

Automatic Drilling Machine Based on PLC

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Abstract - This Paper aimed to design and fabricate an “Automatic Drilling Machine based on PLC”. The drilling machining process proposed for a ‘cycle of drilling’. The cycle process starts when the start switch is pressed; the linear motor is puts the drilling head in home position, and rotate the rotary disk to bring the first work pieces to desired position. Meanwhile, the drilling process is running after the ‘inductive sensor’ senses the object. Then the process will stop automatically after making the hole and went back to the home position. After that the rotary disk start to rotate by quarter cycle to carry the drilled object out the table during the lower rotary disk. The PLC used to perform these operations, by reading data from sensors and actuate the AC motors.

Key Words: PLC, Inductive sensor, Quarter cycle, AC motors.

INTRODUCTION

Conventionally drilling machine are hand operated. Often these machines are used for drilling a hole through the job. In conventionally drilling machine, human is the main operator. This engages a Person with time consuming efforts taken to drill the objects. The manually operating Drilling Machine is automated with the help of “PLC Assembly”. The proposed of system will reduce the Human Efforts required to Drill the objects. In these system, concept is based on designing of an Automated Drilling System so as to perform drilling operation automatically in an efficient way. The PLC used to perform these operations, by reading data from sensors and actuate the AC motors. Drilling machine with the PLC control to increase reproducibility with improved accuracy and the quality of drilling process is optimized.

The automated drilling machine system consists of four important stages;

The first stage consists the sensors and switches (input devices). These feed the controller by some information about the machine situations.

The second stage is the controller (PLC), which is the brain of the system, which receives information from sensors and takes the necessary action according to the programmed data.

The third stage is the relay (output devices), which receives orders from the PLC.

The fourth stage is the drilling machine which is to be operated automatically.

When start switch is pressed the first relay is on through PLC and it starts the geared AC motor. Then the geared ac motor starts rotating in forward direction and move the vertical rod downward until the lower limit touched. When the wooden object is in front of photoelectric sensor and if the wooden object comes under the limit range of this sensor it gives signal to the drill motor through PLC and the drill motor starts to drill the object. Once the drill is done the drill motor stopped and geared motor start rotating in reverse direction and brings the vertical rod upward.

Once it touches the upper limit the geared ac motor stop. The whole process is stop by stop switch.

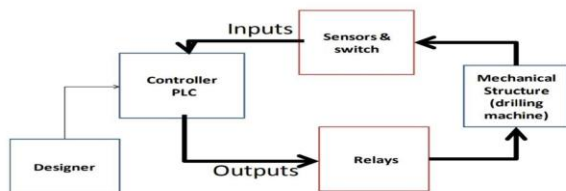


Fig. Block diagram of Proposed System

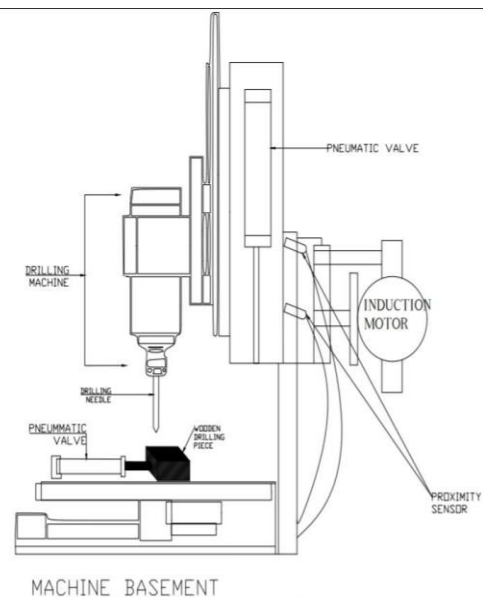
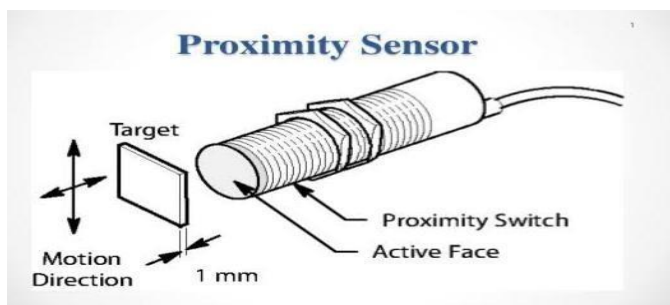


Fig. 2D DIAGRAM OF PLC WITH HELP OF PLC

1.2 System Components and Hardware Structure

Sensors:- Sensors are very important devices in industrial control system, which translate a physical phenomenon into an acceptable signal that can be analyzed. They can be used during pre-process, in-process and post-process operations.

