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AUTOMATIC STAMPING MACHINE USING PLC

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Abstract: This paper represents the design project of the application of a stamping process. The stamping mechanism is controlled by PLC hence it can be implemented in small scale as well as big industries for faster operation and less labour requirement. Automatic stamping of object has received significant attention because automatic stamping is reliable and reproducible. An Automated Stamping Machine driven by pneumatic systems that consists of air compressor, directional control valves, and air service unit was designed, fabricated, tested and operated. This current trend of stamping problems has made the small scale enterprises to lose large number of market share to the large scale manufacturing outfits. The need to make stamping process affordable, using easy to maintain machines and also complying to rood regulatory bodies necessitated the need for this work.

Keywords: PLC, Pneumatics cylinder, SCADA, Solenoid valve, Photo sensor, Conveyor.

I. INTRODUCTION

Conventional method for object stamping is manual, it is very time consuming and in non-automatic form. Continuous stamping or printing results in hand fatigue requires lots of efforts and also affects the accuracy to result so the manual method must be replaced by PLC Automation. Automatic stamping of object has received significant attention because automatic stamping is reliable and reproducible. This not only reduce manual effort but also gives more time for marketing also prevent danger which might occur when human being works in hazardous environment. Automation greatly improves the profit and productivity, it is very scalable.

By using automatic stamping machine it is easy to print the logo, name, sticker on blank paper, metal and leather. Hence to attempt this needs fabrication of automatic stamping machine is needed. Although paper is the most common material, it is also frequently done on metals, plastics, cloth and composite materials. On paper it is usually carried out as a large-scale industrial process and is a needful part of stamping. Automation can be defined as the "technology concerned with application of mechanical, electronic and computer-based systems to operate and control production". There are many reasons for automating the process. The reason may be to reduce manufacturing lead time, to increase labour productivity or to improve the worker safety, etc.

II. SYSTEM METHEDOLOGY

The main components of Automatic Stamping Machine are **PLC I/O** which is the part of the PLC that connects the brain of the PLC, the CPU, to the outside world, the machines. In a PLC system there will usually be dedicated modules for inputs and dedicated modules for outputs. An input module detects the status of input signals such as push-buttons, switches, temperature sensors, etc. An output module controls devices such as relays, motor starters, lights, etc. The output ports of a PLC are relay or opto-isolator with transistor or triac, depending on the devices that are to be switched on or off. Generally, the digital signal from an output channel of a PLC is used to control an actuator, which in turn controls some process. The term actuator issued for the device that transforms the electrical signal into some more powerful action, which then results in control of the process.

A push-button or simply button is a simple switch mechanism for controlling some aspects of machine or a process. A push button is a momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switches physically actuated. An automatic mechanism (i.e., a spring) returns the switch to its default position immediately afterwards, restoring the initial circuit condition.

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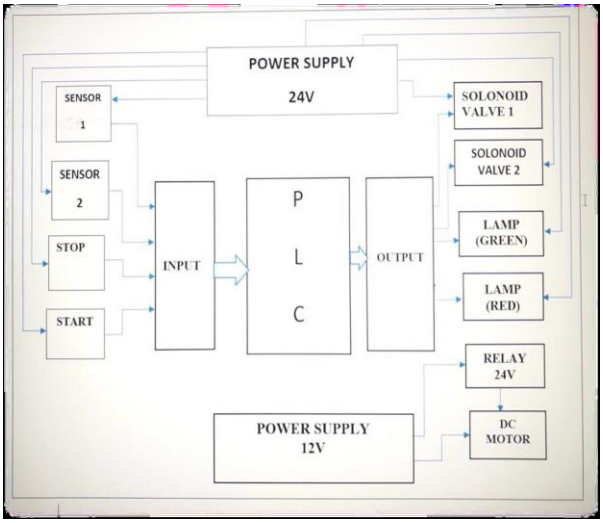

A photoelectric sensor, or photo eye, is an equipment used to discover the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. They are largely used in industrial manufacturing. **Photoelectric sensor** A retro-reflective arrangement places the transmitter and receiver at the same location and uses a reflector to bounce the light beam back from the transmitter to the receiver. An object is sensed when the beam is interrupted and fails to reach the receiver. **Stack lights** (signal tower lights, indicator lights, andon lights, warning lights, industrial signal lights, or tower lights) are commonly used on equipment in industrial manufacturing and process control environments to provide visual and audible indicators of a machine's status to machine operators, technicians, production managers and factory personnel.

It is a form of andon - systems in manufacturing which identify errors as they happen. A Direct Current (DC) **motor** is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal. Pneumatic solenoid valves are electromechanical devices that control the flow of air or process gas. They are mostly used for controlling pneumatic actuators such as cylinders, turbines (pneumatic motors), diaphragms, and tubes. **Pneumatic solenoid valves** and actuators form auxiliary air circuits Relay is an electrical switch that control (switch on & off) a high voltage circuit using a low voltage source. A relay completely isolates the low voltage circuit from the high voltage circuit.

