Design and Development of Automatic Bottle Filling Machine

GROUP NO. :- 22

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Outlook

- Project background

- Scope of project

- Objectives

- Literature review

- Structure

- Components

- Calculation

- Conclusion

- References

▶ Project Background

- The field of automation had a notable impact in a wide range of industries beyond manufacturing

- One of the important applications of automation is in the soft drink and other beverage industries, where a particular liquid has to be filled continuously. Our Project aim is to be making a filling machine having different volume of bottle.

- The filling operation is controlled using microcontroller.

- The microcontroller is cost effective, space efficient and reduces complexity. By programming the we control the entire system.

Objectives
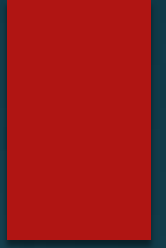
- The main objective of the project is to Design and Develop a Automatic liquid filling to bottles of different height with Microcontroller Integration.

- the present machines are that it can fill only a particular type of containers of specific volume, and the filling amount is as set by the operator.

- To develop a filling machine which can fill different volume of bottles on the bases of volume.

- This Can used in different industries like medicine, oil, chemical etc.

► Scope of Project
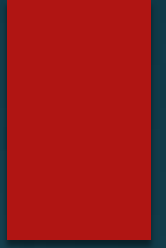
- Automation reduces the labor requirement.

- The machines are specialist for filling soft drink or water In any kind of bottle.

- Depending on the size, shape and Weight of the bottles filling operation can be done.

▶Literature Review

PLC Based Automatic Bottle Filling and Capping System With User Defined Volume Selection -8th August 2012

In This Research Paper the researchers **T.Kalaiselvi, R.Praveena at all.. Have** develop an automatic bottle, filling and capping system with a mechanism using sensors. Automatic filling process for all the bottles simultaneously with a user defined selection for volume to be filled.

AN AUTOMATED BOTTLE FILLING AND CAPPING PROJECT FOR FRESHMAN ENGINEERING STUDENTS –June 2005

In this paper the researchers **Kala Meah , Timothy Garrison , York College of Pennsylvania at all..** The students work in small teams and have roughly 12 weeks to design an automated electromechanical system that first transports three empty bottles, three tennis balls. The machine must fill each bottle. of water, cape each bottle by covering the top with a tennis ball, and then deliver the capped and filled bottles to an area outside of the operational zone.

PLC(Programmable Logic Controller) BASED AUTOMATIC BOTTLE FILLING -3rd may 2015

In This Research Paper the researcher **Jaymin Patel Department Of Physics and Electronics of Hemchandracharya North Gujarat University, Patan** has develop a bottle filling system based on certain specifications. More features can be added to this system as follows: Depending on the size, shape and weight of the bottles, Filling operations can be implemented.

AUTOMATIC LIQUID FILLING TO BOTTLES OF DIFFERENTHEIGHT USING PROGRAMMABLE LOGIC CONTROLLER –14th July 2013

In This Research Paper the researcher **MALLARADHYA H M, K R PRAKASH** have Design and Develop an automated liquid filling to bottles of different height using PLC. A total control is made in a filling is achieved. The programming to this system developed is flexible, quickly and easily.

