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Smart Punching Machine With Pneumatic Accuator Based On Weight Using Plc & Scada

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Abstract:-*The present project is for general purpose usage which can be used for industrial and automation applications so that the problem associated with the punching process and separation of material can be carried out.*
The proposed work describes the design of prototype of automatic punching machine with pneumatic actuator based on weight controlled by PLC and interface with SCADA. Punching or pressing process is one of the most important and necessary processing step in sheet metal industry. By automating this process one can have a greater control over the process. Programmable Logic Controllers are used for the control of the system. This system can replace existing manual feed and operated punching and pressing machines. By interfacing PLC controls with the conventional machines, it is possible to achieve good results in the form of reduced manufacturing lead time, reduced cost and increased safety of the worker.

1. INTRODUCTION

1.1 Problem Summary

We have studied different types of punching machine & PLC programming, its application and some basic of it. We want to implement our knowledge in our final year project.The objective is to develop outline for designing and constructing a kind of smart punching machine in reality to face challenges of automation. So we decided to work on smart punching machine which is work on weight reference with the help of PLC and scada.

In today's practical and cost-conscious world, sheet-metal parts have already replaced many expensive cast, forged, and machined products. The reason is obviously the relative economy of operation, easier implementation for mass-production, as well as greater control on the technical parameters. In most of the sheet metal operations punching or pressing operation is the main or initial operation in the process sequence. Automating this operation results in reduced lead time and also can reduce human effort.

What exact problem we are trying to solve?

- ✓ Noise Pollution
- ✓ Workers hard labour
- ✓ Efficiency Problem
- ✓ Complex Operation
- ✓ Flexibility

1.2 AIM AND OBJECTIVE OF PROJECT

- ➢ To reduce man power.
- ➢ To provide a clean and safe punching mechanism.
- ➢ Increase the speed of punching process.
- ➢ Using PLC safe & secure operation

1.3 PROBLEM SPECIFICATION

- **Punching Process**:

The press is the punching machine tool designed to punch blank of sheet by applying mechanical force or pressure. The presses are exclusively intended for mass production and they represent the fastest and more efficient way to form a metal into a finished punched product. In manual or conventional methods of pressing the disadvantages may be

- ✓ angular misalignment of the sheet
- ✓ higher material handling time and manufacturing lead times
- ✓ reduced safety for the worker

- **Noise Pollution**:The noise level in our cities is rapidly increasing. This is due to heavier mechanical machine and more powerful engines. On top of that there is a growing number of vehicles which are much louder and do not adhere to Canadian Noise Standards.

Workers hard labour: workers may feel very hard labour to exchange goods from one place to another place by their own effort especially in Indie.

- **Complex Operation**: Operation of PLC and SCADA are little bit complicated

1.4 Planning of this project

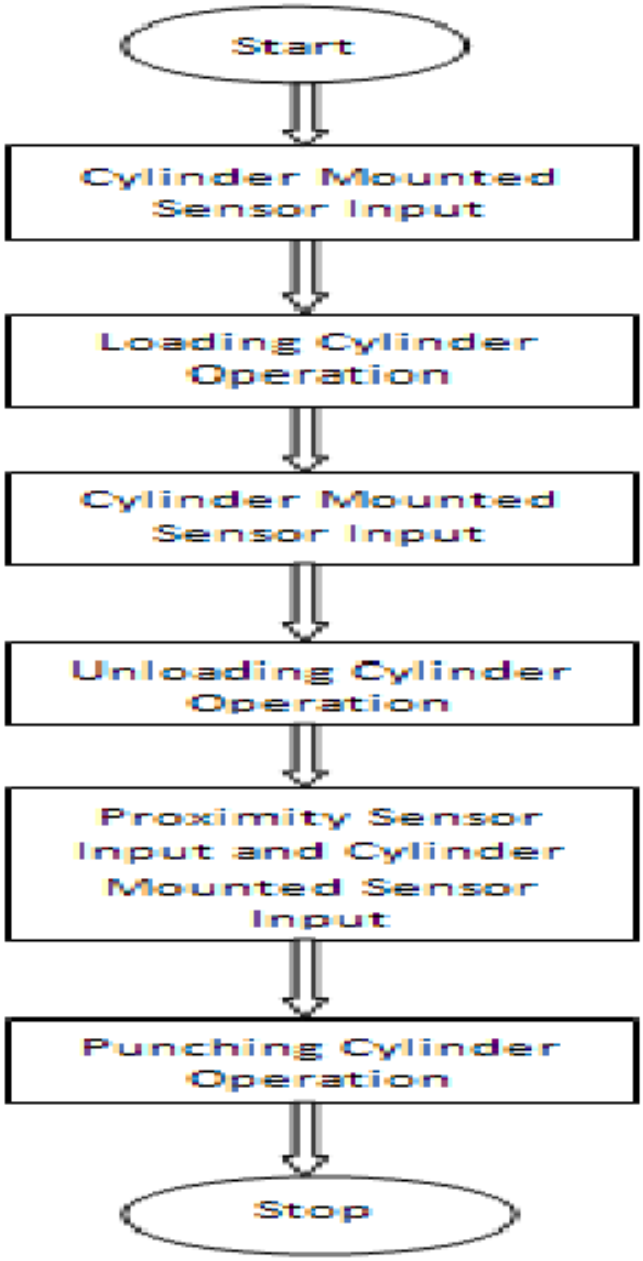
"SMART PUNCHING MACHINE" project is starting with meet our internal guide a first week, to collect information and also other information from via internet, books and survey at market, this literature review for the project must do for every week. The progress of the project and guided by Asst. professor Mrs PALAK GAJJAR to solve difficulty.