III. SOFTWARE DETAILS

A. PLC SOFTWARE:

EcoStruxure Machine Expert Basic 1.0 is a powerful software for developing HMI, SCADA, OEE and Dashboard projects dedicated to Line Management & Lite Supervision applications to run in Harmony Industrial PC and GTU Open Box A program in ladder logic, also called a ladder diagram, is similar to a schematic for a set of relay circuits. An argument that aided the initial adoption of ladder logic was that a wide variety of engineers and technicians would be able to understand and use it without much additional training, because of the resemblance to familiar hardware systems.

(This argument has become less relevant given that most ladder logic programmers have a software background in more conventional programming languages, and in practice implementations of ladder logic have characteristics such as sequential execution and support for control flow features that make the analogy to hardware somewhat imprecise.)

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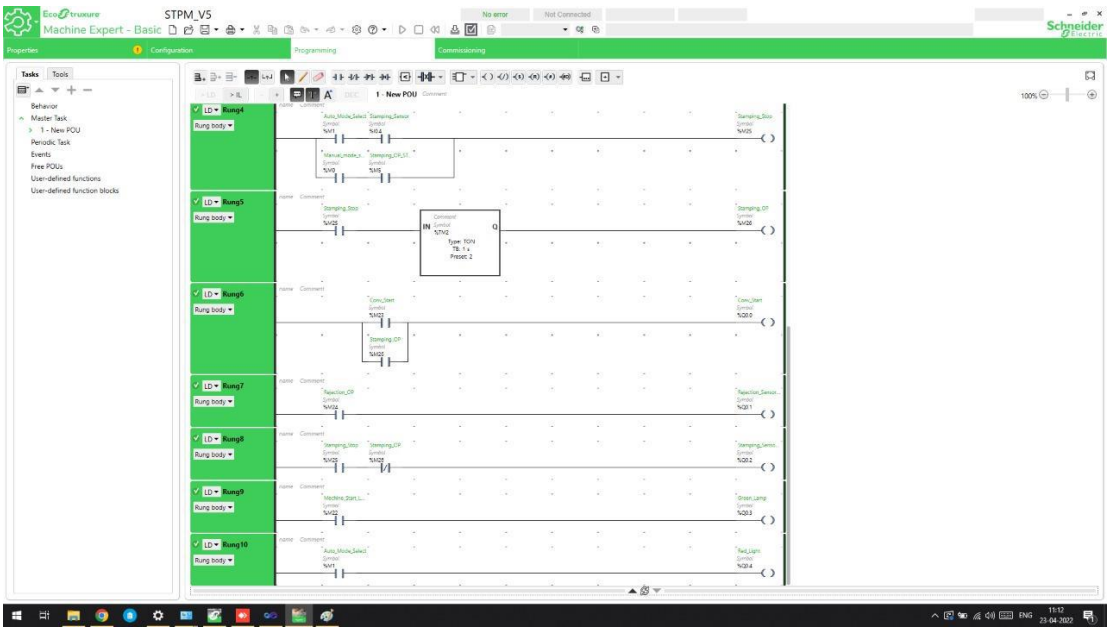
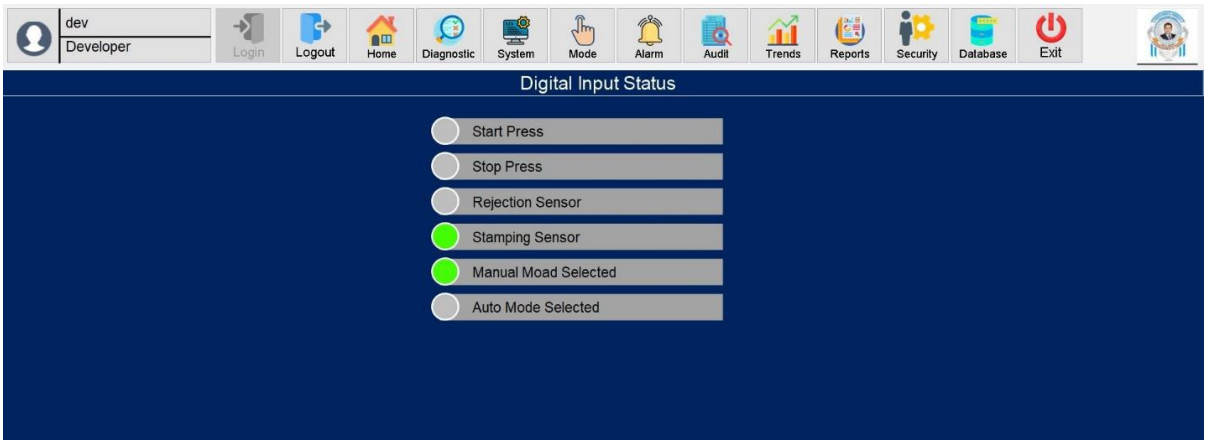


