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# Automation of Ration Shop Using Plc

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***ABSTRACT:*** *Automatic Ration Dispensing System presented here is an advanced system useful for the automatic & more efficient way of ration distribution. This project is designed to minimize the manual intervention in the process of ration distribution, so that more transparency & efficiency can be maintained*
*Our project focuses on design and implementation of Automation of Ration Shop. In recent scenario, all the public and private sectors go for automation in their process. Civil Supplies Corporation is the major public sector which manages and distributes the essential commodities to all the citizens. In that system various products like Rice, sugar and kerosene are distributed using conventional ration shop system. Some of the limitations of conventional ration shop system are Due to the manual measurements in the conventional system, the user can not able to get the accurate quantity of material.*
*And also there is a chance for the illegal usage of our products in the conventional system. i.e. the materials are robbed by making wrong entries in the register without the knowledge of the ration card holder. Due to that large amount of money given by government gets wasted. The Ration shops cannot able to meet the requirements of the user due to the over population of our country. So the processing speed is low As a result, there is always crowd of people in the ration shop.*

## I. INTRODUCTION

Automatic Ration Dispensing System presented here is an advanced system useful for the automatic & more efficient way of ration distribution. This project is designed to minimize the manual intervention in the process of ration distribution, so that more transparency & efficiency can be maintained.

Our project focuses on design and implementation of Automation of Ration Shop. In recent scenario, all the public and private sectors go for automation in their process. Civil Supplies Corporation is the major public sector which manages and distributes the essential commodities to all the citizens. In that system various products like Rice, sugar and kerosene are distributed using conventional ration shop system. Some of the limitations of conventional ration shop system are Due to the manual measurements in the conventional system, the user can not able to get the accurate quantity of material.

And also there is a chance for the illegal usage of our products in the conventional system. i.e. the materials are robbed by making wrong entries in the register without the knowledge of the ration card holder. Due to that large amount of money given by government gets wasted. The Ration shops cannot able to meet the requirements of the user due to the over population of our country. So the processing speed is low As a result, there is always crowd of people in the ration shop. Due to the human operations the working hours of the ration shops are restricted, so that the user cannot able to get the material at any time i.e. 24 * 7 basis. To overcome these problems we go for the automation of the ration shops using embedded PLC. In our project, we have desired to control the parameters Level and Load by GEFANUC PLC. Some of the commodities distributed under Public Distribution system are Rice, Kerosene and Sugar

To overcome those problems, we are going for the Automation of ration shop. In our project we designed the hardware for two commodities namely Sugar and Kerosene. These two commodities are stored in reservoir tanks and they are measured and supplied to the user as and when required. The user has to enter the required product and quantity using a keypad andLCD display. For the measuring purposes, we use load cell for sugar and Resistance type Ball float Level Sensor for Kerosene. And these parameters are controlled by the Embedded PLC GEFANUC. Motorized gate valves are used for the measurement and delivery operations. Four tanks are designed, two of them are reservoir tanks and another two of them are delivery tanks.

## II. BLOCK DIAGRAM

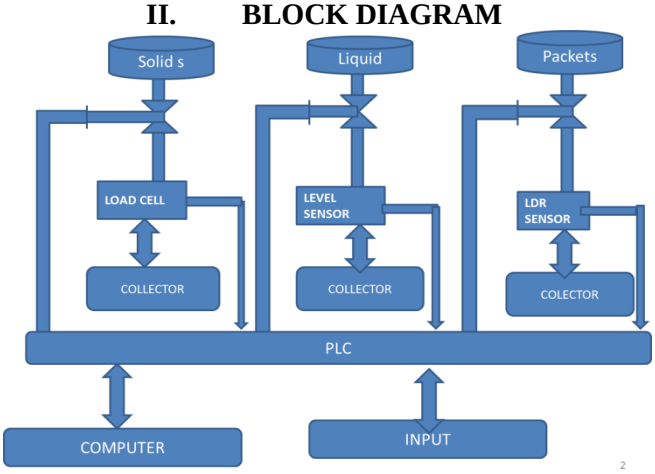



Fig.1: Block Diagram of automatic ration shop system

In automatic ration shop we use PLC for controlling purpose. Three different commodities like sugar/rice, oils and packets/soaps can be counted using three measuring set ups. For programing purpose we use personal computer. Inputs are given directly from mechanical switches and sensors. The controller outputs are used to drive motors and solenoid valves. Different sensor assemblies used are,

## III. LEVEL SENSOR

The level station consist of three containers ;

