



OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

AUTOMATION FOR THE PROCESS LOADING AND UNLOADING OF METAL SHEET

Vinod Wairagade¹, Rajvardhan Pawar², Ravina Jadhav³, Anil Ghadge⁴

Assistant Professor, Department of Electronics & Telecommunication Engineering, CSCOE, Aurangabad-431001, India¹

Student, Department of Mechanical Engineering, CSCOE, Aurangabad-431001, India²

Student, Department of Electronics & Telecommunication Engineering, CSCOE, Aurangabad-431001, India^{3,4}

Abstract: In the manufacturing plants various operations are done such as punching operations, blanking operation, forming operations. In this operation labour is required who is able to understand the process and who works efficiently. But in these operations worker feels fatigue. To reduce this fatigue we have designed the process which can be used for minimize the labour requirements for same manufacturing process. The manufacturing firm's machine operates on daily or hourly basis. In this the machine and labour cost has to be deducted from the annual turnover. When man and machine works together then maintenance as well as wages of the worker is required. This project idea reduces the labour cost because this process does not need any skilled worker it only uses a person who will fill the raw material in the stack. Some of the industries face the problem of shortage of the labour. Some processes require experienced operators but many of the times they do not get these operators. These cause that industry low production. Present manufacturing process increases difficulties at intermediate level. So to avoid that issue we have designed this project. Manufacturing process contains various types of operations such as punching, blanking process. In these processes, machine can be proven dangerous to the operator. Sometimes operator works improperly and it results into accidents. This makes manufacturing and labour loss. This project allows the machine to work without any human interference. So the accidents are avoided. When it comes to manufacturing quality, it is very essential to be precise and accurate dimensions of the product. The reputation of the company is built up by its quality and precise work, but in the industry the manufacturing processes contains lot of incorrect processes that leads to the low quality of the product. If the industry uses automation in these processes, more precise work can be done.

Industries manufactures product which is complex in operation. These operations take lot of the time which gradually reduces the plant efficiency. Plant efficiency plays an important role in total profit of the manufacturing plant. Due to complex operations, human limitations come in the process. To avoid these limitations automated process is required. Manual operations are more complex and costly processes. If the industry has appointed 2 workers for one manufacturing operation, it needs to pay the workers for their work. In automated process the one time installment is required. Once the automation is implemented in the plant there is no need of separate worker who interfere the manufacturing process. This result in reduced labour cost and time required for the process.

Nowadays there are many efforts being made for taking away the burden on the humans, the burden cause by hectic process. This leads to more chances of collision which is associated with manual operation. In manual process the proper utilization of raw material does not take place which causes wastage of raw material. Such type of problem is minimizing by implementing "Automation for the Process of Loading and Unloading of Metal Sheet".

Keywords: manufacturing process, loading and unloading, process automation.

I INTRODUCTION

Automation is a set of technologies that results in operation of machines and systems without human intervention and

achieves performance superior to manual operation. The application of machines to tasks once performed by human beings or increasingly, to tasks that would otherwise be impossible. Although the term mechanization is often used to

refer to the simple replacement of human labour by machines, automation generally implies the integration of machines into a self-governing system.

Explanation highlighting the theme:

- Help to reduce the human efforts
- Increase the use of automated material feeding system in the industry
- The material feeding system is reliable
- Our project gives the smartness to material feeding management and handling issues
- This system consumes less initial investment with more efficiency

In manual process the proper utilization of raw material does not take place which causes wastage of raw material. Industries manufactures product which is complex in operation. These operations take lot of the time which gradually reduces the plant efficiency. Such type of problem is minimizing by implementing “Automation for the Process of Loading and Unloading of Metal Sheet”. IOT system is use in our project if the stack of metal sheet is empty then the alert message is goes to the operator using GSM module.

