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PLC Based Paper Glass Bottom Cutting Machine

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Abstract: Advance paper glass bottom cutting machine is an ideal and professional machine. It is mainly used to cutting bottom of waste paper glass. Various sizes of paper glass are cutting by using this machine. It is also used in agriculture area. It is a automatic machine with multi running position.

Paper cups have numerous advantage like they are manufactured in a very simple process using food grade raw materials with least waste and are easiest to recycle. They are ideal for individual servings at all kinds of parties, functions picnic, occasions, marriages, chat, tea and food joints, etc. non toxic in nature, the shapes and surface designs on these paper cups are attractive and present an inviting look. These paper cups can also be custom printed with an outlets logo, brand punch line or advertising message. Available in a wide variety of designs, textures, colors, and sizes, disposable paper cups are gorgeous, stylish and eloquent. Adding premium aura wherever used, these cups are made with utmost care to detail and are a unique addition to any table setting. Hence the future of proposed unit for manufacturing paper cups is very vibrant and will be a gesture towards supporting the usage of eco-friendly products.

Keywords: Air Compressor,Pneumatic valve, PLC, Pneumatic Cylinder

I. INTRODUCTION

Advance paper glass bottom cutting machine is an ideal and professional machine. It is mainly used to cutting bottom of waste paper glass. Various sizes of paper glass are cutting by using this machine. It is also used in agriculture area. It is a automatic machine with multi running position.

Disposable food service products were initially developed to enhance public health by improving practices. In the food service industry. This requirement when combined the environmental threat faced by us at the tur of the 20th century and need of strong efforts in order to conserve the environment gave birth to the concept of PAPER GLASS CUPS. There are several inherent advantages in using paper cups as compared to cups of other materials. These paper cups are gaining popularity all across the globe as a beautiful and stylish way of minimizing exposure to food borne infections. Paper cups have numerous advantage like they are manufactured in a very simple process using food grade raw materials with least waste and are easiest to recycle. They are ideal for individual servings at all kinds of parties, functions picnic, occasions, marriages, chat, tea and food joints, etc. non toxic in nature, the shapes and surface designs on these paper cups are attractive and present an inviting look. These paper cups can also be custom printed with an outlets logo, brand punch line or advertising message.

Available in a wide variety of designs, textures, colors, and sizes, disposable paper cups are gorgeous, stylish and eloquent. Adding premium aura wherever used, these cups are made with utmost care to detail and are a unique addition to any table setting. Hence the future of proposed unit for manufacturing paper cups is very vibrant and will be a gesture towards supporting the usage of eco-friendly products

II. LITERATURE SURVEY

Programmable Logic Controllers (PLCs) have become a crucial part of industrial automation due to their reliability, flexibility, and ability to control complex processes with precision. In recent years, research on PLC-based automation has significantly contributed to the advancement of manufacturing and material processing industries. Several studies have explored the use of PLCs for cutting applications, leading to improved efficiency, accuracy, and safety in industrial operations.

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Wang and Liu [1] developed a PLC-controlled paper-cutting system using a motor feedforward and fuzzy PID strategy to enhance control precision. Their research emphasized the need for adaptive control methods in cutting machines, which help minimize errors and improve operational efficiency. Similarly, Sah [2] presented a study on a cut-to-length machine that utilized a PLC for automating the process, leading to reduced human intervention and increased productivity.

Mashori [3] explored the development of an automatic cutting machine based on PLC, highlighting its advantages in terms of precision and ease of operation. Their research demonstrated that PLCs could significantly reduce material waste and improve production speed. Durrani and Riaz [4] extended this concept by integrating SCADA with PLC-based pneumatic cutting machines, allowing for remote monitoring and control, thereby enhancing industrial automation applications.

Another study by Kumar et al. [5] focused on automated profile cutting using PLCs, showing how automation in cutting operations could lead to consistency in quality and reduced manual labor. They implemented a closed-loop control system that ensured accurate cutting with minimal deviations. This study aligns with the findings of Gupta and Sharma [6], who developed a stepper-based precise cutting machine incorporating both PLC and HMI interfaces, enabling user-friendly control and real-time monitoring.

Verma and Singh [7] proposed a cable-cutting machine using PLC, which shares similarities with paper cutting applications. Their approach emphasized the importance of integrating stepper motor control programs with PLC logic to achieve high-precision cuts. Patel [8] also investigated the design and fabrication of a PLC-based paper-cutting machine, highlighting the importance of synchronization between the PLC program and the mechanical cutting mechanism.

Sharma [9] provided a comprehensive review on PLC-operated cutting machines, discussing various approaches and technologies used in the field. Their work emphasized the need for real-time monitoring and adaptive control to optimize the cutting process. Additionally, step-NC technology [10] and Linux CNC-based control systems [11] have been explored in CNC-based cutting machines, providing valuable insights into software-based enhancements for PLC-controlled machines.

