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Pipe Measuring and Marking Machine

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Abstract**—***In many pipe manufacturing industries, manufactured pipes are measured and marking by manual method only. They use ropes and some more manual methods to measure and mark the pipe which was delivered from injection molding. That can consume too much of time and labor cost also. In order to reduce that difficulty, that industry needs any automation technique to brief that manual method.*

Keywords**—** *Pipe Marking, Pipe Measuring, PLC, Pneumatics, Pipe Roller.*

I. INTRODUCTION

By analysing the manual methods, it is clearly determined that what are the techniques they are used to measure the pipes and what the drawbacks they are facing while they are measuring the pipes manually so decided to solve this problem by creating a solution we planned to design automatic pipe measuring device which can measure the pipes automatically once it is manufactured it does not require any additional time for measuring after manufacturing because the measuring are automated ,for the automation we have used PLC, solenoid valve, proximity metal detector sensor & single acting cylinder connected with marker with help of this components we can automate the marking and overcome this issue.

II. COMPONENTS

The selection of components involves the study of their characteristics, advantage, availability, cost, user friendly property of components that we want to use.

A. PLC

A programmable logic controller (PLC), or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis. They were first developed in the automobile industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays and timers. Since then they have been widely adopted as high-reliability automation controllers suitable for harsh environments.

B. Proximity Metal Detector

Metal detector is very common devices for checking the person in shopping malls, hotels, cinema halls to ensure that person is not carrying any explosive metals or illegal things like guns, bombs etc. Metal detectors can be created easily and the circuit is not that complex. The LC circuit will trigger the proximity sensor if it detects any metal near to it. Proximity sensor will give glow the led, and also make the buzz with the help of the buzzer.

C. Pneumatic Cylinders

Pneumatic cylinder(s) (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage. Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement.

D. Solenoid Valve

A solenoid valve is an electromechanically operated valve as shown. The valve is controlled by an electric current through a solenoid, in the case of a two- port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. Besides the plunger-type actuator which is used most frequently, pivoted-armature actuators and rocker actuators are also used.

III. DESIGN

The machine structure is designed using proper calculations and accurate measurements. An initial CAD model is designed based on which the changes are made.

A. CAD Model

The CAD model for the setup of our project is designed using the SOLIDWORKS software as shown in Fig. 1(a) and 1(b). The setup contains the parts such as Centered Shaft, threaded shaft, Brick alloy, Roller, Bearing support alloy. Except Brick alloy and setup which supports roller all the component made up of Mild steel. Cast iron is the material for Brick alloy and Aluminum for the setup supporting roller. As per design, Shafts such as Threaded Shaft and Centered Shaft have the height of mm length and diameter of 15mm and 20mm respectively. And then the dimension of roller is 25mm diameter. The brick alloy is rectangular shaped alloy and have the dimensions of 252*150*25mm.

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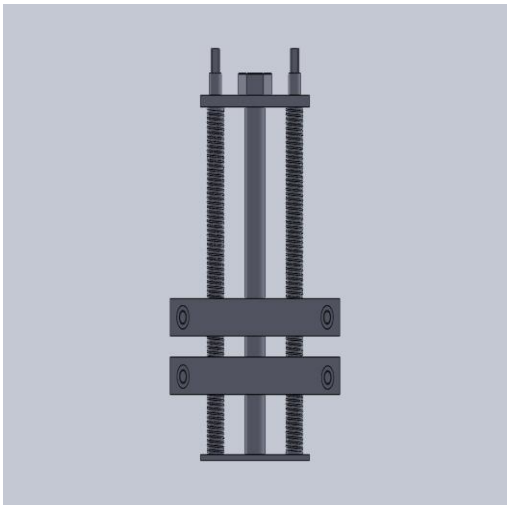
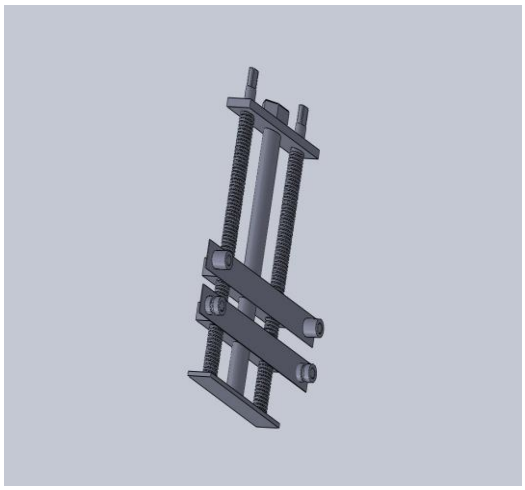


(a). Front view.



(b). Isometric view.
Fig. 1 (a) & (b). CAD model.

