

# Design and Fabrication of Pneumatic Systems using Automation

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**Abstract**— In this project we are initiating the use of pneumatics in production line. The use of pneumatics along with automation can take the production a step further in efficiency and quality. The design and fabrication of pneumatic machine is totally economical in human effort and useful in improvement of cost factor in work place layout, and design of plant and equipment. We know that pneumatic machines are very cheap as compared to hydraulic machine and easy to maintain. The projects main focus is to develop a working model of a production line consisting of operations like a)Work piece movement b)Pneumatic pick and place c)Pneumatic hammering d)Pneumatic punching and e)Pneumatic sheet metal cutting, the project also shines a light on how to develop a cost effective equipments for small industries. We also aim to develop a safer environment for the labour force as we try to automatize the working model.

**Keywords:** Automize; Work piece movement; Pneumatic pick and place; Pneumatic hammering; Pneumatic punching; Pneumatic sheet metal cutting

## I. INTRODUCTION

Pneumatics is a field of engineering which deals with the use of compressed air. The first dated knowledge of pneumatics date back to ancient Greece. Who date that he could power his inventions using steam or wind. Then a modern era of pneumatics starts the 17th century, where a German physicist invented a vacuum pump, which was a huge leap in the field of pneumatics. The pump was capable of drawing air from an attached container, but now in the 21st century, the field of pneumatics has changed drastically and is used extensively. These days' pneumatic devices vary from simple hand-held instruments to sophisticated machines that can perform several tasks at a time. The machines developed today has the capability of handling differs from soft, delicate products like an egg to cutting and handling of hard metals. The pneumatic system has a wide range of and, air. The supplied to the systems are mostly dried, removing the moisture, and a small amount of oil is added into the compressor to prevent corrosion and to lubricate the machine. There are no worries about poisonous gases being released into the air as the gas is usually just air. Small stand-alone devices use OFN (oxygen-free nitrogen). Any compressed gas other than air can be said as asphyxiation except oxygen, even though oxygen cant is used in its purest form as its highly flammable, expensive, and has no performance advantage over compressed air. The much smaller devices use in vehicles, small robots use compressed carbon dioxide.

### A. Pneumatics in Material Handling

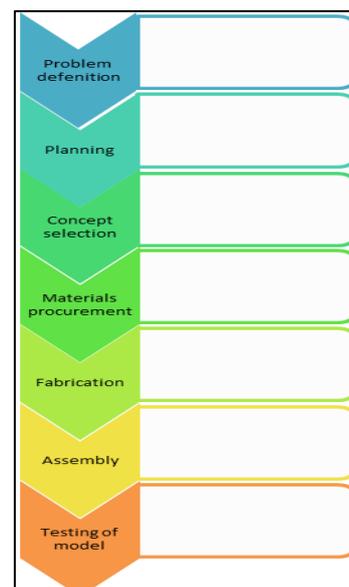
Pneumatic systems usually operate at a much lower pressure than that of hydraulic systems. They hold many advantages that make it more likely to be suitable for many applications.

As the pressure of a working pneumatic system is lower than that of hydraulic systems, the components required can be developed using lighter materials such as aluminium and engineered plastics. Whereas hydraulic components are made of steel and ductile or cast iron. Hydraulic systems are usually considered rigid, and pneumatic systems offer to cushion. The pneumatic systems are simpler as the air can be exhausted into the atmosphere, wherein hydraulic systems the fluid has to be directed back to the reservoir. They even hold an advantage over electromechanical power transmission methods as they succumb to limitations due to high heat generation. The heat generation in the pneumatic system is not an issue as they are expelled to the atmosphere as the air keeps circulating. As there are no requirements for heavy equipment in pneumatic systems, we can save repair costs and electricity, thus directly favours the environment

## II. OBJECTIVES

- To develop an automated production model that can be reliable.
- To select the best and safer automation system for the future taking into consideration of environment and
- A system with lower initial investment and maintenance cost.
- A system which can be operated from any part of the world.
- To design a small simpler system to be manufactured in small industries.
- To increase efficiency of production lines and decrease stress on labor force.
- To design machines for simple but common operations in production lines.

## III. MATERIALS AND METHODOLOGY



– MATERIAL USED

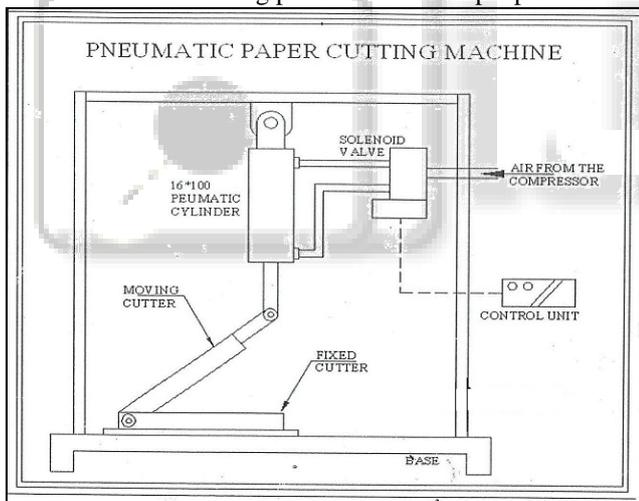
- 1) Cast iron base for frame
- 2) High speed steel for sharing blade
- 3) ARDUINO chips
- 4) LCD screen
- 5) WIFI ESP
- 6) IR sensors
- 7) Weight sensors
- 8) Traffic sensors
- 9) Micro controller
- 10) Nano radio frequency
- 11) DC motor
- 12) PCB

