



PLC-BASED AUTOMATION PLACING MACHINE

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Abstract

This paper aims at studying the development of a placing machine using PLC (programmable logic control). Originally, the tedious task of placing the components of a product involved immense human labour. But nowadays industries are aiming at minimizing the human efforts by using automated optimized machines. These machines are all- in-one, multi-headed and multi-gantry. This automated machine when put into action directly places the product onto the next stage of production line. The software involves ladder logic programming and hardware involves pneumatic system, limit switches etc. Which would be further discussed in the paper. More productivity being the need of the hour, this machine considerably increases the speed of operation and significantly decreases human efforts.

Keywords

PLC, Ladder Logic , Solenoid valve, Sensor

Introduction

This paper discusses the working of Placing automatic Machine in the production line of various industry such as furniture industry. This machine is used to pace up the boxes using pneumatic single acting cylinder from the conveyor belt and .This was previously being done by human operators and to overcome the tedious and

monotonous task of placing the components of a product which involves immense human labour using automated optimized machines was a solution, which increases the production and reduces human effort.

Workers invest a huge amount of time in manually picking and placing products for the next stage of operation which can be utilized for other relevant operations.

This propelled and motivated to design a mechanism that could eliminate these drawbacks. Presently, this machine is part of an industrially automated production line. Once this machine is put into action the machine will directly place product onto the particular place. This machine will considerably increase speed of operation. Thereby, making production more efficient leading to increasing profits to the industry.

PLC programming is used for the operation of this machine.

Review of literature

Programmable Logic Control is a device that is on a greater scale used in the industry for interlocking of operations, automation, event based control, and order of operations, is utilised in every process industry, requiring process safety and interlocks e.g. thermal power plant, steel industry, cement industry, pharmaceutical industry, petrochemical industry etc. A programmable logic controller, called a PLC is a computer-type device used to control the devices in an industrial facility. The PLCs control variety of industrial facilities E.g. Conveyor systems, food-processing machinery, auto assembly lines. PLCs have gained preference on the factory floor and will remain on the top of the list of choices for some time to come.

These devices were originally designed to replace relay logic circuits. The basic programming language, ladder diagram, resembles the same relay logic schematics. They are real-time controllers using cyclic behaviour. The ladder diagram and instruction list was the first programming language. Like mentioned earlier, the ladder diagram is historically connected with the relay logic used in control before programmable logic controllers emerged. The ladder diagram's basic structure looks like an electrical scheme, with contacts and coils connected between two power rails called rungs.