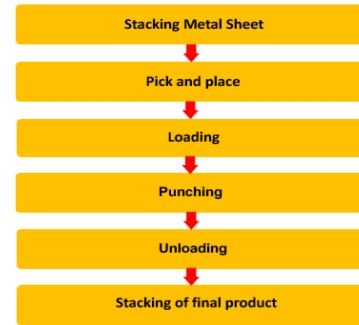
II PROBLEM STATEMENT

In mechanical industries various operations are done such as punching, blanking o, forming operations.in these operation labor is required who is able to understand the process and who works efficiently but in these operations worker feels fatigue.to reduce this fatigue we have designed the process which can be used for minimize the labour requirements for same manufacturing process. In manual process the proper utilisation of raw material does not take place which causes wastage of raw material.industries manufactures product which is complex in operation. These operations take lot of the time which gradually reduces the plant efficiency. Such type of problem is minimizing by implementing “Automation for the Process of Loading and Unloading of Metal Sheet”.

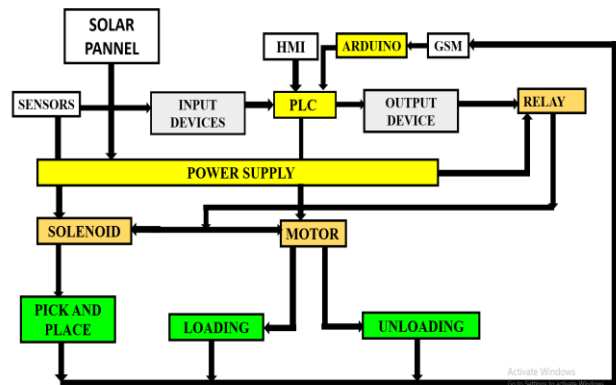
III PRESENT SITUATION W.R.T. PROBLEMS

1. Current operations are done manually.
2. Chances of accident.
3. Less production Rate.
4. Time is not utilized properly.
5. Product Quality is not uniform and consistency.
6. Required skilled labour.
7. Required manual counting.
8. Remote process monitoring and control is not possible.