The next task is research of literature review with the means of the internet, books, available published articles and materials that is related to the multipurpose punching machine.

Designing phase start of by sketching few models using manual sketch on A4 papers. Do it comparison for choose the best concept. Software applications are downloaded from internet to design the model based on the sketches
The next step is the fabrication of make some method for this project. Choose the material, make some list for the material

Do it planning of fabrication process for this project design and fabrication process, we will do in next semester. Make some analysis and testing for the project. After that, the final report writing and final presentation will be the last task to be accomplished.

2. METHODOLOGY



There are three main components used in this system. They are Loading Cylinder, Unloading Cylinder, and the Punching Cylinder. All these cylinders are operated in a sequence in order to perform the required operation

2.1-Materials and Tools required

- **List of Components**
  1. PLC
  2. HMI / SCADA
  3. Load cell
  4. SMPS (Power Supply=24v)
  5. Relay
  6. Conveyor belt
  7. Pneumatic cylinder
  8. Object sensor/Proximity sensor
  9. Stepper Motor

In today's practical and cost-conscious world, sheet-metal parts have already replaced many expensive cast, forged, and machined products. The reason is obviously the relative economy of operation, easier implementation for mass-production, as well as greater control on the technical parameters. In most of the sheet metal operations punching or pressing operation is the main or initial operation in the process sequence.

Automating this operation results in reduced lead time and also can reduce human effort.

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.

2.2 Implementation Details

2.2.1 Miniature Circuit Breaker

Safety of the user as well as the system components is most important in any system. Here, we have used the Siemens 5SL series miniature circuit breaker for this purpose. The 5SL miniature circuit breakers can be used as main switches for the disconnection or isolation of plants. To facilitate cable entry, the devices are equipped with square terminals for the joint accommodation of pin bus bars with cables from 0.75 to 35 mm2. The rated current range is between 0.3 and 63 A. The model used is 5SL62047RC C4. The 230VAC is supplied through this.

2.2.2 Switched-mode Power Supply (SMPS)

It is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. The SMPS transfers power from the mains power to the DC loads, while converting voltage and current characteristics. The SMPS used is Omron SMPS S8JC-Z10024CD for the main control panel. The SMPS used for the PLC is Siemens 6EP0 133-3AA00-0AA1. Two terminal blocks are given the outputs from the SMPS. This makes it easier to provide +/-24VDC to various devices.

Unique features of smart punching machine :

- ✓ More convenient,
- ✓ Eco-friendly,
- ✓ Easy to operate,
- ✓ Noise less,
- ✓ No fuel requires,
- ✓ Electricity based,
- ✓ Cheap in cost,
- ✓ Convertible,
- ✓ Flexible mechanism,
- ✓ Comfortable

