PLC based automatic cutting machine

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Abstract— **To understand the application and importance of the involvement of automation in conventional cutting machine in manufacturing. A cutting machine is available in various shapes and sizes, with small hand-held power cutting systems and to bench mounted and finally floor-mounted models. This paper includes the types of cutters, and shop formulas for setting up each operation. Safety plays a critical part in any operation involving power equipment. This paper also includes procedures for maintaining, and proper setting up the work and methods of selecting various tools, and object holding devices to get a job done safely without causing damage to the equipment, yourself, or someone nearby.**

Index Terms—**Pneumatic System, PLC.**

I. INTRODUCTION

Though to evolve and admit automation by the involvement of various types of drives, cylinders and man motion study. In this paper it has been innovated that how we can use or convert conventional cutting process with the help of PLC, Pneumatic Cylinder, sensors and dc motor into the process. It is a time saving with good quality procedure. In the paper the various Man Motion has been done with help of cylinders. Such kind of conversion can be done easily anywhere where high volume with good quality to be produced. The industrial CNC machine components are fabricated using quality material and technology. These are available in varied diameter and sizes at the leading market prices. We ensure to monitor its quality before offering to our esteemed clients across the world.

A. MANUFACTURING AND APPLICATIONS

A cutting machine consists of a part called as cutter, is used to cut the metal, wood, or other materials. Cutter is circular in shape. All the edges of cutter are equally sharp. This cutter is held by a shaft and is rotated and fed into the work at variable speeds.Operators must know how to set up the work, set speed and feed, and provide for coolant to get an acceptable finished product. The size or capacity of the cutting machine is generally determined by the largest piece of stock that can be cut.The system aspects of manufacturing are more important than ever today. The word manufacturing was originally derived from two Latin words, Manus (hand) and factus (make), so that the combination means made by hand.Depending on the human participation in the manufacturing process performed by the manufacturing industries following three categories can be distinguished:
1) Manual-work systems
2) Worker-Machine systems
3) Automatic systems

1) *Manual-Work Systems*: A manual work system consists of one or more workers performing one or more tasks without the aid of powered tools.

2) *Worker-Machine Systems*: In a worker machine system, a human worker operates powered equipment such as machine tool or other production machine.

3) *Automatic systems*: An automatic system is the system in which a process is performed by a machine without direct participation of a human being.

II. DRAWBACKS OF CONVENTIONAL SYSTEMS

In earlier era, cutting technology could not meet the needs of smart cutting system. Generally, manual and semi-automated systems has serious reliability problems and did a poor job. Some problems related to existing systems are as follows-
1) Manual operation
2) Discontinuous operation because of manual working less speed of operation
3) Startup time is more
4) Less production rate
5) It cannot detect metal present in object
6) Unsafe working due to more manual efforts. High maintenance
As this paper is based on automation, it will emphasize on it more. Before discussing on paper I would like to give a brief idea about automation. The automated elements of the production systems are separated in two categories-
1) Automation of the manufacturing systems in the industry
2) Computerization of the manufacturing systems

Automated manufacturing system are classified into three basic types:
1) Fixed automated systems
2) Programmable automated systems
3) Flexible automated systems

1) *Fixed automated systems*: These are the systems in which the sequence of processing operations which is to be carried out is fixed by the equipment configuration.

2) *Programmable automated systems*: In programmable automation, the machine is designed with the capability to change the sequence of operations to accommodate different product configuration

3) *Flexible automated systems*: It is the next version of programmable automation. It is capable of producing a variety of products with ideally no lost production time while reprogramming the system and altering the physical set up. (tooling, fixtures and machine settings)
Opportunities for automation:There are so many opportunities for automation in different manufacturing

operations whether the operations are related to machining or assembling of component.

