AUTOMATIC SEALING MACHINE FOR METAL CONTAINER

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Abstract:-

Packaging of food material is final stage in food industry. The life of the material packed is depending on the structure and quality of packaging. So there is need of precisions in the packaging, especially for the food material.In many industries for packaging of large quantity of material, metal containers are used. These containers cannot seal by plastic coating. So there is need of metal sealing by means of solder that container. This kind of packaging is done manually which create many problems. To overcome these problems, an approach has to be made to find a proper platform for the design and testing of the sealing projects which makes the packaging proper and perfect.

In this proposed system, an invention made for solving a problem of packaging of metal containers in food industry. This Project details the mechanical design and software requirements. This paper describes the Automation done for the sealing the metal container to fulfill the industrial need.

Introduction:-

Packaging of metal container is done by manually. Though the sealing will convert from manually to automatically the sealing material remains same. The material is made of Pewter. The sealing of metal container using pewter is known as 'Soldering'. Soldering requires the heater to melt the soldering material. Currently we follow the manual procedure of soldering in which the soldering heater is heated by using coal. The coal heating is slower process which takes more time than soldering. By making automation in this we can reduce the time consumed by the coal heating.

The main objective of the project is to make the machine which will solder the cap of metal container as per industrial requirements by improving the efficiency and also to reduce the time. So as there is need of survey of some factors like how much time requires for the heating the heater? How much time requires soldering / sealing single container? What is the production rate? So, we can reduce the sealing time which will beneficial for industries as well.

Block Diagram:-

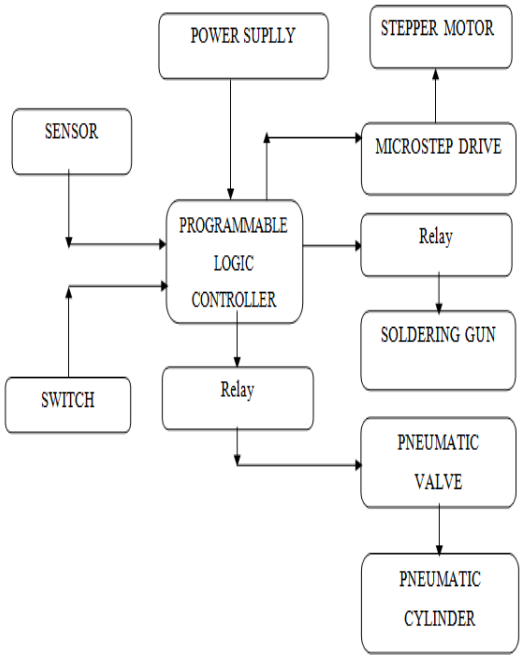

Fig.1.Block diagram

- **Description**:-

Above fig shows the block diagram of Automatic sealing machine. As shown in figure PLC is connected with input devices

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and with output devices in different ports. For the input devices there is no need of consideration of the device type like NPN or PNP. We can connect any of them.

The input devices we can connect to PLC are switches, sensors. Similarly output devices are valves, motors (stepper, dc motors), relays etc.

Mostly for connecting valve, DC motors there is need of connecting the relay, so as to perform the switching operation. But as shown above for stepper motor we require a driver to communicate with PLC.

All devices shown in above block diagram, operates on the 24V DC voltage. The total current required for system is about 3.5amp.

Manufacturing:-

- **Hardware**

The hardware used in this proposed work is listed below:

SrNo.	Name of Device
1.	Switched Mode Power Supply (SMPS)
2.	Programmable Logic Controller(PLC)
3.	Sensor
4.	Micro step Driver
5.	Stepper Motor
6.	Pneumatic Valve
7.	Pneumatic Cylinder
8.	Gear- Bevel Gear

- **Programmable Logic Controller (PLC):-**

This is the main part of this design. It is programmable hardware which controls all other hardware's operations.

Working of PLC:-

Input signal:

PLC reads the ON/OFF status of each input and stores the status into memory before evaluating the user program. Once the external input status is stored into internal memory, any change at the external inputs will not be updated until next scan cycle starts.

Program:

PLC executes instructions in user program from top to down and left to right then stores the evaluated data into internal memory. Some of this memory is latched.

Output:

When END command is reached the program evaluation is complete. The output memory is transferred to the external physical outputs.