3. RESULT

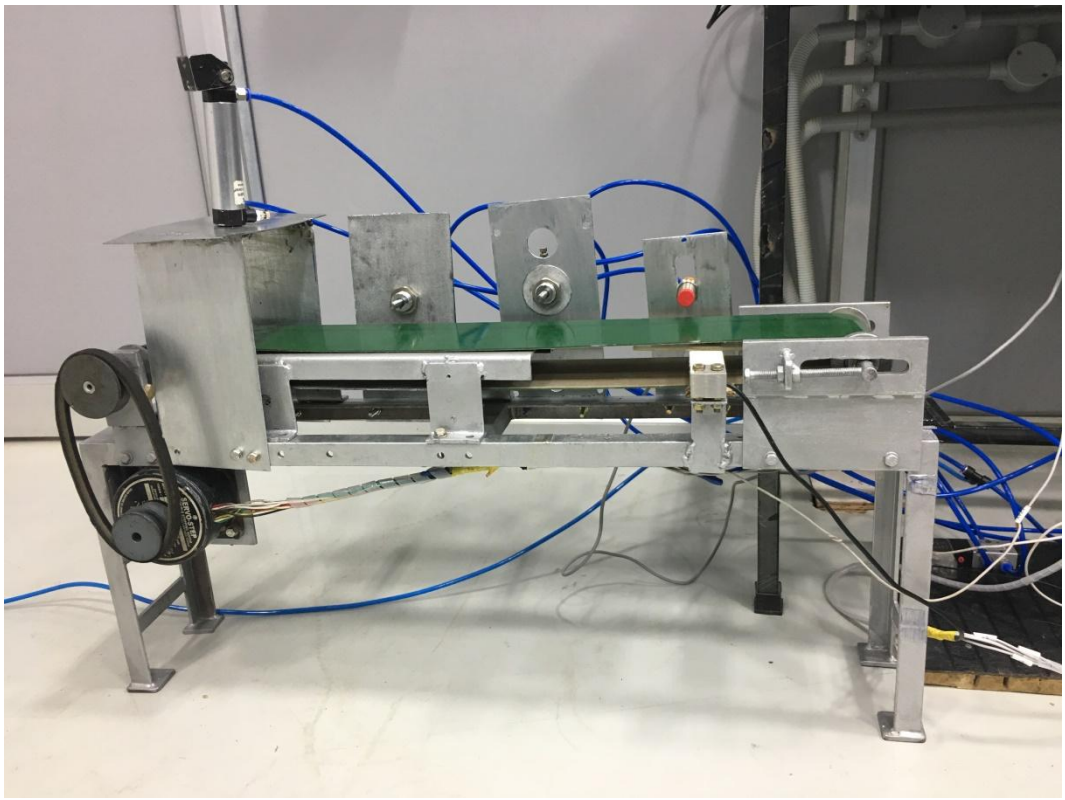
The hardware was tested and the desired results were obtained. Upon power on and start command the conveyor belt starts to run at the specified speed. As an object is placed on the conveyor, the value of weight is read. The outputs are driven as required.

As per the requirement of the system, each object is sorted successfully. Under Selection1, the first pusher pushes non-metallic objects into their box. The second pusher pushes metallic objects into their respective box.

Under Selection 2, the first pusher pushes the objects in the weight range of 0.24-0.7kg. The second pusher pushes objects in the range of 0.7-1.0 kg. All objects failing to fall in either category travel to the end of the conveyor where they are punched into, to show rejection.

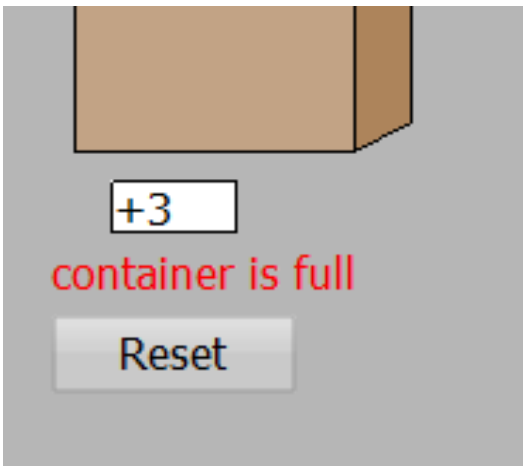
The Selection 3 combines both of the first two and sorts lighter, non-metallic objects as well as heavier, metallic objects. Objects failing to fall in appropriate categories are punched into, that is, rejected.

The final assembly is shown on the following page.



The SCADA screen that is used for this simulation has already been shown in the previous chapters.

When 3 objects are counted into one category, the conveyor belt automatically stops until the values are reset. Upon reset, it will start as soon as a new object is detected. The SCADA screen will blink the following message in red and black under the container that is now full. Reset button is provided on the SCADA Screen as well.



The metal part must be placed within 0.8cm of the proximity sensor to be detected, as is its range. Also, manual placement of objects may sometimes not be in the centre of the conveyor, thus giving a timing error or piston pushing not being able to completely push the object away. This is because the timing is adjusted in such a manner that the actuation occurs when the object is at the centre of the pusher.

4. CONCLUSION

By using Programmable Logic Controllers as the controller of the system, good control over the system can be achieved, manufacturing lead time of the system can be reduced by developing automatic feeding mechanism and worker safety can be increased by reducing the human participation in the process.

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