Weight (in Kg)	Load cell output Voltage (mv)	Amplifier Output
NO LOAD	0.57	0.18
1Kg	2.7	0.74
2 Kg	5.3	1.3
3 Kg	7.2	2.2
4Kg	9.6	2.7

Above calculations are for the output which we get from the load cell, which is in millivolts. That output must be amplified using instrumentation amplifier (INA125). This is the main weight measuring part of our project and this operates on the resistive principle.

8. CONCLUSION

We have implemented a compact, economic and user friendly ‘Automatic Rationing system’. It is flexible in terms of filling various batches based on quantity of solid & liquid to be filled.

This paper has proposed an application of automation illustrating a PLC based automatic rationing system. The real time representation of the process can be viewed on the Elipse SCADA software.

Thus we have developed a system that can help to extend its use over wider area.

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