International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Design and Development of Semi-Automatic Plastic Glass Packaging Machine

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Abstract – *The packaging industries has advanced leaps and bounds over the few years. The glass packaging machine also known as form fill and seal machine. These are available over a wide capacity range. A low cost automated packing machine can be used by small enterprises which would help reduce their cost of plant. This low cost automated machine uses simple mechanical, electrical and electronic system. In these paper we have presented one such low cost glass packing machine. An additional filling and packing mechanism has been added to increase the accuracy of the system. The Various processes involved in the in the glass packaging are neatly aligned and properly timed to get optimum production rate. A mechatronics system, developed for this machine, which takes feedback from sensors and accordingly controls the manipulators has been introduced in this paper. A microcontroller is used for this particular machine. A detailed cost comparison between a conventional machine and the one developed by us has been presented.*

KeyWords **:Packaging, Low Cost Automation, Microcontroller, Mild steel etc.**

1. INTRODUCTION

This project introduces a semi automatic packaging machine in industry. The main aim of the project is to design and fabricate a small and a simple packaging system. Packing technology have been increasing rapidly and proving its role in automation beneficially. In small scale industry this type of machine requires for glass packing with liquid. In addition to that, this system is able to decrease product time and increase the product rate as compared with traditional manual system. The purpose of this project is to develop an semi automation technique.

Automation is mostly used in various industry for increasing speed, accuracy and effectiveness of the production and also reduce risky hazards. This project is used to auto filling liquid with same level of the object in automation technique. Human workforce is used in filling and packaging industries in the existing system.

1.1 Summery

a. Study and analysis of problem.

b. Selection of suitable mechanism.

c. Design of different parts.

d. Modeling on solid works.

e. Selection of material.

1.2 Assumptions

a. For only filling and packing system.

b. Required quantity of liquid per unit time.

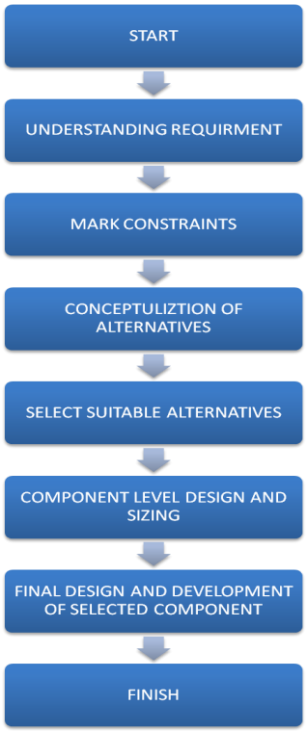
c. Silver foil is used for glass packing.

2. LITERATURE REVIEW

Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale and use. Carton is the name of certain types of containers typically made from paperboard which is also sometimes known as cardboard. Many types of cartons are used in packaging. Sometimes a carton is also called a box. Cartons can be made from many materials: paperboard, various plastics or a composite. Some are "food grade" for direct contact with foods. Many cartons are made out of a single piece of paperboard. Depending on the need, this paperboard can be waxed or coated with polyethylene to form a moisture barrier. This may serve to contain a liquid product or keep a powder. Prepress is the term used in the printing and publishing industries for the processes and procedures that occur between the creation of a print layout and the final printing.

A few years back, the mineral water market had been crawling at the rate of 3-4%, or even a lower figure. Indians carried drinking water in earthen pitchers, bucket, plastic or bottles. A number of cases of typhoid and other waterborne diseases began to be reported. Apart from that, liberalization happened and the mineral water industry began to be stirred and shaken. The market started growing an astounding rate of over hundred percentages per annum. The fact that there were very few players in the market meant that their business grew by leaps and bounds.

3. RESEARCH METHODOLOGY



3.1 Material Selection

- **Mild Steel**

Mild steel is a type of steel alloy that contains a high amount of carbon as a major constituent. An alloy is a mixture of metal and non metal, designed to have specific properties. Alloys make it possible to compensate for the shortcomings of a pure metal by adding other element. To get what mild steel is, one must know what are alloy that are combined to make steel. So let us see what we mean by steel, which will help us in understanding what mild steel is and also in understanding properties of mild steel.