Design methodology

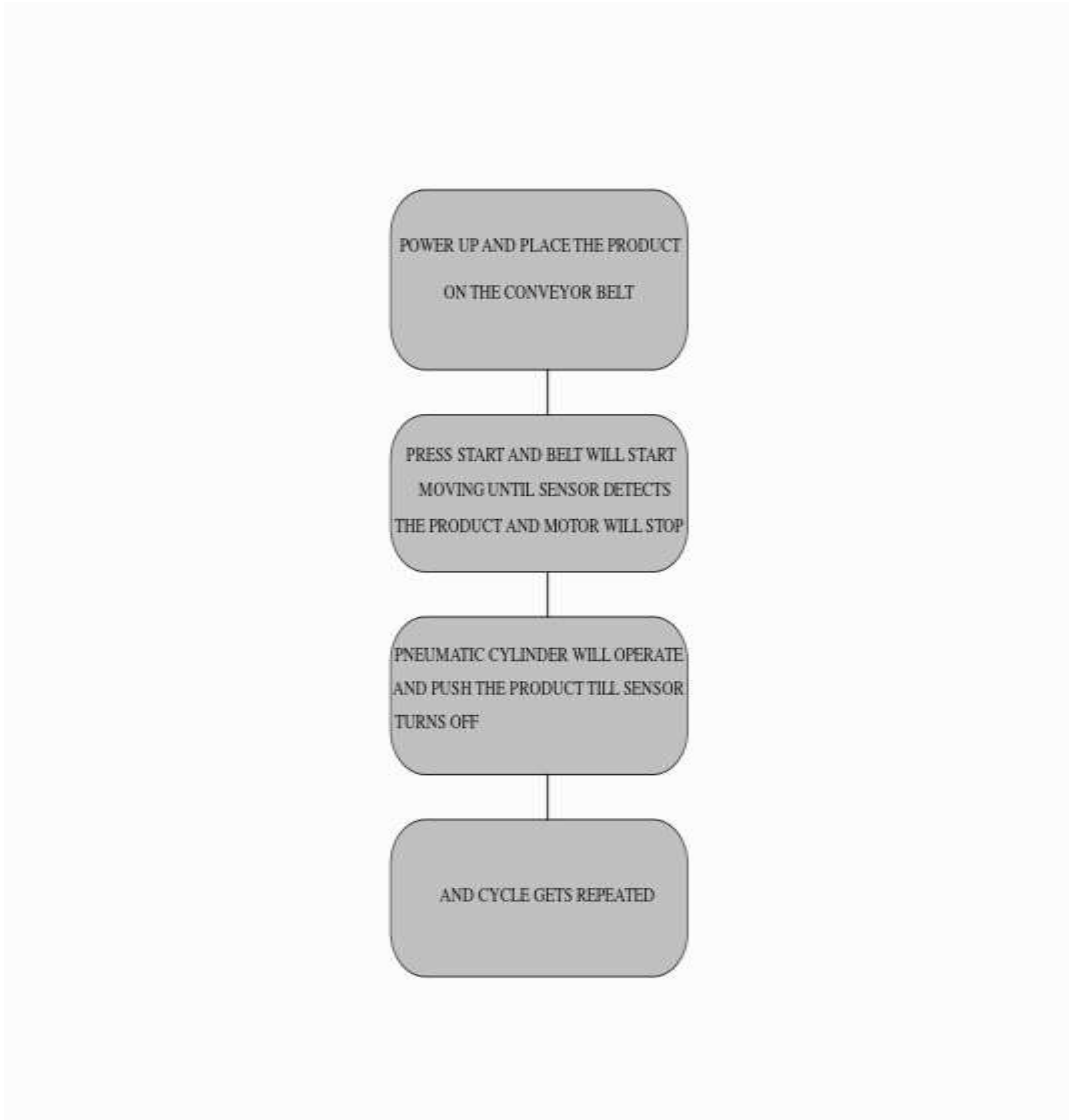
1. This machine makes use of a **pneumatic system**, to push the product out of the conveyor belt.
2. The hardware consists of a **speed limiting sensor** which is used to decrease the speed when the machine arm reaches near the specified destination. The sensor is a **photoelectric sensor**.
3. The machine arm travels towards to the destination with a specified speed and after detecting the sensor the speed decreases so that the machines doesn't crash and there is no damage to the machine