B. *Calculation*

In our project, there is some computational process has been solved for implement PLC program. Actually, computational method need to determine the conversion of area of roller into length. This needs because of frame the PLC program. In PLC program, there is preset value which indicates the counts of sending of sensed signal. For assign that value, there is an emerge for know about that how many rotation gives the value of pipe's length as our requirement. Requirement is changeable one so it is necessary to get knowledge in conversion mechanism. So the terms and formulae which we used were given below:

Actually, that roller covers 1 meter by rotating 6.4 times
Hence1m = 6.4* rotation of roller.
Radius of roller = 2.5cm,
Therefore, Circumference, $C = 2\pi r$

$$\text{Circumference} = 2 * 3.14 * 2.5$$

$$C = 15.63 \text{ cm.}$$

So, we set the program as when the sensor senses 6 times, PLC receives the signal continuously. When sensor giving signal 6th time to it, it will give supply to actuator with 1 second delay. This is for 1meter pipe output, we can alter this programming method as per our desired way.

IV. METHODOLOGY

A. *Flow Chart*

Our project had some procedural flow to regularize it to predefined path. This enhance more reliable and make others to understand it easily. That flow was represented as flow chart to simplify its process to get a keen knowledge about it.

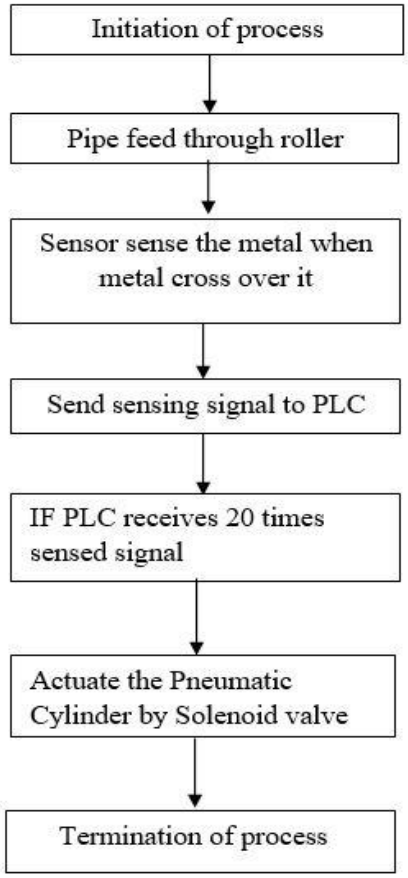


Fig. 2. Flow chart.

As per the Fig. 2, initial action proceeds from sensor. Actually, pipe feeds through roller and make it to rotate along with it. That rotating motion of roller makes the sensor to arise the signal. This is because of Proximity sensor, there is a metal attached on roller. Whenever roller rotates the metal cross the proximity sensor. This leads to sends the sensing signal to PLC by sensing that metal on roller.

Then PLC sends actuation signal to Solenoid valve which present here as actuator. But it sends only as per programming. For instance, program states as 20 times sensing signal makes actuator to actuate. PLC done that perfectly. After receiving actuation signal from PLC, Solenoid valve gets energized and opens the way to expand the pneumatic single acting cylinder. The Marker which is attached at the end of piston of pneumatic cylinder. That marker moves up along with pneumatic cylinder's piston and

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makes marking on ongoing pipe. This is the procedural flow for our project to done the automatic marking on pipes.

B. Circuit Diagram

In our project, we placed our setup in after for injection molding. In our setup, we had five divisional units such as height adjustment panel, Roller setup, PLC Kit, Marking mount and Sensor Mount as per figure. Height adjustment mount is used here to adjust the height of roller according to pipe diameter as shown in Fig. 3. So, by using this we can use this equipment to various diameter of pipe. After that unit, there is a unit of Roller setup. That is used in many ways in our project. First of all, it is used to deliver pipes from the manufacturing machine smoothly. And also it is used to send signal to PLC. This is because of presence of proximity sensor over roller. A metal is placed on roller. As a roller rotates metal is sensed by proximity sensor as per the rolling.

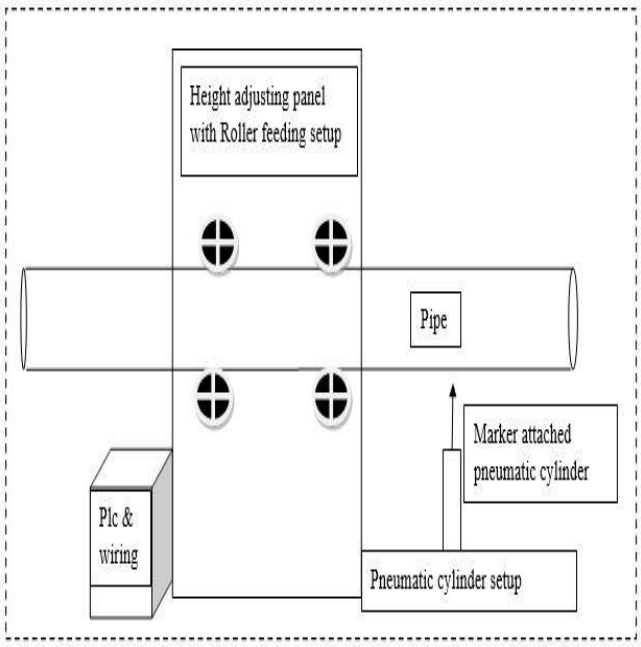

Fig. 3. Circuit diagram.