The reviewed literature suggests that PLC-based automation in paper glass bottom cutting can lead to significant improvements in efficiency, precision, and reliability. Most studies focus on optimizing control algorithms, integrating real-time monitoring, and reducing human intervention in the cutting process. The current research builds on these advancements by designing a specialized PLC-based system for paper glass bottom cutting, which aims to improve accuracy while ensuring ease of operation.

III. METHODOLOGY

Methodology consists of three processes, basically our project works on the parameter that related in this project mainly used to cutting the bottom of waste paper glass, so here we need to check that parameter and process on same. Three methods are as follows,

1) Air Creating Process
2) Controlling Process..
3) Sensing Process..

For compressor we have used to air compression in our project. Then input supply to pneumatic valves and pneumatic valve is automatically control by using proximity sensor.

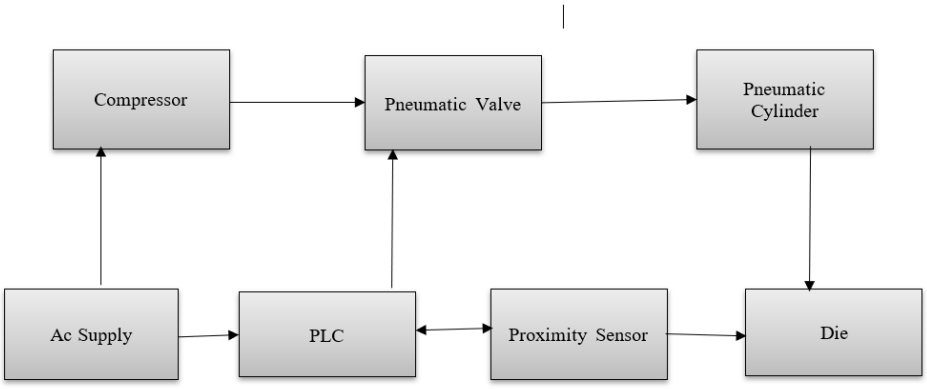

Fig :1.1 Block diagram of PLC Based Paper Glass Bottom Cutting Machine

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ACTUAL CIRCUIT DIAGRAM

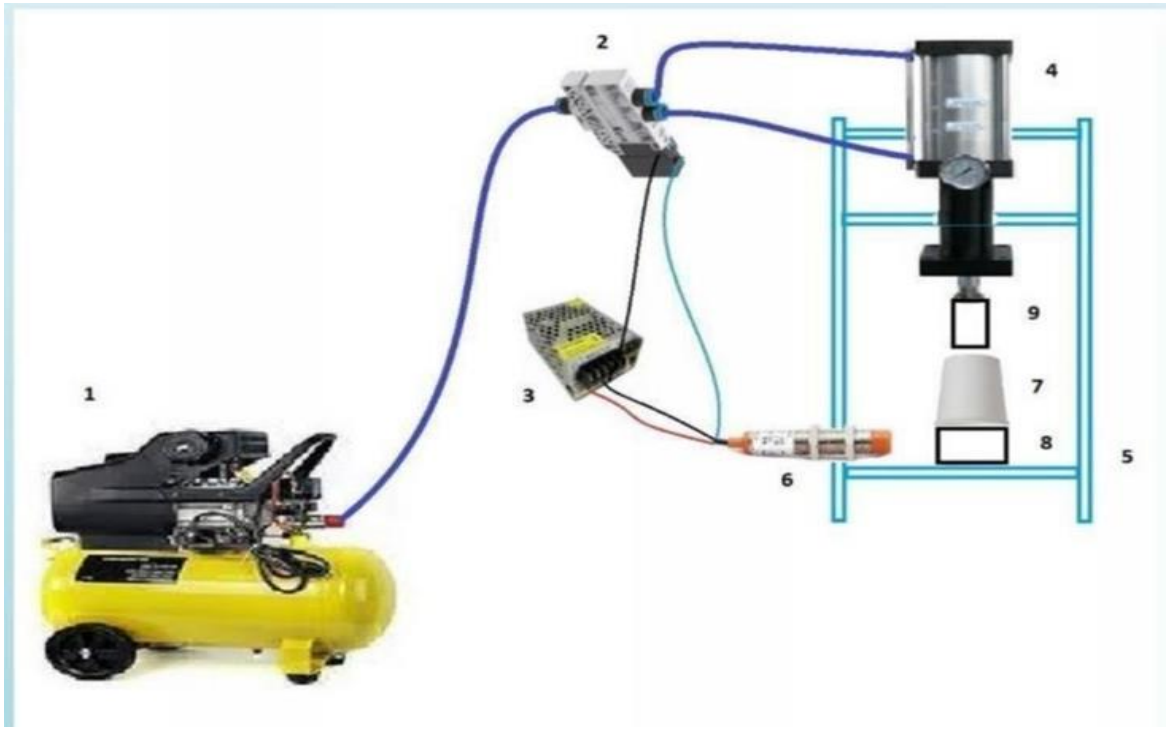

Fig 1.2 Actual Circuit Diagram of PLC Based paper glass bottom cutting machine.