4. This machine includes solenoid valves , which changes the direction of air pressure in the pneumatic cylinder electrically
5. Pressure regulator is been added in series with the solenoid valve in order to control the air pressure of the pneumatic cylinder
6. High power 12vdc(100rpm) has been used to operate the conveyor belt

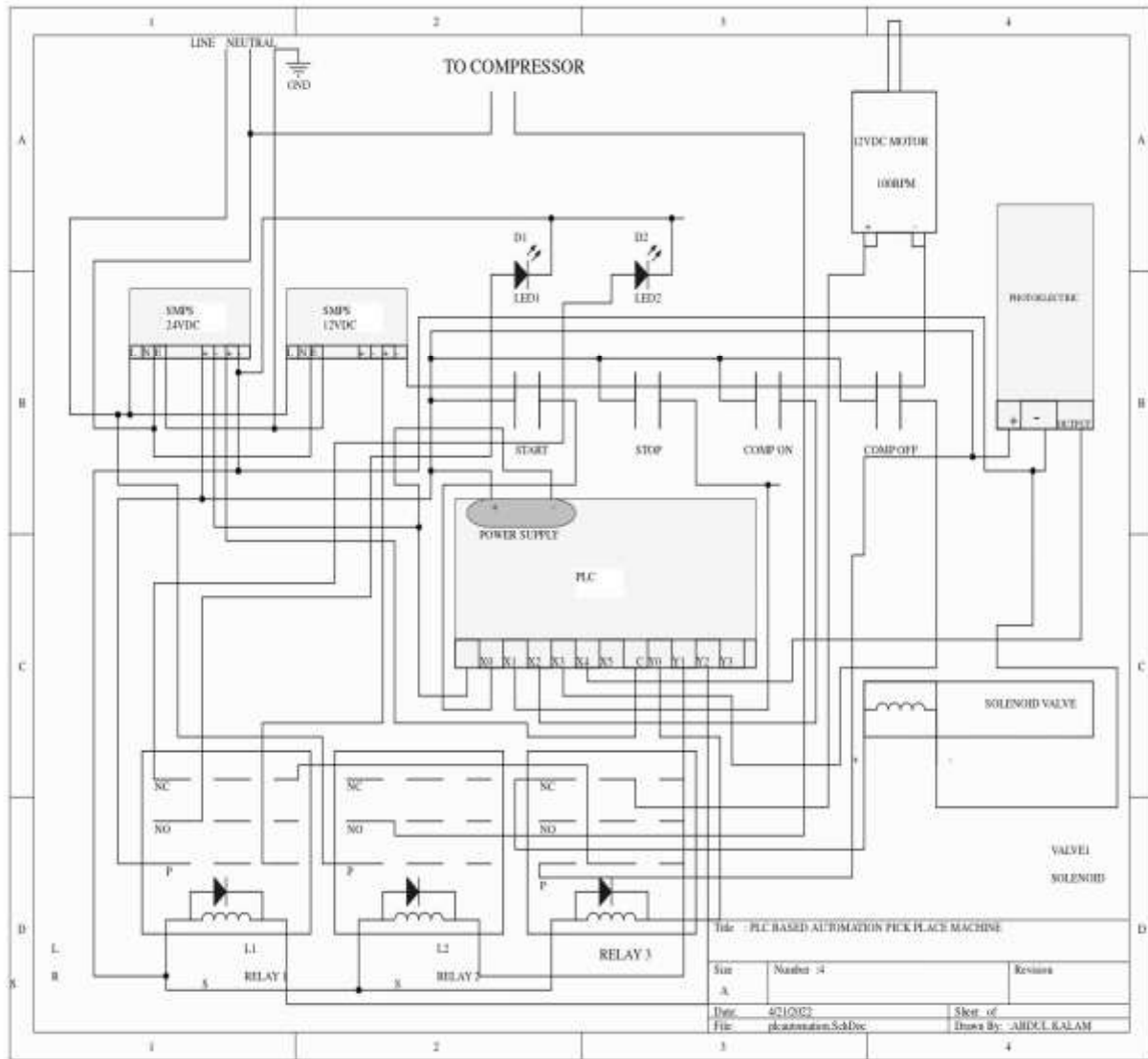
The interfacing of machine needs few electronic and electrical devices. The devices are