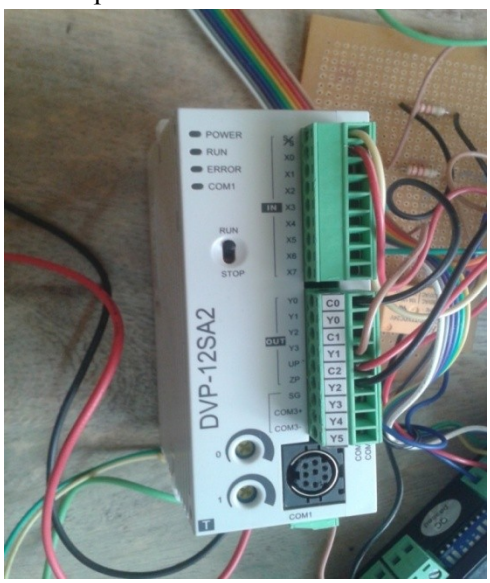

Fig2. Programmable Logic Controller

The PLC used is of manufacturer DELTA. The model name is DVP12SA211T having 8 inputs and 4 outputs. This PLC is NPN type PLC. Gives output of 0V with respect to 24V supply. As this model is of transistor type PLC, the Transistors are used both at input and output ports internally.

As transistorized device is used here, when the base current goes high then switching is perform. This is simplest than using relay at every ports. So that whole

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system got the reduced size and less complexity.

This device requires 24V DC supply carries current of 1amp. Also supports all devices operating on 24V DC supply.

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I/O Configuration

Model	Input		Output		I/O Configuration	
	Point	Type	Point	Type	Relay	Transistor
DVP 12SA211R	8	DC (Sink Or Source)	4	Relay	S/ S X0 X1 X2 X3 X4 X5 X6 X7	S/ S X0 X1 X2 X3 X4 X5 X6 X7
DVP 12SA211T				Transistor	C0 Y0 Y1 Y2 Y3 ▮ SG COM3+ COM3-	Y0 Y1 Y2 Y3 UP ZP SG COM3+ COM3-

Note: The layout of output terminals on DVP-SA2 is different from that on DVP-SA.

Software:-

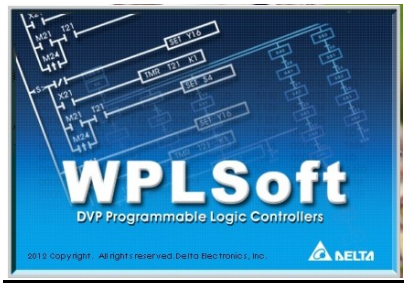
IEC 61131-3 standard

IEC 1131-3 is the international standard for programmable controller programming languages. The following is a list of programming languages specified by this standard:

- Ladder diagram (LD)
- Sequential Function Charts (SFC)
- Function Block Diagram (FBD)
- Structured Text (ST)
- Instruction List (IL)

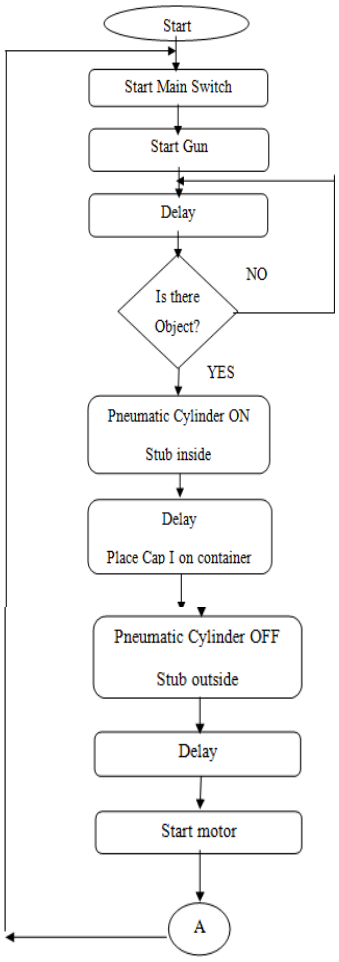
One of the primary benefits of the standard is that it allows multiple languages to be used within the same programmable controller. This allows the program developer to select the language best suited to each particular task.

Software Used in Proposed System:-



This software supports all Delta PLC. Programmer can program in three languages viz. Ladder logic, Sequential Flow and Instruction Set.