Project requirement:
1) To increase the productivity
2) To reduce the manpower
3) To reduce the processing time
4) To reduce the overall manufacturing cost
5) To improve quality
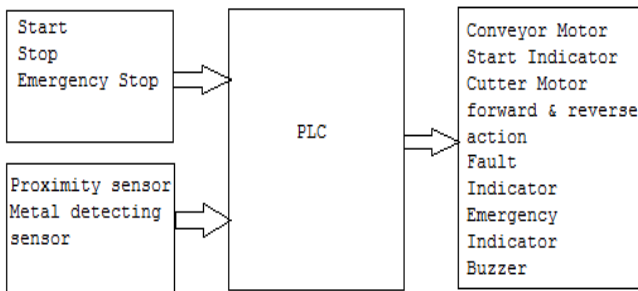
III. HARDWARE

A Block diagram of system

Fig. 1. Block Diagram

Block diagram consists of-
1) Pneumatic system and PLC
2) Proximity sensor
3) Conveyor assembly
4) Control Panel
5) Cutting Setup

B Block diagram description-

The system consists of the main conveyor assembly, cutter with motor arrangement, object detecting, pneumatic cylinder, proximity sensors

The proposed system consists of Pneumatic system and PLC. Here PLC is the main controller which will accept the inputs from proximity sensor, and then take control action on the conveyor, pneumatic cylinder and necessary cutting process assembly. Pneumatic Setup: It is an assembly of pneumatic actuators integrated together with the help of mechanical assembly controlled through PLC via Solenoid valves. Pressurized air is supplied through air compressor.

Programmable Logic Controller (PLC): It is the main element of the system which is used to control the automated systems. It accepts the inputs from Proximity Sensor and gives controls the Pneumatic Setup, Conveyor and cutting motor.

Proximity Sensor: One Inductive proximity sensor is used for object detection. This sensor gives signals to PLC for taking the necessary control action.

Conveyor Arrangement: It is used for carrying or moving the object from one location to another desired location

C System working-
It is necessary to describe the proper sequence of operations which helps to run the system is successful manner. The sequence of operations can be described using narrative statements. These statements describes what must happen in the system and in what way to achieve the required result. The steps involved in this project are as follows:

1) Place the job on the conveyer
2) Press START push button on the control panel
3) Conveyer motor starts indicator glows and the inductive sensor detects for any presence of metal contains in the material.
4) If any metal is present, fault indicator and buzzer gets ON to indicate that the material is faulty. After some delay, faulty material get rejected and process continue.
5) If no metal is detected, the box proceeds towards cutting panel.
6) Sensor detects the material and after some delay the conveyer stops. The pneumatic cylinder gets activated and clams the material.
7) The proximity switch sense that the material is clamped, the drilling motor starts and the motor moves in forward direction to bring the cutting motor in downward direction for cutting.
8) The job is unclamped and conveyer starts again. Sensor acts as the feedback and the loop is repeated.

IV. SOFTWARE

A. ABB PLC
Programmable Logic Controller or PLC is an intelligent system, which was introduced in the instrumentation and control industry for replacing relay based logic. Now a days, better I/O handling capabilities and more programming elements have been added along with improvement in communication. Basics of a PLC function is continous scanning of a program. The scanning process involves three basic steps.

Step1: Testing input status
First the PLC checks each of yhe input with intention to see which is the status on or off. In other words it checks whether a switch on a sensor etc., is activated or not. The information that the processor obtains through this step is stored in memory in order to be used in the following steps.

Step 2: Programming execution
Here a PLC executes a program instructions based on the program and based on the status of the input has obtained in the preceding step, and accordingly action is taken. The action might be activation of certain outputs and the results can be stored in memory to be retrieved later in the following steps.

Step 3: Checking and Correction of output
Finally, a PLC checks up outputs and adjust it as per need. Changes are carried out based on the input status that had been read during the first step and based on the result of the program execution in step two Following execution of step three is done and PLC returns a beginning of the cycle and continually repeats these steps. Scanning time = Time for performing step 1+ Time for performing step 2+ Time for performing step 3.

B. Input-Output Configuration for PLC
1) Input Configuration- Start, Stop and Emergency stop, Limit switch - 4 inputs. Metal detecting sensor-1 proximity sensor-1 input. sensors-

2 inputs.