Proximity Sensor:- Proximity sensor is electronic device, non-contact type used to detect an absence or presence an object. Proximity sensors come of two types, inductive proximity sensor and capacitive proximity sensor.



Switches:- Switches are electrical or electronic contact devices used to turn (ON) or (OFF) the flow of electricity through a circuit. Switches are essential components in almost all the electronic devices used today. Switches require another device or action (Force) to change their state from open to close or close to open. Switches might operate manually or mechanically.



Programmable logic Controller :- A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

PLCs were first developed in the automobile manufacturing industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers. Since then, they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

In this project we are using ALLEN BRADLEY micrologix 1100 PLC

Specification :-

INPUT	- 10 (I/0 - I/9)
OUTPUT	- 6 (O/0 - O/5)
Programming software	- RS logix500
I/O capacity	- 156
Communication software	- RS linx
Programming language	- Ladder Diagram programming.
Digital input	- 1. Push button (start/stop switch) 2. Limit switches (upper / lower) 3. Photoelectric sensor
Digital output	- Relay



Fig. ALLEN BRADLEY PLC (micrologix 1100)

Scan Time:- A PLC program generally loops i.e. executes repeatedly, as long as the controlled system is running. At the start of each execution loop, the status of all physical inputs are copied to an area of memory, sometimes called the "I/O Image Table", which is accessible to the processor. The program then runs from its first instruction rung down to the last rung. It takes some time for the processor of the PLC to evaluate all the rungs and update the I/O image table with the status of outputs. Process of a scan cycle.

There are 5 main steps in a scan cycle :-

1. Reading inputs
2. Executing the program
3. Processing communication requests
4. Executing CPU diagnostics
5. Writing outputs

Overview

- ✓ PLCs can range from small modular devices with tens of inputs and outputs (I/O), in a housing integral with the processor, to large rack-mounted modular devices with a count of thousands of I/O, and which are often networked to other PLC and SCADA systems.
- ✓ They can be designed for multiple arrangements of digital and analog I/O, extended temperature ranges,

immunity to electrical noise, and resistance to vibration and impact.

- ✓ Programs to control machine operation are typically stored in battery-backed-up or nonvolatile memory.

LITREATURE REVIEW

[1] Arvind Kumar et al. (1) Automation of drilling machine with the help of Pneumatic Devices. This automation the findings, which demonstrate that any manually operated machine can be converted into automatic machines by using pneumatic devices. But to achieve this one should have the full knowledge of the devices which are being used. By doing so the existing old machines can be modified and made automatic by which the initial cost, to procure new automatic machines may be minimized.

[2] 'G.Niranjan et al. (8) Drill the job/workpiece up to certain Specified Depth controllability. The project "Automated drilling machine with depth controllability" was designed such that the drilling depth is controlled automatically to set value by microcontroller based system.

[3] 'Dnyaneshwar B. Bharad et al. (4) drill two holes at a time with the help of Two Drilling Spindle. The drilling two holes at a time with provision of varying centre distance between two drilling spindle. It has advantage of portability. The size of machine is smaller than the older machine so it is very simple to move from one place to another. So this machine can be easily transported. The overall space required is also minimizing. The efficiency of this machine is better than the older machine. Large saving in power has been achieved. The machine is very simple to operate. It drills the holes at faster rate.

[4] 'Md Ruhul Amin et al. (6) Development of a PLC Controlled Drilling Machine. The existing drill machine was successfully automated using PLC control system. Two motors need in this system. Main motor is used to feed and controlled in different speeds according to work piece hardness. Auxiliary motor needs to control depth of cut according to operation time. The tool bit automatically withdraws from work piece by reversible speed. The step or step less drilling is possible in any type of job with very short time. The whole system is able to shut down automatically after the drilling operation.

[5] 'Chukwumanya, Emmanuel O et al. (7) theoretical design and analysis of a Semi-Automatic Multiple Spindle drilling head. By using multi spindle drilling head, Productivity can be improved. It is also necessary to reduce total machining time. It is possible to drill 2 holes of different diameter can be drill at a time. This machine is very easy to operate and compact in size. Also it is very light in weight. The efficiency of this machine is very high. It has very low cost as compared to other machines.

CONCLUSIONS

The automatic drilling machine was successfully designed and implemented using different techniques of automation. The automation is done to drill a small hole in wood work piece about (3mm) in depth, and perform smoothly and reliably in order to increase the efficiency of drilling machines instead human work. From the results of drilling performance tests, it indicates that the system become more advantageous, as it reduces all the drawbacks of existing manual drilling machine. This automation project gives more accuracy and reduces time consumption for work done. Also increase the productivity in terms of both quality and quantity.

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