Flow Chart



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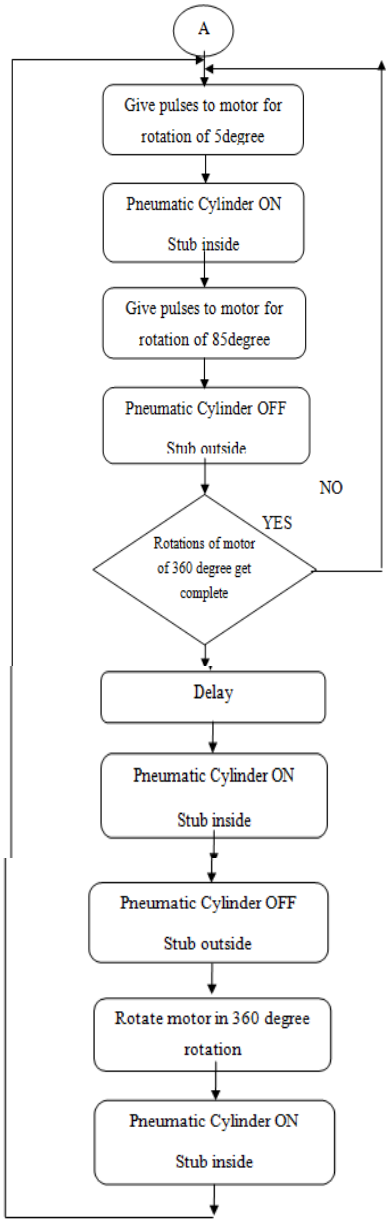


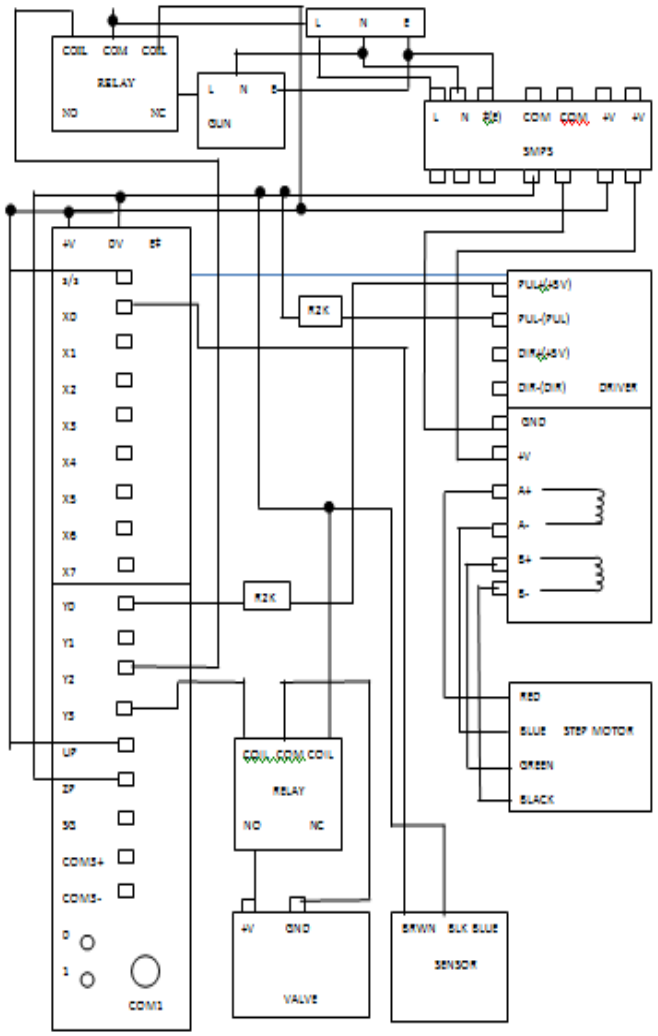
Description:-

As per requirement of sealing pattern above flow is designed. Here soldering gun is switched by considering the production rate. One counter is used for counting the objects, which is further used for switching soldering gun. As for controlling the rotation of soldering gun with respect to angle, the stepper motor is used. Pulses to stepper motor are given by driver, controlled by PLC.

Pressure to pneumatic cylinder is given by solenoid valve.

Experimentation:-

- **Interfacing Diagram:-**



s/s is input supply for input devices.

If input devices are NPN then s/s acts as sink mode, s/s= +24V is needed for sink mode.

If input devices are PNP then s/s acts as source mode. Then s/s is neede to be ground.