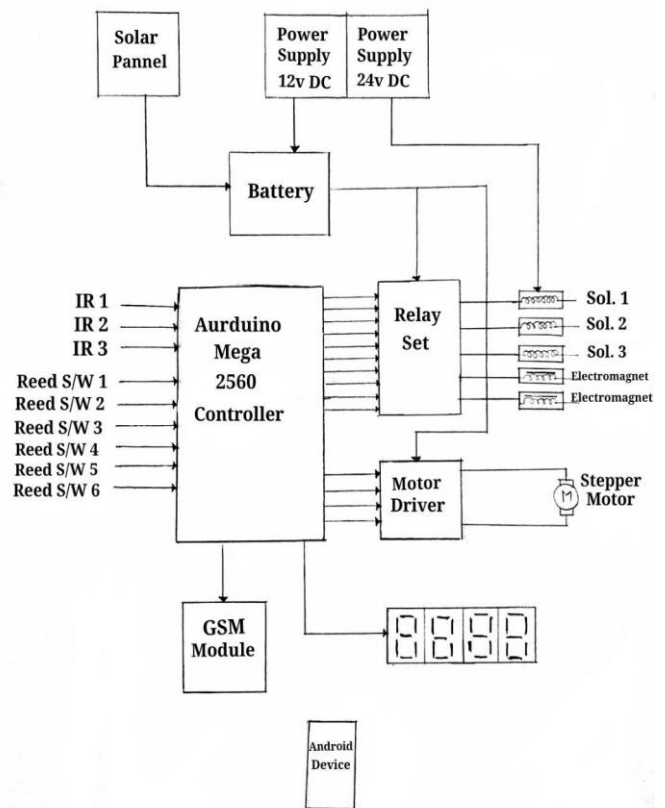
IV FLOW CHART OF PROCESS



V BLOCK DIAGRAM



VI CIRCUIT DIAGRAM



VII CONCEPTUAL DRAWING

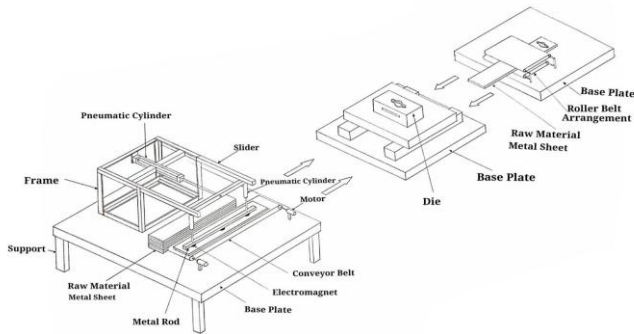


Figure 1: Conceptual Diagram

VIII PROCEDURE

- In fig. shows various types of components such as pneumatic cylinders, servomotors, L-shaped strip, conveyor belt and electromagnet with their specifications. The Aluminum base containing the metal sheet and below that aluminum base there is a sensor S1 which detects the metal sheet at that time if there is present or not.
- If there is no metal sheet present in aluminum base the sensor will detect which is placed on base, and the switch will automatically stop the further feeding process. If there are metal sheet present, sensors will be detect and switch will on automatically.
- With the help of rack and pinion holding arrangement is connected to both Pneumatic cylinder and the motor which passes the metal sheet on the conveyor.

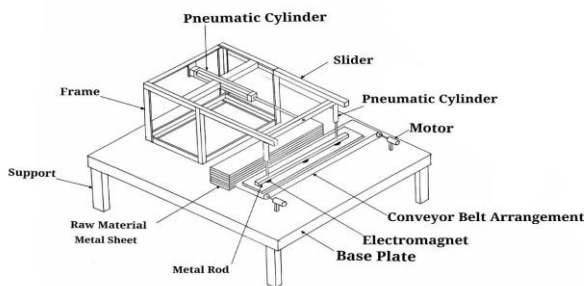


Figure 2: Station 1

- The metal sheet will ready to move on the conveyor belt. The electromagnet is connected to double acting cylinder then the slider will ready to move forward direction at the top of the conveyor belt which is mounted on the aluminum base.
- The double acting cylinder will active then piston will expands at a certain position. After that metal sheet get lifted with the help of electromagnet. At the end of process metal sheet is placed on conveyor belt.
- There is a sensor S2 which detect the previous metal sheet in punching machine. If metal sheet is not present

in machine then sensor S2 will active and conveyor belt will start.

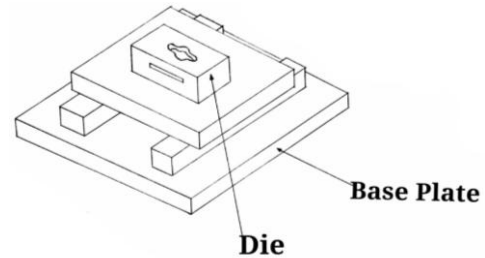


Figure 3: Station 2

- With the help of conveyor belt metal sheet feed in the punching machine slowly. The punching machine punched the metal sheet with required distance. There are distance sensors to detect the distance between two punches.
- Figure shows station 2 in which raw metal sheet are punched.

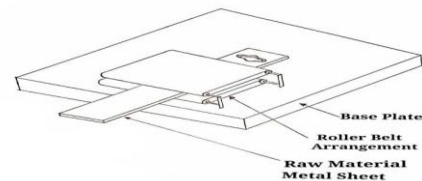


Figure 3: Station 3

- After punching operation the metal sheet get deformed. So to avoid this deformation of metal sheet we have provided such arrangement of roller and belt due to which deformation of metal sheet get restricted.

IX NECESSITY

Companies undertake projects in manufacturing automation and computer integrated Manufacturing for a variety of good reasons. Some of the reasons used to justify automaton are the following:

- To increase labour productivity.
- To reduce labour cost.
- To mitigate the effects of labour shortages.
- Till reduce or eliminate routine manual and clerical tasks.
- To improve worker safety.
- To improve product quality.
- To reduce manufacturing lead lime.
- To accomplish processes that cannot be done manually.
- To avoid the high cost of not automation.