Pipe manufacturing machine delivers pipe continuously. That delivered pipe is entered onto our kit as per arrangement. That pipe entered via roller setup. Because of this roller rotates along with pipe's linear movement. Because of roller's rotary motion, proximity sensor senses the rotating metal on roller. That sensed signals transmitted to the PLC by proximity sensor. That signal actuates the solenoid valve by PLC. That actuation expands the pneumatic cylinder. That expansion makes the marker to move forward over the direction of pipe. Because the marker is attached onto the edge of pneumatic cylinder. That moved marker makes the mark on ongoing pipes. This work process is shown in Fig. 4. This is the working method of our project.

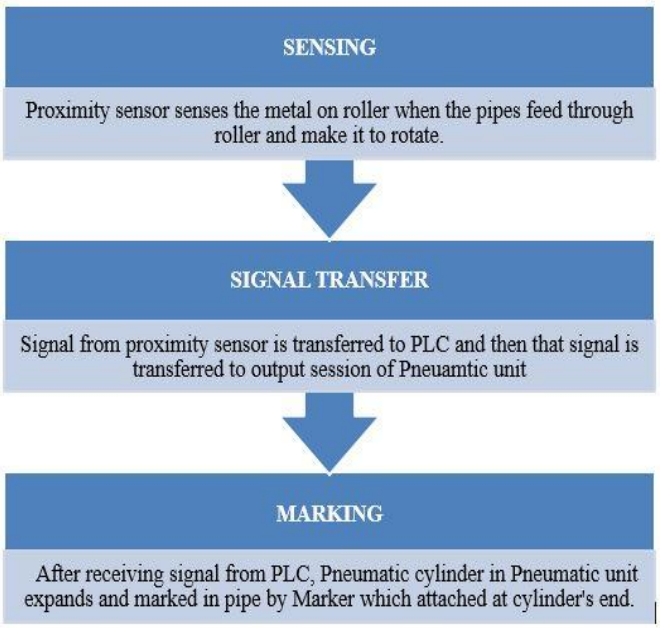

Fig. 4. Work process.

C. Program

In our project, we include programming for purposes of signal transmission and actuation of some equipment. In this, programming was done on PLC software. On that, we assume sensor's sensing signal as input and solenoid valve as output. In that PLC programming we assign input as "s1" which indicates sensor and output as "out" which indicates solenoid valve we need solenoid valve to actuate after getting signal 20 times from sensor.

For that purpose, we use counter "cu". In counter we set pre-set value 20. So when ever sensor send signals, counter start to count when that count reaches 20 it actuates output "out" and also reset counter because we assign the address of reset as same as address of output as shown in Fig. 5.

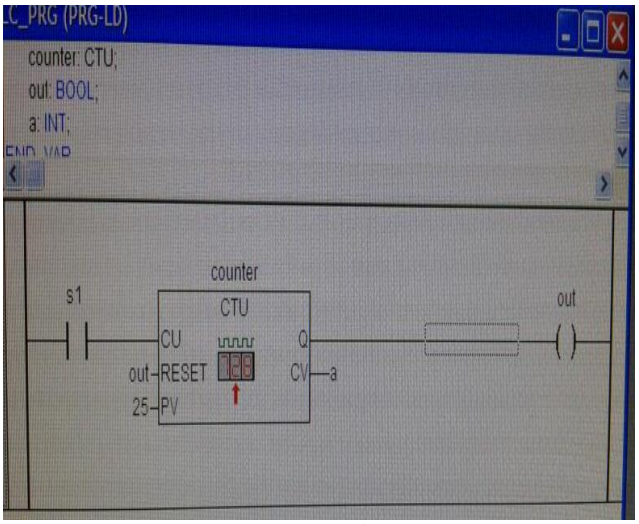

Fig. 5. Screenshot of program.

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V. RESULTS

This project can help in pipe manufacturing industries in terms of cost and accuracy it also reduces man power. Data comparison has been established in the table I for the efficiency in production between normal method and by using our project method on the basis of outcome of the industry.

TABLE I. Comparison of production rate.

S. No.	Time (Hour)	Production rate (meters)	
		Normal Method	This project
1	1	100	100
2	5	450	650
3	8	800	1000
4	10	1050	1200

Similarly, Data comparison has been established in the table II for the labor cost between normal method and by using our project method on the basis of outcome of the industry.

TABLE II. Comparison of labor cost.

S. No.	Production rate (Meters)	Labor Cost (Indian Rupees)	
		Normal Method	This project
1	1000	500	500
2	2500	1250	1000
3	5000	5000	1500

VI. CONCLUSION

By insist our project, some positive feedbacks achieved by in the processes. That are all improvements in production rate, accuracy, precision and labor cost. After insist our project, production rate was increased 25% than previous rate and also increase in accuracy. There is an option for increase response timing. Especially, our project can reduce the labor cost by half than previous costs. So our project yields many advantage for user. By analyze about our advantages, we believe our project is accepted and preferable one for people.

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