Simillary, UP and ZP acts as output supply for output devices. But unlike s/s, for UP and ZP the supply configuration is fixed. Means for NPN PLC user can operate only NPN output devices.

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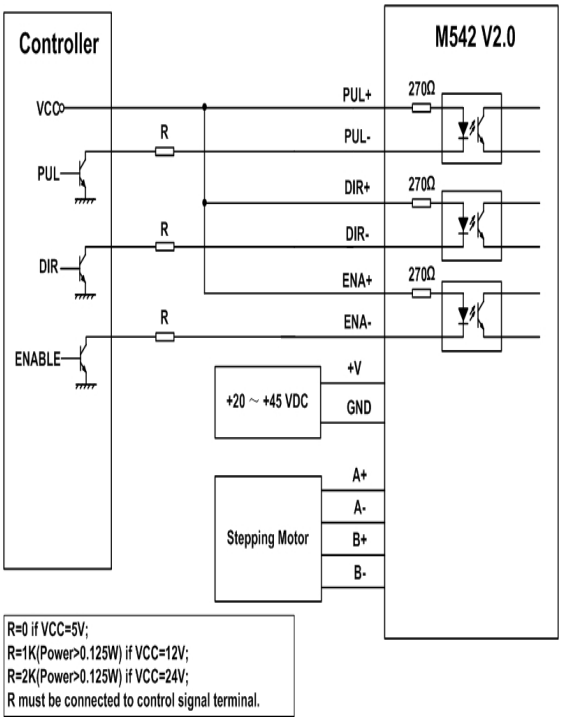
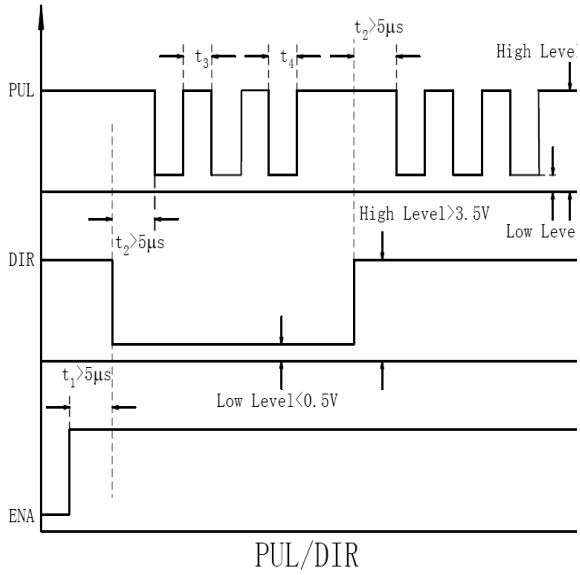
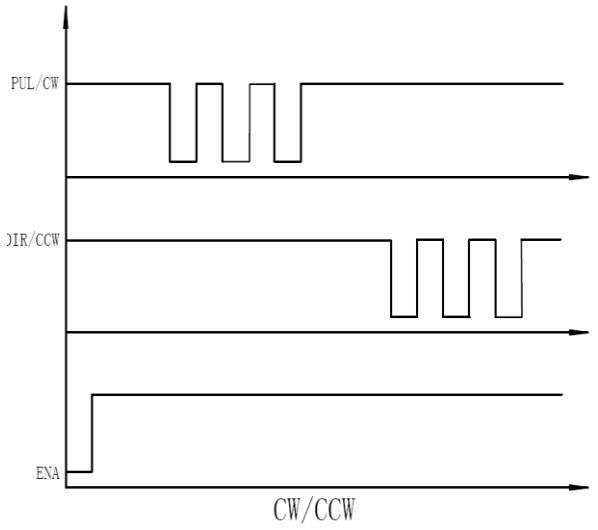
Typical connection of Stepper Motor with Driver