- Reservoir/storage tank
- Measuring chamber
- Collecting flask

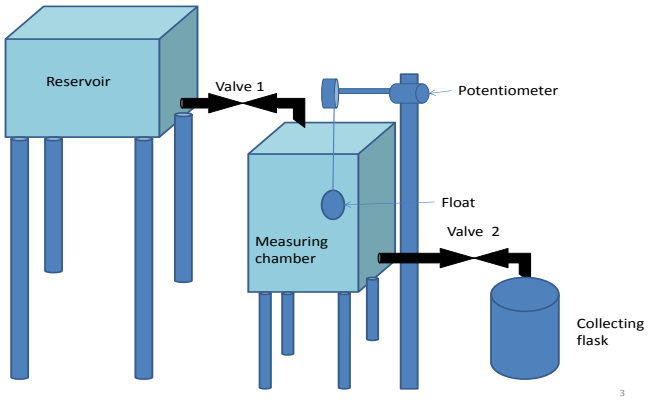



Fig 2: level station

Before the starting of measuring process, the measuring tank level should be a the specified reference level it can be achieved by the operation of on/off valve connected between the reservoir and collecting chamber .Before the starting measuring process the PLC check whether the measuring chamber level is at the reference level. If thru, then measuring process starts by opening the valve V2 it remains open until the specified amount of liquid is discharged from the measuring chamber or collected at the collecting flask.. If the condition is false, then the measuring chamber level is adjusted to the reference level by opening valve V1.

## IV. COUNTING STATION

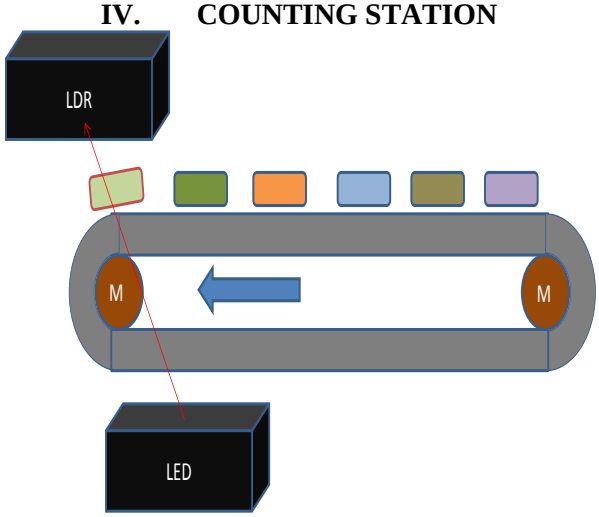



Fig 3: counting station

In counting station we use a LDR sensor circuitry and a conveyer system, the chain conveyer is driven by a high torque 24v dc motor. The rotation of the motor is controlled by PLC output. In LDR sensor setup a LED and LDR are placed in opposite position. When packed items moves through the conveyer, the intensity of light falling on the LDR changes, this change is sensed by the sensor circuitry and counted by PLC. The counting speed of the setup is depends on the sensitivity of LDR so the motor speed should be adjusted with the sensitivity of LDR.

## V. LDR SENSING CIRCUIT

This circuit uses a popular timer I.C 555. I.C 555 is connected as comparator with pin-6 connected with positive rail, the output goes high(1) when the trigger pin 2 is at lower then 1/3rd level of the supply voltage. Conversely the output goes low (0) when it is above 1/3rd level. So small change in the voltage of pin-2 is enough to change the level of output (pin-3) from 1 to 0 and 0 to 1. The output has only two states high and low and cannot remain in any intermediate stage. Pin

4, 6 and 8 is connected to the positive supply and pin 1 is grounded. To detect the present of an object we have used LDR and a source of light. LDR is a special type of resistance whose value depends on the brightness of the light which is falling on it. It has resistance of about 5k ohm when in total darkness, but a resistance of only about 1k ohms when brightness illuminated. It responds to a large part of light spectrum. We have made a potential divider circuit with LDR and 4.7K variable resistance connected in series. We know that voltage is directly proportional to conductance so more voltage we will get from this divider when LDR is getting light and low voltage in darkness. This divided voltage is given to pin 2 of IC 555. Variable resistance is so adjusted that it crosses potential of 1/3rd in brightness and fall below 1/3rd in darkness.
Sensitiveness can be adjusted by this variable resistance. As soon as LDR gets dark the voltage of pin 2 drops1/3rd of the supply voltage and pin 3 gets high and LED or buzzer which is connected to the output gets activated.