B. SCADA SOFTWARE:

EcoStruxure Machine SCADA Expert 8.1 SP4 EcoStruxure is Schneider Electric's IoT-enabled, plug-and-play, open, interoperable architecture and platform, in Homes, Buildings, Data Centres, Infrastructure and Industries. Innovation at Every Level from Connected Products to Edge Control and Apps, Analytics and Services.
SCADA I/O that are Input / Output to a SCADA. Inputs are Temperature, Pressure, Flow rate, Humidity, Level etc called as Analog Inputs. Inputs from Flow switches, level switches, Pressure switches, Proximity switches, Limit switches, auxiliary contact of contactor etc are called Digital Inputs.



SCADA system alarms notify the operator of power supply issues (activation of the SCADA UPS and backup power supply) and network issues such as loss of IP connection. The most common SCADA alarm is "Device Down," which occurs when a device stops communicating on the network.
SCADA event logs provide a complete high-level view on the industrial process that is continuous over time and captures information about user activities, system changes in the field as well as system.

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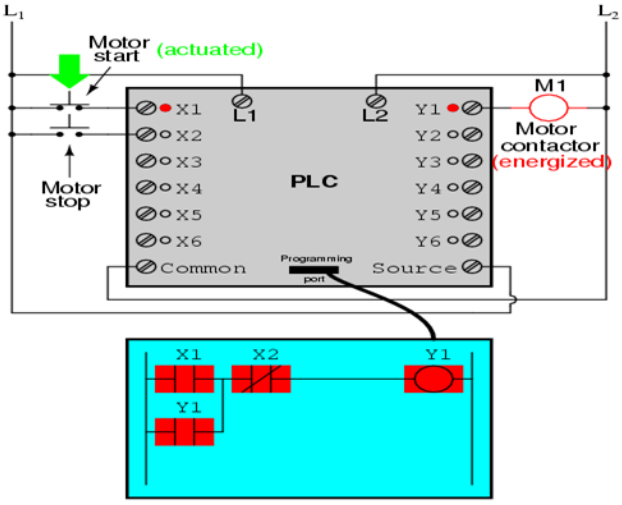
SCADA systems are used not only in industrial processes: e.g., steel making, power generation (conventional and nuclear) and distribution, chemistry, but also in some experimental facilities such as nuclear fusion. The size of such plants ranges from a few 1000 to several 10 thousand input/output (I/O) channels. However, SCADA systems evolve rapidly and are now penetrating the market of plants with a number of I/O channels of several 100 K: we know of two cases ofnear to 1 M I/O channels currently under development. SCADA systems used to run on DOS, VMS and UNIX; in recent years all SCADA vendors have moved to NT and some also to Linux.

SCADA systems have made considerable progress over the recent years in terms of functionality, scalability, performance and openness such that they are an alternative to in-house development even for very demanding and complex control systems as those of physics experiments. SCADA systems are now also now used in the experimental physics labs for the controls of ancillary systems such as cooling, ventilation, power distribution, etc. More recently they were also applied to the controls of smaller size particle detectors such as the L3 moon detector and the NA48 experiment.

C. LADDER LOGIC: STARTING OF MOTOR

If we were to press the "Start" button, input X1 would energize, thus "closing" the X1 contact in the program, Ending "power" to the Y1 "coil," energizing the Y1 output and applying 120 volt AC power to the real motor contactor coil. The parallel Y1 contact will also "close," thus latching the "circuit" in an energized state:



Logic for Continous Running of motor When Start Button is Released

Now, if we release the "Start" pushbutton, the normally-open X1 "contact" will return to its "open" state, but the motor will continue to run because the Y1 seal-in "contact" continues to provide "continuity" to "power" coil Y1, thus keeping the Y1 output energized.

To stop the motor, we must momentarily press the "Stop" pushbutton, which will energize the X2 input and "open" the normally-closed "contact," breaking continuity to the Y1 "coil:" When the "Stop" pushbutton is released, input X2 will de-energize, returning "contact" X2 to its normal, "closed" state. The motor, however, will not start again until the "Start" pushbutton is actuated, because the "seal-in" of Y1 has been lost