There are advantages and disadvantages with using loading and unloading mechanism. First advantage of our mechanism is that it can decrease the labour cost. In actual industries there are many problem associated with labour and

also skill workers such as waste of material, improper handling machine tools, accuracy, and also different types of collision which is done by human being. Current technology is not able to automate desired task. Some task cannot be easily automated, such as the production or assembly of products with inconsistent component size or in tasks where manual dexterity is required. There are some things that are best left to human assembly and manipulation.

If an operator insert metal sheet in feeding machine at that time there is not equal space between two punches. After the punching operation the metal sheet gets tilted and due to the deflection different error occurs. Most of the business owners increase the price of goods or products that they sell because of the price of the tools. This is bad news to the consumers. But there is some businessmen are who prefers low cost material with high strength and good product quality. For achieving this IOT based automation with PLC manufacturing is get used. This machine demand that combine high production output, reliability, product quality along with low man power and maintenance cost.

The machines also need to be flexible enough to adapt to variations in width and length of a metal sheet. The sheet material is sophisticated with different type of blanks. Automation can help improve your blank making operation and machine performance with solutions and services to lower the total cost to design, develop, and deliver machines and meet your customers' requirement. In automation we strive for a holistic approach that focuses on your machine and business performance. What may start out as an "order-by-order" relationship? Can eventually develop into a mutually beneficial business relationship we will work with you to develop solutions that will give you a competitive advantage throughout our machine.

In today's highly competitive in industry it is use different type control system machinery process in factory, forging operations, blanking operation etc. businesses across the globe face unprecedented and volatile changes. Manufacturers, material suppliers, and machine builders (OEMs), are affected by shifting customer demands, globalization, industry consolidation, technology innovations, safety requirements, government regulations and the demand for lower customer prices. Machines come in various configurations based on the different component and it types produced by the machine. The machine might be integrated with upstream machines like a pressing machine.

In general these machines are fully automatic and require command operator intervention only to replenish the raw material and remove the finished products in this feeding process reduce design time and improve performance for blanking operation. This technologies and critical automation solutions available for building high performance based on IOT and PLC operated. Blank making typically has certain

main functions which make up of material holding, feeding, punching, cutting and stacking.

X INNOVATION IN PROPOSAL

- **Substitution of mechanical machine elements**

Flexible, electronic synchronized drives replace rigid mechanical systems with main shaft, gears and cams. Extended machine lifecycle, noise and vibration reduction by decoupling mechanical components.

- **Maximum flexibility**

Easy for synchronize the upstream or downstream machines or processes.

- **Increased productivity**

Increased cycle rates by replacing mechanical transmission components with servo technologies. Automated format change by means of recipe storage.

- **Increased product quality**

Phase correction by use of registration mark control, improves seal and cutting accuracy.

- **Reduced downtime**

No homing after downtime (in case of product jams or power failure) by using servo motors with absolute encoders.

- **Motion Analyzer Sizing Software**

Select the best matching pair of drive and motor from the Rockwell Automation product portfolio for the automation required.

Cost optimization through proper sizing of motor and drive

Support sizing for Rotary and Linear systems. It has also special templates for sizing complex rotary systems like crank, unbalanced load along with templates for applications like rotary knife, flying shear, winder & unwinder.

- **Drives – Premier integration**

Let's you consolidate controller programming and drive system configuration, operation, and maintenance into a single software environment. This exceptional level of integration helps to reduce your programming time, ease start up and commissioning, and streamline diagnostics.

- **Motion – Integrated motion**

With a Kinetics system, you reap the full benefit of the Integrated Architecture platform because the integration doesn't stop at the controller. This system integrates the drive, the motor, and even the actuator at a lower cost per axis of motion. Use the same Mitsubishi programming software to configure, program, and commission your application.

- **Safety - Functional**

Automation offers repeatable safety solutions across a number of industries and custom applications to meet your specific needs. Our safety team follows a solution lifecycle to help ensure projects are executed thoroughly.