Three methods are as follows,

I.Air Creating Process.
II.Controlling Process.
III.Sensing Process.

1) Air Creating Process :-
Air Creating process is the first basic process of our project. An air compressor is a device that converts power using an electric motor diesel or gasoline engine etc. into potential energy ,stored in pressurized air (i.e compressed air) by one of several methods an air compressor force to move more and more air into air storage tank increasing the pressure.

2) Controlling Process : -Our second process is comparison process, for this process we use pneumatic valve. A pneumatic valve is a device that is used control or modulate the flow of air (or another inert gas) in a pneumatic system. Pneumatic valves also called directional control valves are activated in a variety of ways insulting manually or automatically operated

3)Sensing process :-
Sensing process consists of proximity sensor. It is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor adjusted to a very short range is often used a touch switch.

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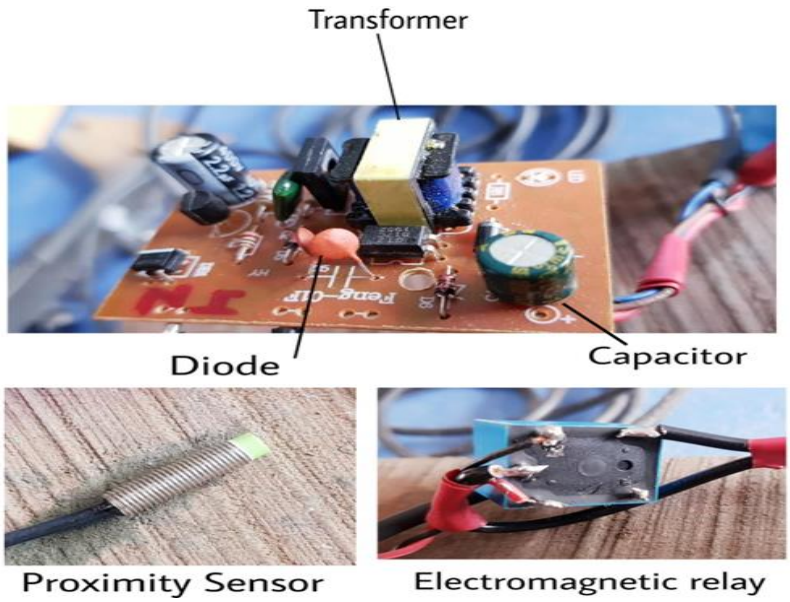
Mechanical Structure

Electrical Design



IV. EQUIPMENT LIST WITH SPECIFICATION

	Equipment	Specification
1	Air Compressor	1phase , 230V/50Hz, pressure 8 bar/116psi
2	Pneumatic Valves	One Port Two way
3	PLC	TWIX 1, Four Input & Output
4	Pneumatic cylinder	80 – 100 psi, 8 bar
5	Relay	Electromagnetic 12V DC
6	Proximity sensor	6 to 36 V DC , PNP , Sensing range 15mm
7	Paper cup	-
8	Lower Die	-
9	Upper Die	-

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1) Air Compressor

Fig : An Air Compressor

An air compressor is a pneumatic device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When the tank's pressure reaches its engineered upper limit, the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank. An air Compressor must be differentiated from a pump because it works for any gas/air, while pumps work on a liquid.

2) Pneumatic Valve

Fig : Pneumatic valve

A valve is a mechanical device that controls the flow of fluid and pressure within a system or process. A valve controls system or process fluid flow and pressure by performing any of the following functions:

- Stopping and starting fluid flow
- Varying (throttling) the amount of fluid flow
- Controlling the direction of fluid flow
- Regulating downstream system or process pressure
- Relieving component or piping over pressure