– SOFTWARE USED

- 1) MATLAB v.16
- 2) ATMEG 1m328
- 3) ARDUINO IDE
- 4) Language in C
- 5) Java programming

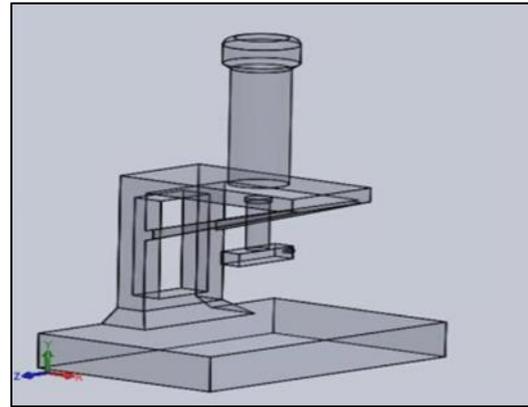
A. Sheet Metal Cutting

The most commonly used tool in mechanical industries, the sheet metal cutting machine is the most vital part for starting a many works. We have aimed at atomizing this machine buy using pneumatics. The machine can here by produce cut sheets on the go of a command. The device is designed to operate at a maximum of 100bars the device can interpret between other machining parts to start or stop a process.



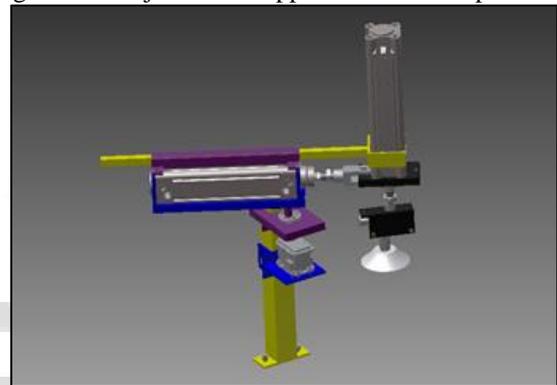
B. Pneumatic Punching and Hammering Machine

The device is connected in a row along with the pneumatic cutting machine the device is designed to perform two operations the first operation is to perform a hammering process where the work piece entering this section gets hammered when the mallet attachments installed and the same work piece gets a punching process performed over it when a die is installed the holding socket. The switching of the process can also be automated but in the presented model the switching need to be manual with the help of three screws.



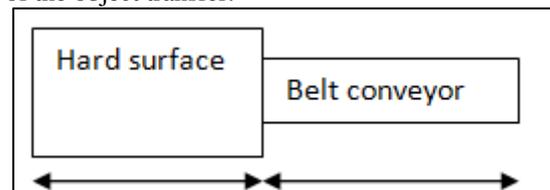
C. Pneumatic Pick and Place

The work piece is fed into the preferred section and the weight and traffic sensors senses the object and the pneumatic arm is actuated to clamp onto the object the acting and retracting of arm causes the work piece to move upwards and the arm is transferred along the supporting railing and the objects are dropped at end of the process.



D. The Work Piece Movement

The work piece movement in the project is very crucial as in for the model to work at its best the movement of the object has to be timed perfectly, to increase the efficiency of production. The movement of work piece is in two different phases. The first half of the transport happens with the help of a screw on a hard surface in order to produce a clean cutting and hammering process. The screw rod pushes the object to the first stage where the cutting process takes place then it moves further away on the same hard surface machined with grooves to accommodate functions like cutting and hammering. The next phase is when the object travels to a belt conveyor as the screw rod pushes the object onto the belt, the pick and place process happens over this part of the object transfer.



IV. EXPERIMENTAL RESULT

The experiment resulted in an automated pneumatic system which can be operated through WIFI. The model would

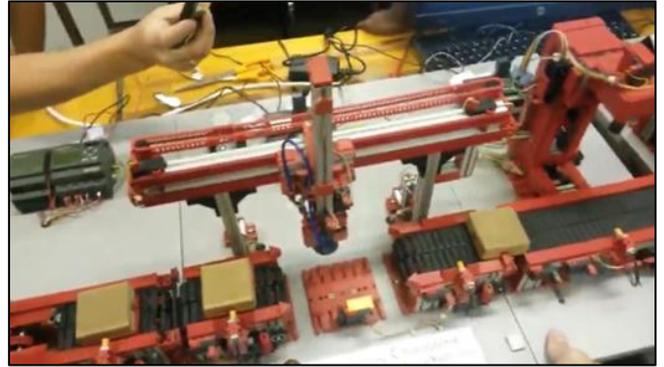
operate successfully, and it can perform the operation required like sheet metal cutting, pick and place, hammering, punching and work piece movement in an organized manner.

## V. CONCLUSION

The experiment has shown us the extensive use of pneumatics in automation within industries. The pneumatic system has made human life simpler and safer, when automation is included. The pneumatic system is more environmental friendly when compared any other systems. The main use of pneumatics till now was at industries which had huge revenues, as of our goal to make this machine affordable could be achieved when components are mass produced. The project was concluded with bright hope of, making pneumatic systems more affordable in the mere feature. So that a small scale industries could invest in automated pneumatic production lie to maximize their profit, and increase their efficiency in production and packaging.

### A. Future Scope

- The model can be implemented in small scale industries.
- The initial investments can be further reduced buy mass producing equipments.
- This model can ensure safety of labor forces.
- The final cost of the products manufactured or packed can be reduced
- Initial time for production can be reduced.
- The maintenance cost of the product can be drastically reduced.
- Harmful effects on environment can be reduced, hence safer for the environment.



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