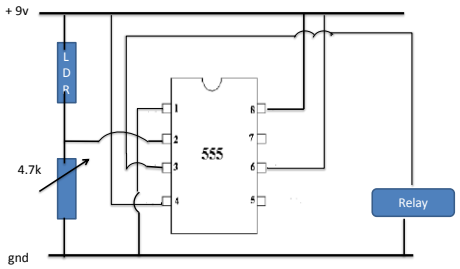
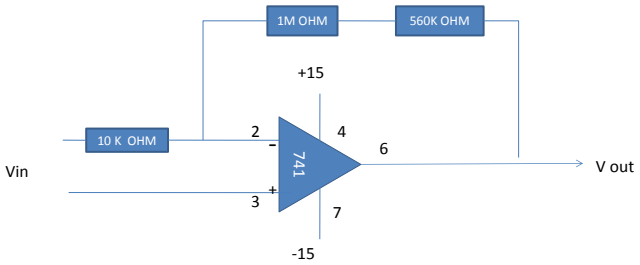


Fig 4: LDR sensing circuit.

When light falls on the LDR then its resistance decreases which results in increase of the voltage at pin 2 of the IC 555. IC 555 has got comparator inbuilt, which compares between the input voltage from pin2 and 1/3rd of the power supply voltage. When input falls below 1/3rd then output is set high otherwise it is set low. Since in brightness, input voltage rises so we obtain no positive voltage at output of pin 3 to drive relay or LED, besides in poor light condition we get output to energize

## VI. AMPLIFYING CIRCUIT




## VII. COMPONENT SPECIFICATION

### VII.1. LOAD CELL

The Wheatstone bridge configured above is a simple diagram of a load cell. The resistors marked T1 and T2 represents train gauges that are placed in tension when load is applied to the cell. The resistors marked C1 and C2 represent strain gauges which are placed in compression when load is applied. The +In and -In leads are referred to as the +Excitation (+Exc) and -Excitation (-Exc) leads. The power is applied to the load cell from the weight indicator through these leads. The most common excitation voltages are 10 VDC, and15 VDC depending on the indicator and load cells used. The +Out and -Out leads are referred to as the +Signal (+Sig) and -Signal (-Sig) leads. The signal obtained from the load cell is sent to the signal inputs of the weight indicator tobe processed and represented as a weight value on the indicator's digital display.

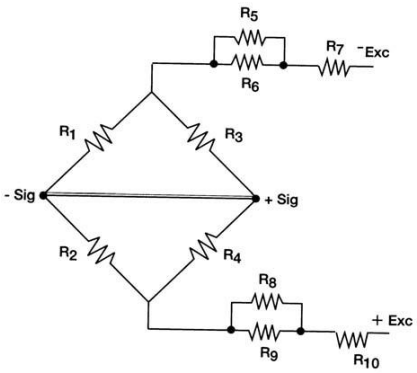


Fig 6: Load cell circuit

As weight applied to the load cell, the gauges C1 and C2 compress. The gauge wire becomes shorter and its diameter increases. This decreases the resistances of C1 and C2. Simultaneously, gauges T1 and T2 are stretched. This lengthens and decreased the diameter of T1 and T2, increasing their resistances.

Fig.7: Strain gauge load cell

| COLOUR | TERMINAL |
|---|---|
| RED | + INPUT |
| GREEN | + OUTPUT |
| WHITE | - OUTPUT |
| BLACK | - INPUT |

Table 1: load cell output

These changes in resistances cause more current to flow through C1 and C2 and less current to flow through T1 and T2. Now a potential difference is felt between the outputs or signal leads of the load cell. Let's trace the current flow through the load cell. Current is supplied by the indicate through the -In lead. Current flows from -In through C1 and through -Out to the indicator. From the indicator current flows through the +Out lead, through C2 and back to the indicator at +In.

**VII.2. LIGHT DEPENDING RESISTOR**

LDR (Light dependent resistor) Engineering is a technique of making several electronics circuits following the logic of a simple light and dark sensor using transistors, 555 IC and 741 IC. Out of several optical sensors, light dependent resistor can be used for making light/dark sensors. A dark sensor switches on transistor or LED whenever the incident light intensity is decreased, whereas a light sensor works in opposite way.

In LDR Engineering, we first understand the working principle of any circuit using LDR, and then we replace the LDR with a fixed resistor or some other electronic component that makes the simple automatic light/dark sensor work as a completely different device.

Making automatic light/dark sensor circuits using different methods can make you observe several electronics components. On the other hand, modifying those automatic light/dark sensor circuits to some functionally different circuits like touch switch,water level indicator, clap switch, etc. can make you understand about those circuits. In this article, we will see how we can use the concept of a dark sensor to make a touch and a clap switch

**VII.3. RELAY**

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching Mechanism mechanically, but other operating principles are also used. Relay are used where it is necessary to control a circuit by a low-power signal or where several circuit must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signals coming in from one circuit and retransmitting into another. Relays were used extensively in telephone exchanges and early computers to perform local operations.