- **Mild Steel Composition & Properties**

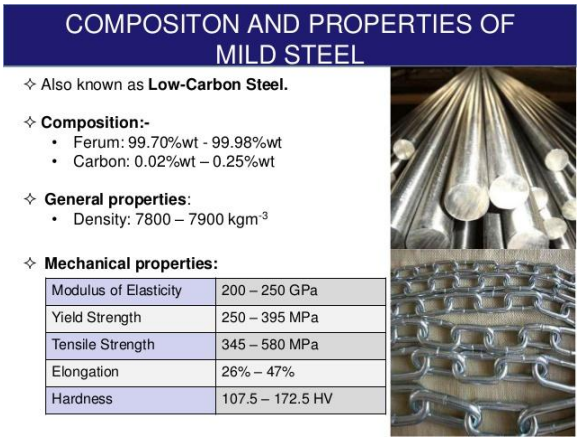


Fig-1: Composition & properties of MS

3.2 PCB & Microcontroller Kit

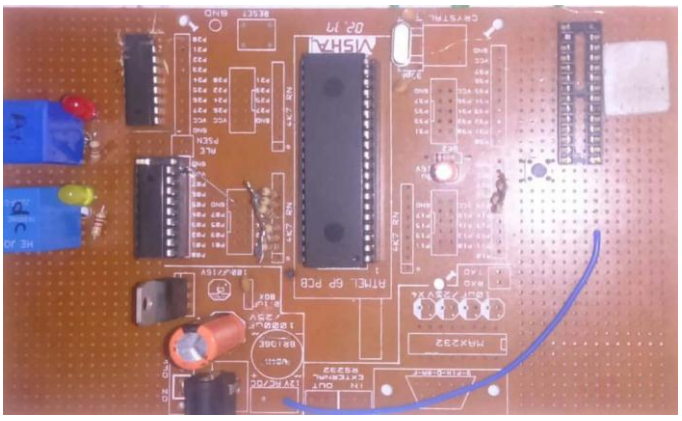


Fig -2: Microcontroller Kit

- **PCB**

A printed circuit board (PCB) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

- **Microcontroller: (AT89C52)**

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

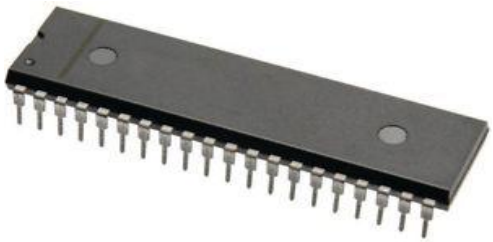


Fig -3: AT89C52

Table -1: Specifications of AT89C52

Ram	256 Bytes
Flash	8 KB
No. of timers	3 (16-bit each)
Number of Interrupt Sources	8

4. CONSTRUCTION & WORKING

The construction details are as follows:

a] Frame:

For construction we have used square pipe of mild steel having size of 1×1".For manufacturing of frame we required total 6.7meter length pipe.

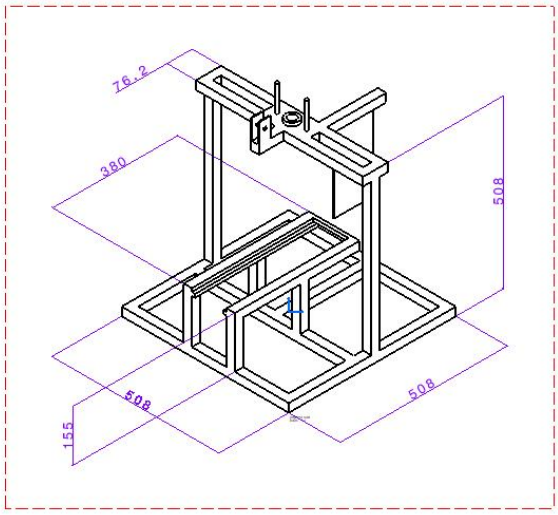


Fig-4: Drafting of Frame

b] Rectangular Die:

Die is also made up of mild steel. The dimensions of die are show in above figure. The die is used to support the plastic glass and move forward and till it touches the other end.

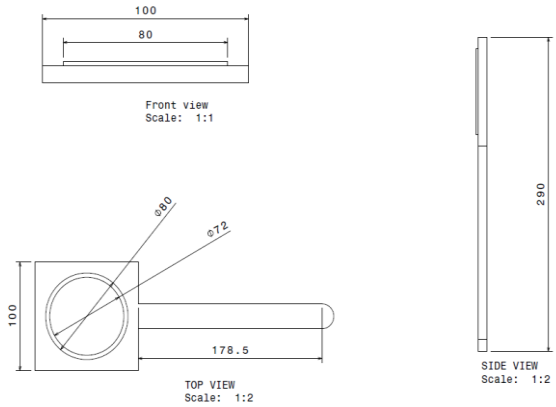


Fig-5: Drafting of Die

c] Heating Coil:

It is used to seal the glass by using sliver foil. The temperature of heating coil for sealing silver foil on the glass is near about 35°c.The outer diameter of heating coil is 135mm and inner diameter is 60mm.

Above figure show drafting of heating coil.