2) Output Configuration- Pneumatic Cylinder - 1 output.Start, Stop, Fault, Emergency indicator-2 outputs. Conveyor motor-1 output Cutting motor-1 output Blade motor- 1 output
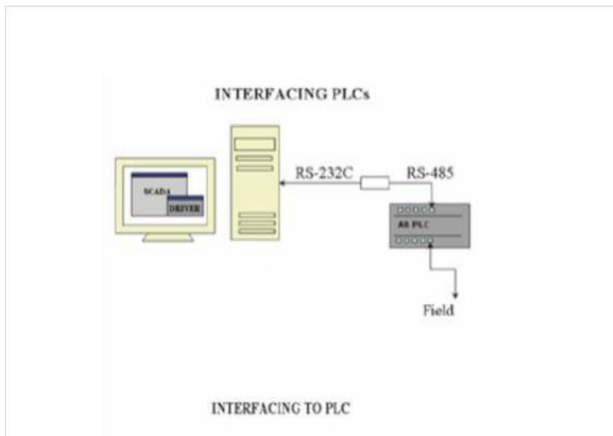
V. INTERFACING

Fig.2 Interfacing

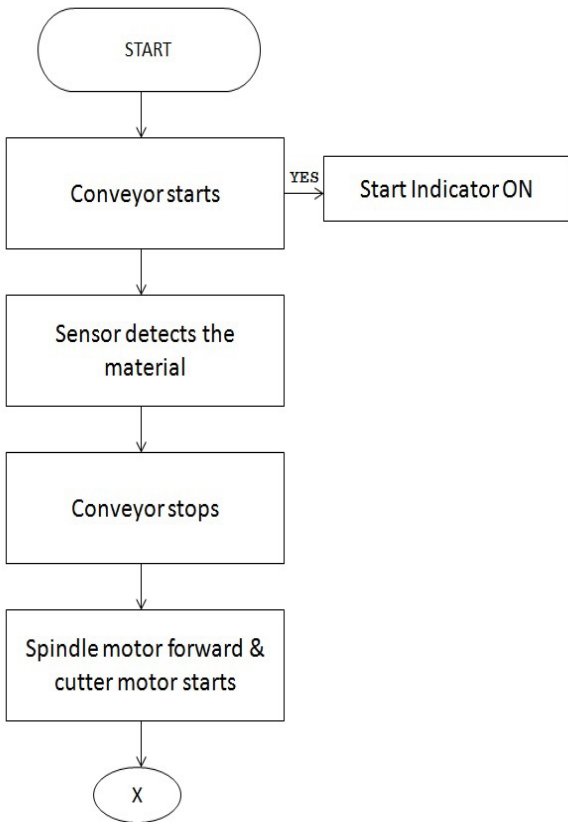## VI. FLOWCHART

Flowcharts are as follows
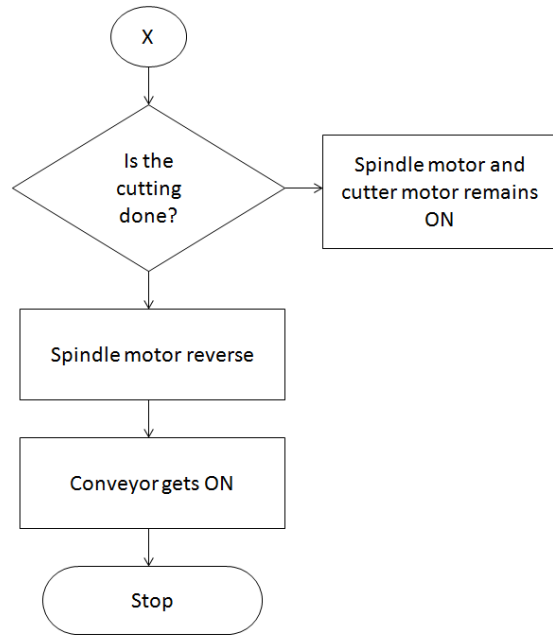

Fig. 3. Flowchart A

Fig. 4. Flowchart B

VII. CONCLUSION

For cutting machine based on programmable logic controller based machine has got faster execution time and is more efficient in working along with safety measures to reject faulty material and ease in operation. Due to relay contactor logic more hardware is required as well wiring is more complexwhich has now been overcome by present programmable logic controller machine. The present system is superior in both performance and is more flexible in operation. Moreover, the running time has got shortened. Thus, desired requirement of customers has been fulfilled by this automation

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