1. Plc : Programmable Logic Controller (PLC) is similar to a computer used in an industry to control manufacturing processes, such as in assembly lines, and robots. It is rugged, highly reliable, and easily programmable and fault diagnosis is comparatively easy. Delta 14ssr model PLC has been used in our machine
2. SMPS : A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Here 230V AC supply is converted into 24V DC supply which is then given to PLC. Also 12vdc 10amp smps is used to operate the motor
3. Relay : Relay is an electrically operated switch. It is used to control a circuit by a separate low power signal and where multiple circuits are controlled by a single signal. Omron relay is been used Note: earthing has been given to every electrical equipment

Algorithm:



Schematic of the project:



Ladder Logic :

- Ladder Logic was a written method used originally to document the construction and design of relay racks used in process and manufacture control. Every device in the relay rack is represented by a symbol on the ladder logic with connections between those devices
- It gets its name from the observation that programs in this particular language resemble ladders with a series of horizontal rungs between two vertical rails.
- This logic consists of contacts that break and make circuits to control coils. Every contact or coil signifies the status of a single bit in the memory of the programmable logic control. A ladder program can refer any number, multiple times to the status of a single bit.

- The "contacts" refer to physical inputs to the PLC from physical devices such as limit switches and pushbuttons.

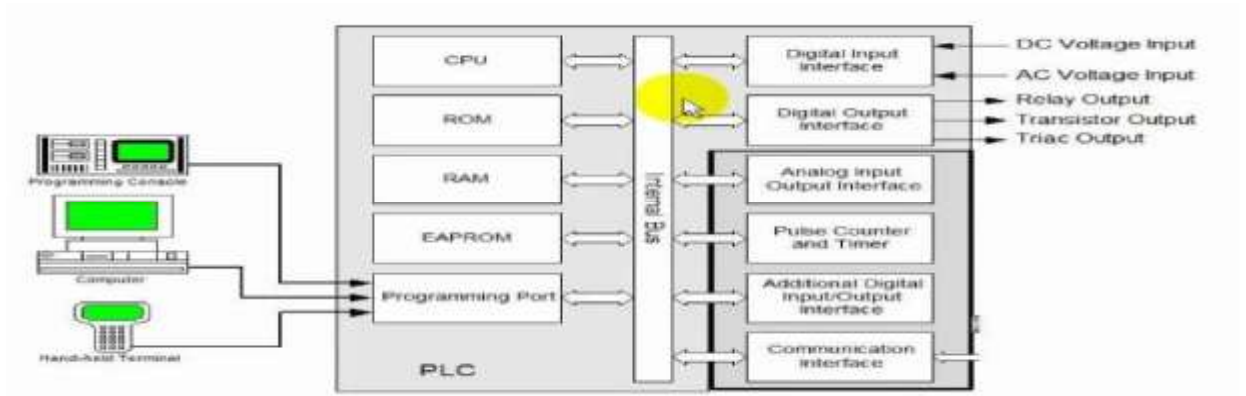


Figure : Block Diagram of PLC

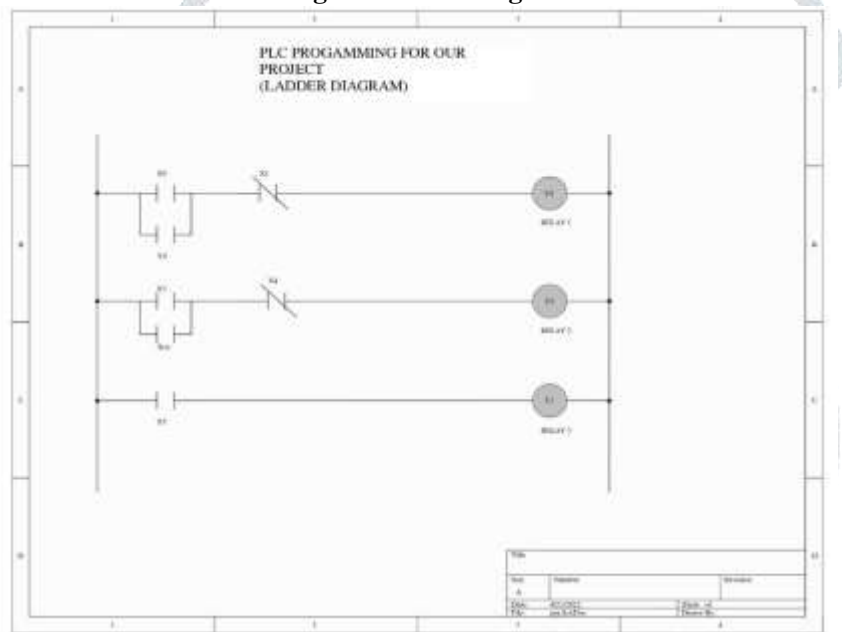


Figure : ladder diagram for our project

Design Constraints

We use two software's to simulate and develop the ladder diagram for the pick and place machine. The two software's are genie g-soft and WPL soft by delta. Both software are freeware and are compatible with a wide variety of PLCs. The software's have their own advantages and disadvantages, g- soft provides a better simulation interface but it has a limit of two contacts per rung, which is too few for any real time operation, on the other hand WPL soft doesn't provide a very interactive simulation interface it allows many more contacts to be placed and hence is better suited for larger designs.

By looking at the figure E , whenever the start switch is pressed , which is connected to the x0 input of the plc , normally open switch in the code (x0) turns into normally closed and hence the output y0 gets turn on. Important

point to remember that whenever x0 gets triggered it should get latched for the continuous supply to the output .In order achieve this normally open switch is placed across x0 with the address bit of output y0. Same goes for the second line of the code, this line is used to turn on and off the compressor. X5 is the input which receives signal from the photoelectric sensor Whenever the products gets detected , x5 gets triggered and turns to normally closed switch.

Note that every output of plc is connected to the relay so that plc doesnot get damaged due to the reverse voltage

It is apparent now that the cylinder system functions correctly. We draw the following conclusions from this example-

1. Auxiliary relays are used to memorize certain events and are used to control the flow of the ladder diagram, i.e. they are used to create a sequential execution.
2. We use hold on circuits to complete the memorizing path even after the input condition is removed.

Specifications Of Components Used :

Sr no	Description	Brand	Rating
1	SMPS	VIVID	24VDC,15AMP
2	SMPS	VIVID	12VDC,10AMP
3	PLC	DELTA	RELAY TYPE
4	SOLENOID	PATEL	5/3,24VDC
5	COMPRESSOR	RENT	240AC
6	PNEUMATIC CYLINDER	PATEL	150PSI

7	RELAY	OMRON	24VDC,4C/O
8	MOTOR	LINTECH	12VDC , 100RPM
9	PHOTOELECTRIC SENSOR	PATEL	0-30VDC,300MM SENSI

Result

Thus the load place on the conveyor belt has been placed in proper collector at proper time . These machines based on PLC have immense scope even from the future perspective, since this has a led to a boom in the automation industry with thunderous results. PLC programming will have varied applications due to the ease in its methodology and numerous advantages.

Conclusion

The PLC has been programmed correctly and is successfully interfaced and operated for automation of placing machine. The use of human labour to pick up panels has been eliminated, increasing the speed of operation efficiently.

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