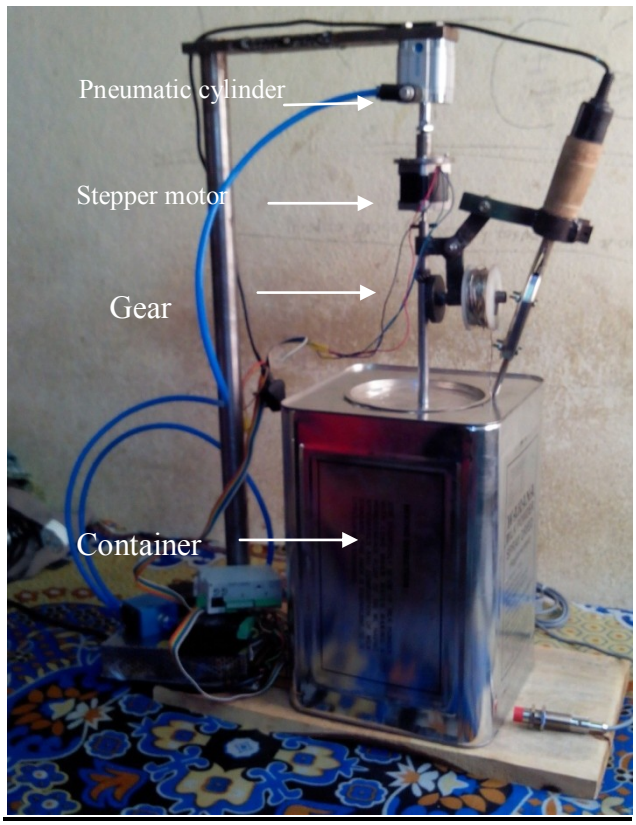
As stepper motor is controlled by PLC by means of Driver, there is need of proper connections. While doing connection, the connectivity between coils of stepper motor must be check. For changing the direction of rotation the direction port is available.

Sequence chart of control signal:-





Hardware Setup:-



Above experimental setup of Automatic Sealing Machine. The metal container is detected by sensor. Pneumatic cylinder is used to move gear and motor system up and down while removing and placing the container on the perticular space.

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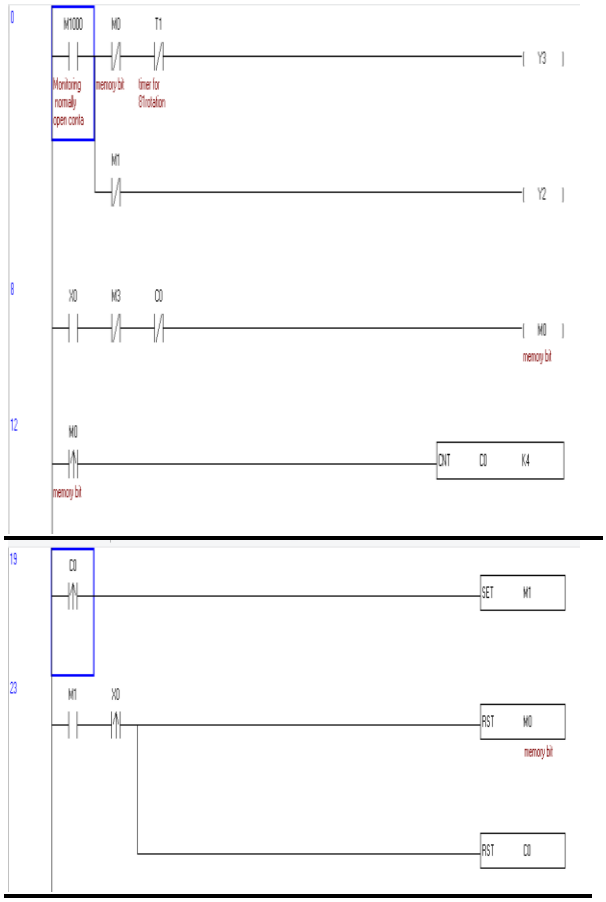
Program inLadder Logic:-



Applications:-

As for solving an industrial problem this project has been designed, there is need of see that whether this solution worked or not. By performing experimentation, it is observed that this model works as per designed. Automation is basically used for reducing man power and improving efficiency. This project exactly proves the use of automation gives tremendous results. Not only time efficient, also saves lots of power as all devices are operating on 24V power supply DC. Also this is analyzed that only one time investment gives long life application with minimum maintenance.

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[15]. International Journal of Engineering Trends and Technology- Volume4Issue3-2013 ISSN: 2231-538Page 500 The Principle of Programmable Logic Controller and its role in Automation Avvaru Ravi Kiran#1, B.VenkatSundeep*2, Ch. SreeVardhan #3, Neel Mathews!4 #Electronics and Communications, KL University, Guntur, Andhra Pradesh, India *Assistant Professor, Electronics and Communications, KL University, Guntur, Andhra Pradesh, India ! General Manager Mobility Solutions, Mahindra Reva Electric Vehicles Pvt Ltd, Bangalore, India

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