Fig.8: relay

A type of relay that can handle the high power required to directly control an electric motor is called a conductor. Sol id state relays control power circuit with no moving parts instead using a semiconductor device to perform switching. Relays withcalibrated operating characteristics and sometimes multiply operating coils are used to protect electrical circuits

from over load or faults; in modern electric power systems this functions are performed by digital instruments still called "protective relays".

**VII.3.1 BASIC DESIGN AND OPERATION**

A simple electromagnetic relay consist of a coil of wire surrounding a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts. The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured are closed, and the other is open.

Other relays may have more or fewer sets of contacts depending on their functions. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit via the yoke, which is soldered to the PCB.

When an electric current is passed through coil it generates a magnetic field that attracts the armature and the consequent movement of the movable contact either makes or breaks a then movement opens the contacts and breaks the conWhen the current to the coil is switched off, the armature is returned by the force approximately half as strong as the magnetic force, to its position relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low voltage application this reduces noise; ina high voltage or current application it reduces arcing.

When the coil is energized with direct current a diode often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Some automotive relays include a diode inside the relay case. Alternatively, a contact protection network consisting of a capacitor and resistor in series may absorb the surge. If the coil is designed to be energized with alternating current, a small copper "shading ring" can be climbedto the end of the solenoid
section, andvice versa if the contacts were open ., creating a small out- of-phase current which increases the minimum pull on the armature during the AC cycle. A solid state relay uses a thyristor or other solid state switching device, activated by the control signal, to switch the control load instead of a solenoid

**VII.4. POTENTIOMETERS**

The humble potentiometer (or pot, as it is more commonly known) is a simple electro-mechanical transducer. It converts rotary or linear motion from the operator into a change of resistance, and this change is (or can be) used to control anything from the volume of a hi-fi system to the direction of a huge container ship.

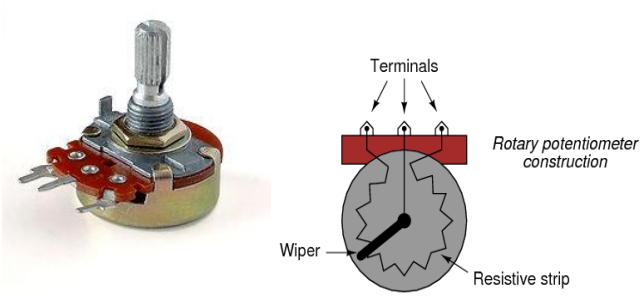


Fig.9: potentiometer

The pot as we know it was originally known as a rheostat (or rheostat in some texts) - essentially a variable wire wound resistor. The array of different types is now quite astonishing, and it can be very difficult for the beginner (in particular) to work out which type is suitable for a given task. The fact that quite a few different pot types can all be used for the same task makes the job that much harder - freedom of choice is at best confusing when you don't know what the choices actually are, or why you should make them. This article is not about to cover every aspect of pots, but is an introduction to the subject. For anyone wanting to know more, visit manufacturers' web sites, and have a look at the specifications and available types.

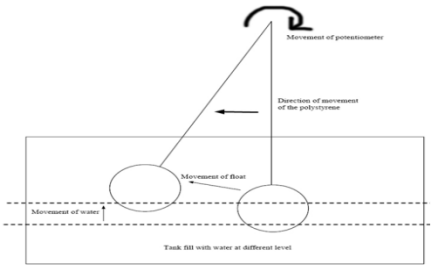


Fig.10: potentiometer movement with level

The very first variable resistors were either a block of carbon (or some other resistive material) with a sliding contact, or a box full of carbon granules, with a threaded screw to compress the granules. More compression leads to lower resistance, and vice versa. These are rare in modern equipment, so we shall limit ourselves to the more common types

**VII.5 SOLENOID VALVES**

The type of solenoid valve refers to whether that valve is a 2-way, 3-way or 4-way. A 2-way valve (Figure 1) has two port connections-a pressure or input port (port 1) and an outlet port (port 2). These valves are used to stop the flow of a fluid or start the flow of a fluid in a piping configuration. Usually, a 2-way valve is referred to as a 2/2 valve, which means the valve has two ports and two positions. The positions are: 1) on or energized and 2) off or de-energized.