3) PLC

Fig: PLC

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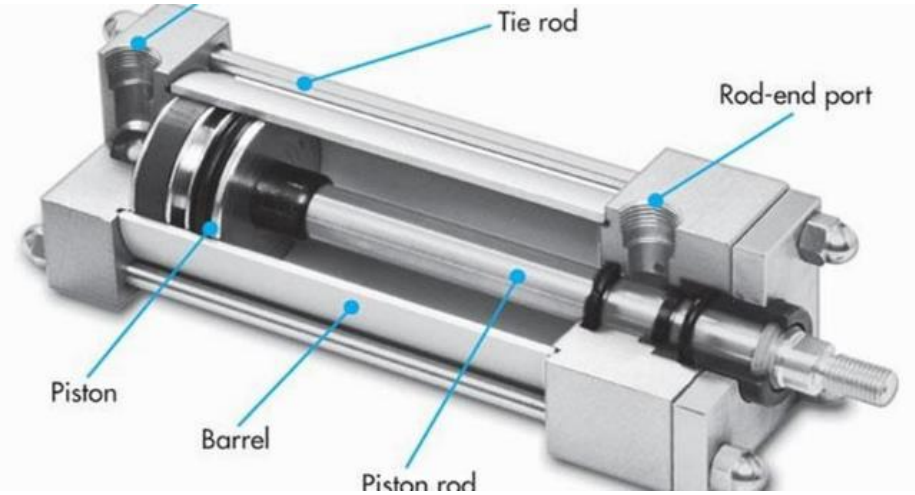
The PLC receives information from connected sensors or input devices, processes the data, and triggers outputs based on pre-programmed parameters. Depending on the inputs and outputs, a PLC can monitor and record run-time data such as machine productivity or operating temperature, automatically start and stop processes, generate alarms if a machine malfunctions, and more. Programmable Logic Controllers are a flexible and robust control solution, adaptable to almost any application

4) Pneumatic cylinder



The P1A range of cylinders is intended for use in a wide range of applications. The cylinders are particularly suitable for lighter duties in the packaging, food and textile industries. Hygienic design, the use of corrosion-resistant materials and initial lubrication with our food-grade grease makes the cylinders suitable for food industry applications. Careful design and high quality manufacture throughout ensure long service life and optimum economy. Mounting dimensions fully in accordance with ISO 6432 and CETOP RP52P greatly simplifies installation and world-wide interchangeability. The cylinders are available in bores of 10, 12, 16, 20 and 25 mm, with stroke lengths from 10 mm to 320 mm. Single-acting cylinders with spring return in the retract direction are available in stroke lengths up to 80 mm. Single-acting cylinders with spring return in the advance direction are available in 16 mm, 20 mm and 25 mm bore sizes and with stroke lengths up to 80 mm. Double-acting cushioned cylinders Adjustable pneumatic cushioning permits greater loads and higher operating speeds, making the cylinders suitable for more demanding duties. These cylinders are available in bores of 16, 20 and 25 mm, with stroke lengths from 20 mm to 500 mm.
In addition to a wide range of standard cylinders, Mini ISO cylinders are available in several standard variants, such as non-standard stroke length, extended piston rods, double piston rods, high temperature versions etc. In addition, a complete range of sensors and mountings are available.

5) Relay

A 12V DC electromagnetic relay functions as an electrically operated switch, where a current applied to the coil generates a magnetic field that moves an armature, opening or closing contacts. When the coil is energized, it attracts the armature, causing normally open (NO) contacts to close and normally closed (NC) contacts to open, allowing or interrupting the flow of current in an external circuit. When the coil is de-energized, the magnetic field collapses, and a spring returns the armature to its original position, reversing the contact states. This allows the relay to control higher power circuits using a low-power 12V DC signal.

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6) Proximity sensor

A proximity sensor detects the presence or absence of an object without physical contact, typically using electromagnetic fields, light, or sound waves. It operates by emitting a signal (such as an electromagnetic field or infrared light) and measuring the changes in the signal caused by an object entering its detection range. When an object is detected, the sensor triggers an output signal, which can be used to activate or deactivate a device or process. Common types of proximity sensors include inductive (detecting metal objects), capacitive (detecting both metal and non-metal objects), and ultrasonic (using sound waves to detect objects at a distance). These sensors are widely used in automation, security, and industrial applications.

V. RESULTS AND APPLICATIONS

For the result of our project.

1) This machine is used for industrial purpose to cut the bottom of different paper glasses with respect to different dies.

2) This machine product is also useful for agriculture purpose

The Applications of our projects are.

1) Tree plantation (to germinate seed)
2) In mulching paper
3) Metal Sheet Punching

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IV. CONCLUSION

This paper deals with design and fabrication of advance paper glass bottom cutting machine. In this machine the work of operator is paper glass bottom cutting In order to increase the accuracy of cut and production rate and decrease the production time and accident caused due to manual cutting bottom of glass. PLC Based paper glass bottom cutting machine is defined in general as machine which manufacture paper glass either an a electronic or timed mechanical system for blank of paper for heating to bottom wall blanks. This machine product used (BOTTOMLESS Glass).

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