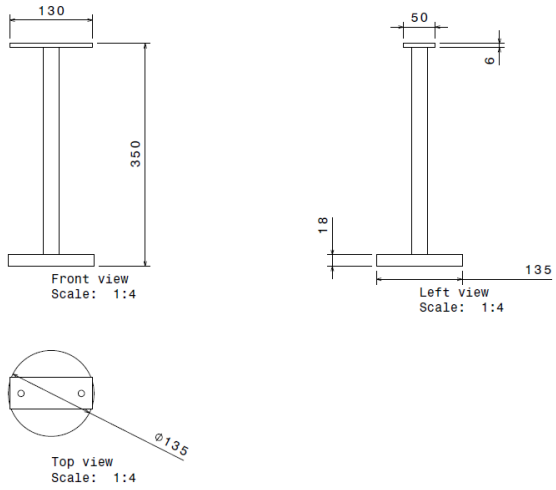


Fig-6: Drafting of heating coil

4.1 Selection of Electronics part

a] Limit switch:

A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection.

b] Microcontroller: (AT89C52)

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is

manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.

c] Water pump: (12V DC)

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

d] Magnetic sensor:

A Hall Effect sensor is a transducer which varies its output voltage in reaction to a magnetic field. These types of sensors are used for proximity switching, speed detection, positioning and current sensing applications. By using groups of Hall Effect sensors, the relative position of the magnet can be determined

e] Temperature Regulator:

It is used to control the temperature of heating coil which is (35°c) for sealing the silver foil on plastic glass.

4.2 Working principle

The empty glass is placed in the sliding die. When the glass is placed in the die, the limit switch for pump motor gets actuated. The pump motor starts and runs for 3 seconds and delivers 200ml. After filling the glass pump motors stops. The sliver foil is placed on the glass. Now the sliding die is slided forward. This actuates the limit switch of wiper motor. The wiper motor starts and presses the heating coil. The temperature of heating coil is 35°c which is controlled by temperature regulator. The pressing die is pressed for 2 sec and then release. After sealing the sliding die is moved backward and sealed glass is taken out and another empty glass is placed.

4.3 Machine Layout

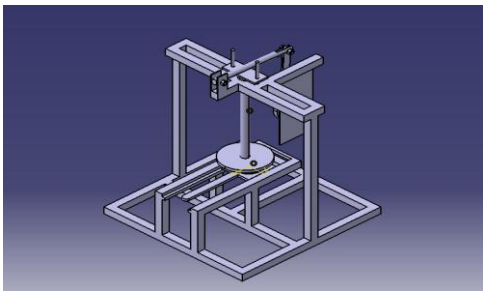


Fig-6: Catia Drawing

4.4 Process Flow

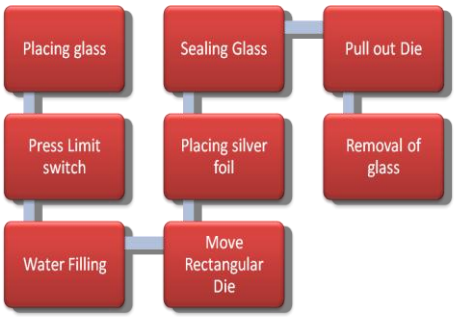


Fig-7: Process flow chart

4.5 Actual Machine

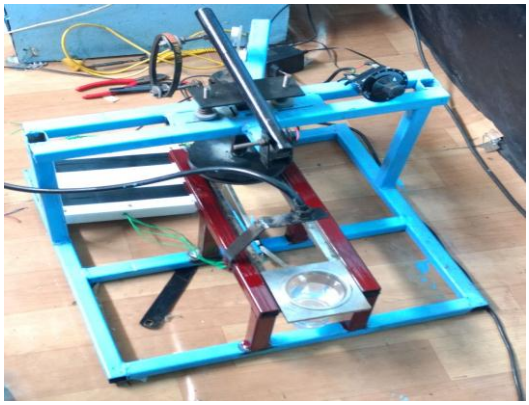


Fig-8: Actual machine

Fig-9: packaged glass

4.6 Advantages

1. Improve labor productivity.
2. Ensure packaging quality.
3. Handle specialized requirements, such as pressure filling.
4. Reduce labor and improve working conditions for bulky/heavy products.
5. Reduce packaging cost

5. CONCLUSIONS

Using currently available information and data on automation techniques and mechatronics systems the automation of the machine has been developed. Due to simple design and use of low cost reliable components, the machine is developed in lesser cost as compare other conventional machines. Low cost automated glass packing machine is successfully developed which can benefits small industries and enterprises. Safety of the workers is achieved as the machine requires very less human intervention.

We have concluded that by the application of recent techniques, we can achieve higher packaging quality at lower cost with maximum production efficiency. Packaging is the need of the hour. Packaging industry will expand in future and consequently it will enhance its market shares.

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