Fig.11: solenoid valve

Three-way valves (Figure 2) are those that have three ports-a pressure or inlet port (port 1), a cylinder port (port 2) and an exhaust port (port 3). A 3-way valve's most common application is for process valve automation. The solenoid valve sends air to a spring return actuator or cylinder, which creates rotational or linear movement to open or close a process valve.In this case, the media is usually compressed air or gas that is creating work, which is where the term "fluid power" is derived. The power of a compressed gas or pressurized liquid is controlled to create mechanical work. Three-way valves are usually referred to as 3/2 valves-they have three ports and two positions.

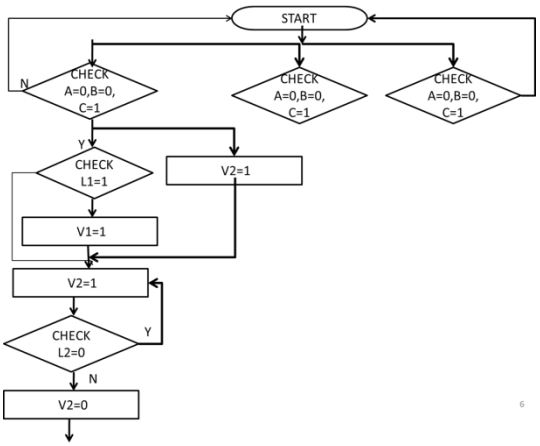
Operation is a word used to describe if a valve is normally open (NO), normally closed (NC) or universal (U). NO and NC refers to the state of a 2-way solenoid valve when de-energized or off. NO, NC or U is used to describe the state of a 3-way valve when it is de-energized or off. Below is a table that describes operation modes of 2-way and 3-way valves.

**VII.6. HIGH TORQUE DC GEARED MOTOR 100RPM**

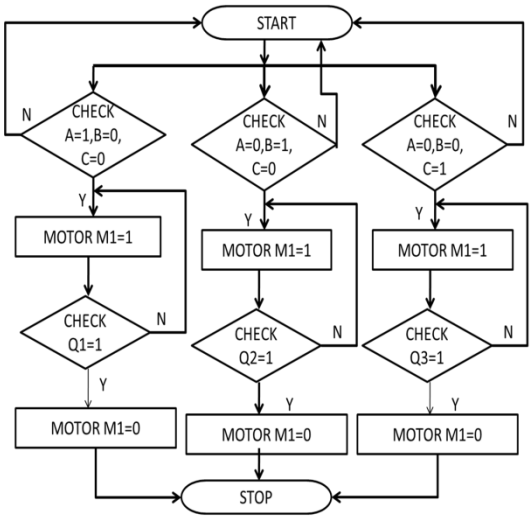
- High torque DC motor with Metal Gear box and off centered shaft.
- 100 12V DC geared motors for robotic application.
- It gives a massive torque of 35 Kgcm.
- The motor comes with metal gear box and off centered shaft.
- 6mm diameter shaft with M3 thread hole.
- Gear box diameter 37mm.
- Motor diameter 28.5mm.
- Length 63mm without shaft.
- Shaft length 15mm.
- 150gm Wight.
- No load current 800mA, load current up to7.5A.

## VIII. FLOW CHART

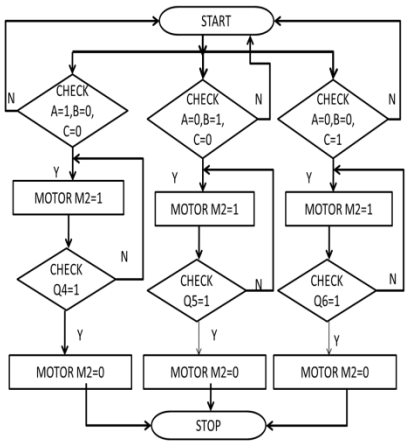
**VIII.1 LEVEL STATION**



**VIII.2. WEIGHING SECTION**




**VIII.3. COUNTING STATION**




## IX. ADVANTAGES

- Reliability
- PLC/DCS along with upper computer raises the system reliability.
- The upper computer is not with the real time control process of PLC/DCS, except gives the order of initial process parameters and control; therefore, the upper computer is off-line, PLC/DCS can successfully go through the production.
- Mixed programming with high-level and assembly languages.
- Not only ensure the system reliability, but also benefit for software upgrade;
- Make operation easy and intuitive;
- Visualization
- Flexibility
- Bring transparent.

## X. CONCLUSIONS

Our project focuses design and implementation of Automation of Ration Shop. In recent scenario, all the public and private sectors go for automation in their process.. In that system various products like Rice, sugar and kerosene are distributed using conventional ration shop system. Some of the limitations of conventional ration shop system are Due to the manual measurements in the conventional system, the user can not able to get the accurate quantity of material.Through our project we are overcome these problems.

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