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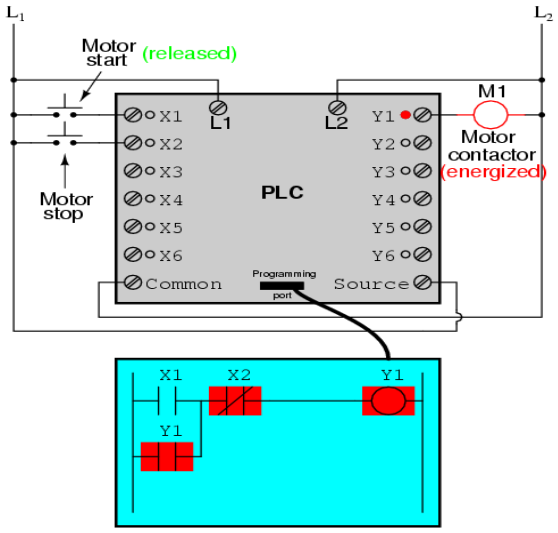
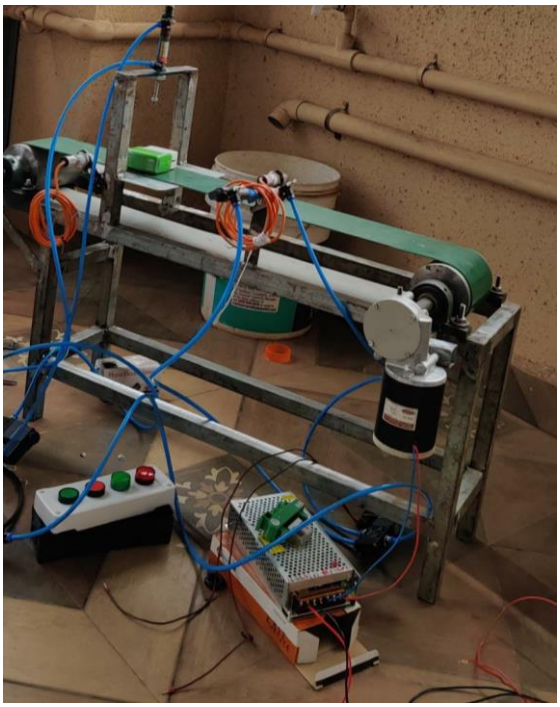


To Stop the Motor

IV. DESIGN CONSIDERATION

The design of a machine requires the inter-related consideration of a number of factors, such as material and heat treatment, strength for power and loading requirements, pressure, volume, weight and space limitations etc. With the objectives of this project in mind, the design and fabrication of the machine is meant to ensure compliance to food and safety regulation and guarantee higher efficiency at a minimum cost.

Therefore, the following **Design considerations** were made:
i. The construction of the machine should be at minimum cost compatible with its efficiency.
ii. The labour requirement in operating the machine should be minimal
iii. There should simplicity in the design and fabrication
iv. The component parts should be easily replaceable in case of any damage or wear.



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Design Assumptions

For the ease of design, the following assumptions were made:

i. An electric motor of 0.5 HP and 75rpm will be used.

ii. Maximum pressure of the cylinder will be 0.1MP

iii. Density of steel=7.86 x 10^3 kg/m^3Service factor of the belt=1.4

iv. The specifications mostly used were those of American Society of Mechanical Engineers (ASME) code.

The materials selected must possess the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environment attack from chemicals, service life, reliability etc. The various mechanical properties concerned are strength in tensile, comprehensive shear, bearing tensional and bucking load, fatigue resistance impact resistance, elastic limit, and modulus of elasticity, harness, wear resistance and sliding properties.

IV APPLICATION & ADVANTAGES

Applications: Pharmaceutical industry to pack and stamped ready product boxes, We can use this in all types of Packaging industry, Can use all types of manufacturing plants such as Beauty products, food products, electronic goods etc. By using this system Industries can increase their production. We can use this in Steal manufacturing Plants to fulfil our daily product requirement.

Advantages: It will Improve Productivity, Machine can tune as per Industry requirements, Cost efficient system, Reduced Human Interference, Machining time is less depending on operator speed, Only simple support structures are required Design & fabrication is easy, It is a faster process.

CONCLUSION

An automatic stamping machine working on pneumatic structure. With the help of this pneumatic Structure, we get enough time to stamp on desired position. Hence, we succeed to design a structure which operate in low cost, low time consumption, with maximum accuracy, less human Interference. The machine uses pneumatic system with PLC controller make it fast, easy to use and maintain. From break event point calculation, the machine gives very good cost saving since it built at affordable price and gives significant time saving. SCADA is used for the constructive working not for the destructive work using a SCADA system for their controls ensures a common framework not only for the development of the specific applications but also for operating the detectors. Operators experience the same "look and feel" whatever part of the experiment they control. However, this aspect also depends to a significant extent on proper engineering. we conclude that “Automatic stamping machine” It is the reliable printing mechanism this replaces traditional hand stamping on any object. The general purpose of the present invention, which will be described subsequently in greater details, is to provide a portable automatic pneumatic stamping machine which has many advantages of the low power consumption effective performance and many specified features of the system.

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