Safety solution lifecycle as bellows

Step 1: Safety Assessment – Identify hazards and estimate the associated risks.

Step 2: Mitigation Technique Selection – Evaluate safeguarding options based on industry acceptable solutions.

Step 3: Safety System Design – Design system architecture, safety critical circuit design and guarding design.

Step 4: Project Execution – Material procurement, assembly, integration testing, commissioning.

Step 5: Validation – Verify that systems are operating within defined parameters and applicable standards have been satisfied.

Step 6: Maintenance – Change Control

Bag Making is a complex process. A misstep or improper procedure at any of the stages can threaten the structural integrity of the bag. Oftentimes it is during the manufacturing process that issues occur, causing the product failure reports prevalent in today’s news. By integrating control and information along with finite capacity scheduling, manufacturers can streamline their operations. Significant financial savings can be realized, including achieving increased manufacturing throughput as well as benefits from greater visibility, tracking and control of operations. Let Mitsubishi Automation be your solution experts in bag making machines. Helping your business succeed and grow is what we do best, with power, control and information services designed to give you a competitive advantage. Our in-depth understanding of the policies and requirements affecting you can help you reduce business risk, improve operational efficiency and achieve faster time to market. Automation is your answer today!

XI BENEFITS

1. High Effectiveness

Many factories have equipped their production lines with compressed air supplies and movable compressors. There is an unlimited supply of air in our atmosphere to produce compressed air. Moreover, the use of compressed air is not restricted by distance, as it can easily be transported through pipes. After use, compressed air can be released directly into the atmosphere without the need of processing.

2. High Durability and Reliability

Pneumatic components are extremely durable and cannot be damaged easily. Compared to electromotive components, pneumatic components are more durable and reliable.

3. Simple Design

The designs of pneumatic components are relatively simple. They are thus more suitable for use in simple automatic control systems.

4. High Adaptability to Harsh Environment

Compared to the elements of other systems, compressed air is less affected by high temperature, dust, corrosion, etc.

5. Safety

Pneumatic systems are safer than electromotive systems because they can work in inflammable environment without causing fire or explosion. Apart from that, overloading in pneumatic system will only lead to sliding or cessation of operation. Unlike electromotive components, pneumatic components do not burn or get overheated when overloaded.

6. Easy Selection of Speed and Pressure

The speeds of rectilinear and oscillating movement of pneumatic systems are easy to adjust and subject to few limitations. The pressure and the volume of air can easily be adjusted by a pressure regulator.

7. Environmental friendly

The operation of pneumatic systems does not produce pollutants. The air released is also processed in special ways. Therefore, pneumatic systems can work in environments that demand high level of cleanliness. One example is the production lines of integrated circuits.

8. Economical

As pneumatic components are not expensive, the costs of pneumatic systems are quite low. Moreover, as pneumatic systems are very durable, the cost of repair is significantly lower than that of other systems

XII FUTURE SCOPE

- Maximum flexibility.
- Reduced delivery time.
- Use of GSM technology for feedback.
- Use IOT based systems support.
- Manual system is converted into automatic system.
- Use PLC and HMI in material feeding process.

XIII CONCLUSION

It helps reduce human interference. It also manages the material feeding process. The main advantage is to reduce in labor cost and also avoid collision associate with human. It is economically efficient and fully automated process. By using IOT, operator/Manager will get feedback from machine.

REFERENCE

- 1) Yanik, P. (2017, April 11). Fundamentals of Programming. Cullowhee, NC, United States of America.
- 2) T. G. Jeong, D. B. Bogy, "An experimental study of the parameters that determine slider-disk contacts during dynamic load-unload", *ASME Journal of Tribology*, vol. 114.

- 3) A. B. Bogy, Q.-H. Zeng, "Design and operating conditions for reliable load/unload systems", *Tribol. Int.*, vol. 33.
- 4) J. P. Peng, *ASME J. Tribology*, vol. 121, P. W. Smith, G. L. Best, *Tribology Trans.*, vol.4.