AUTOMATED MULTIPLE WATER FILLING (AMWF) MACHINE - April 2009

In This Research Paper the researcher **RUHAIRI BIN ABDUL RAHIM from University Teknikal Malaysia Melaka** has developed a project to apply filling system where this system can automatically filling 2 type of liquid into their bottle randomly by using PLC as a controller. The filling system will be using the filling concept Time Gravity Filler Selection Guide.
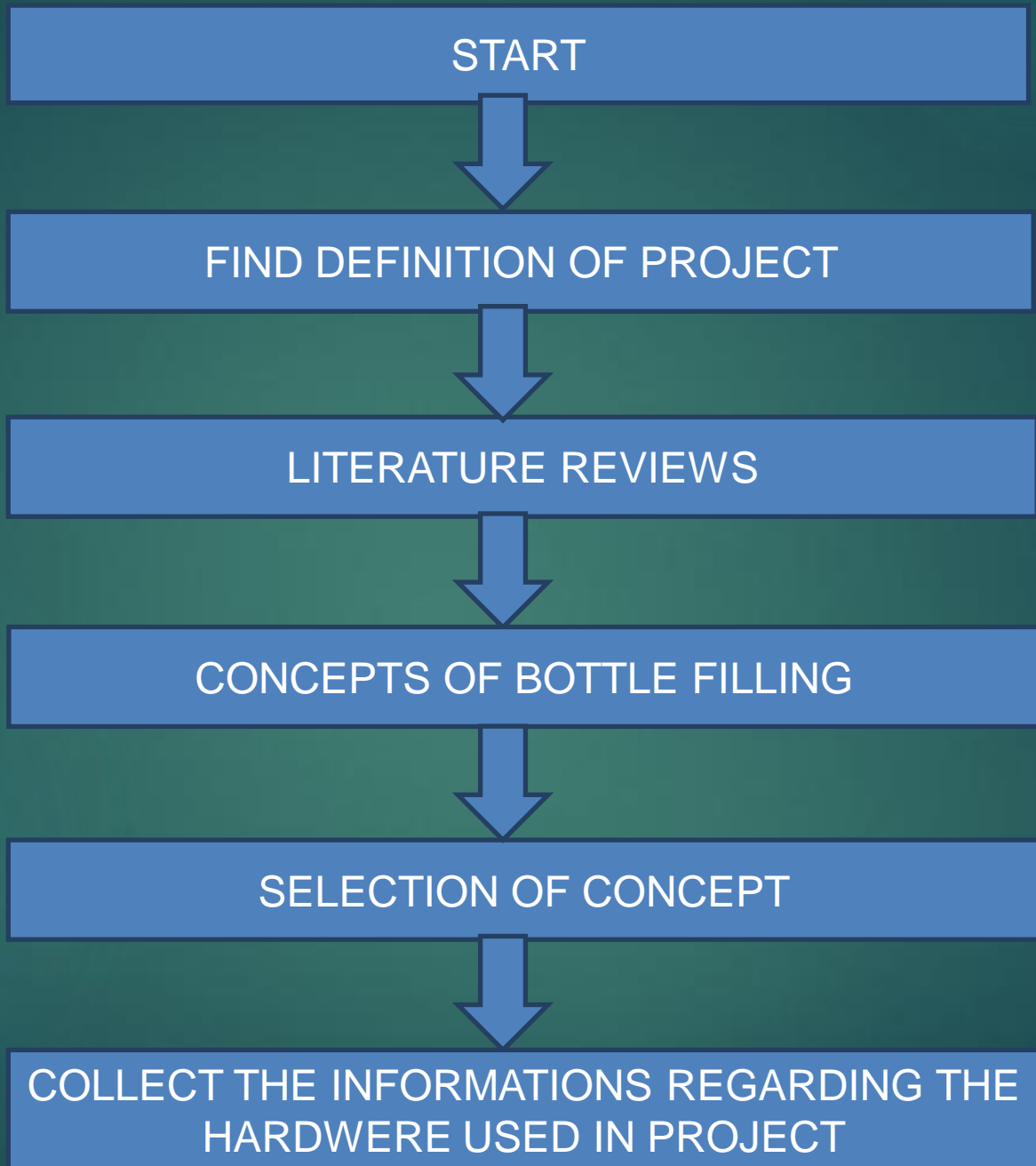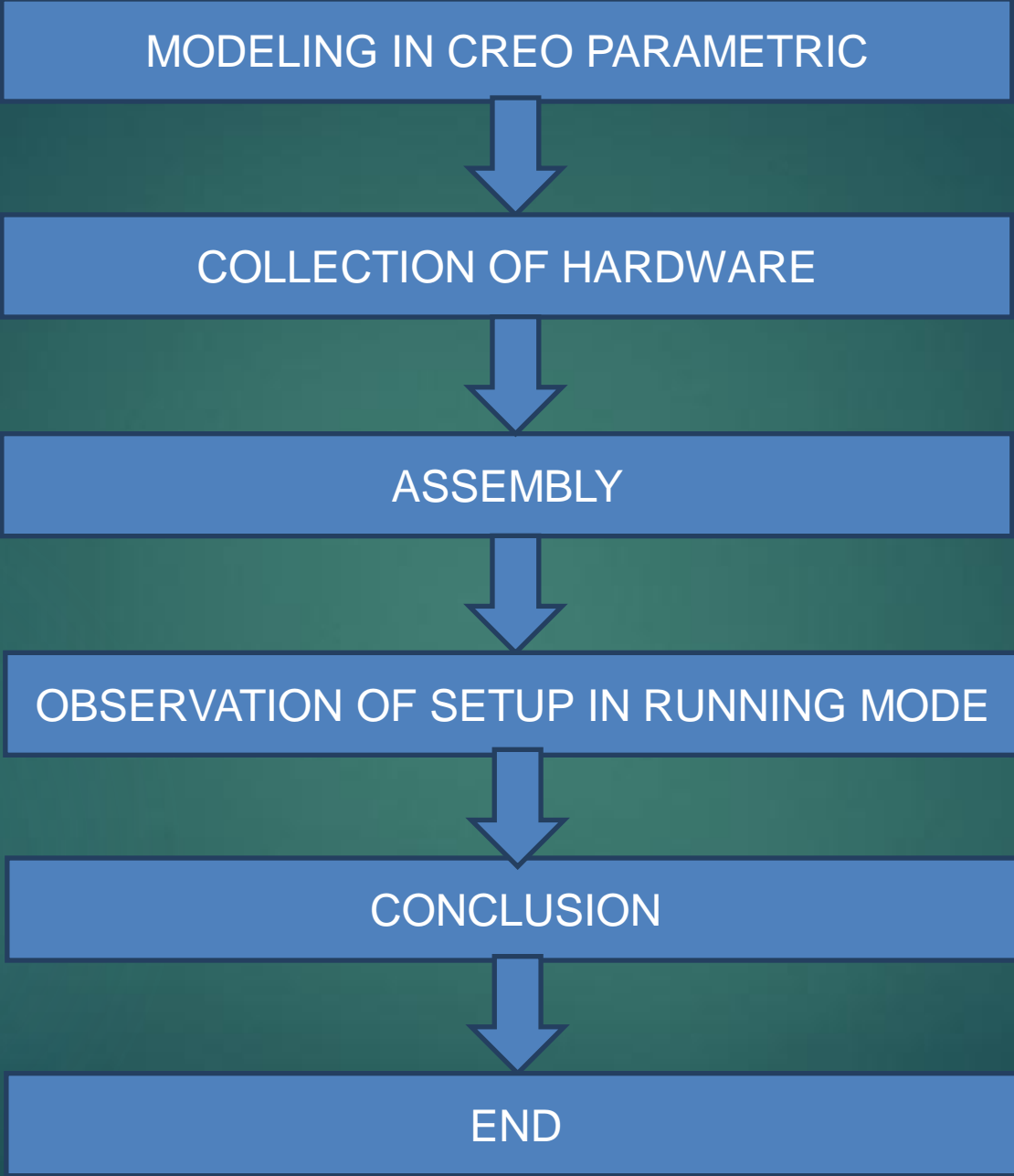
PLC BASED AUTOMATIC LIQUID FILLING SYSTEM - March 2015

In This Research Paper the researcher **S.Gowtham at all.. From INFO Institute of Engineering, Coimbatore has** developed a bottle filling machine for filling of same size of bottles. The Entire system is reliable and time saving.
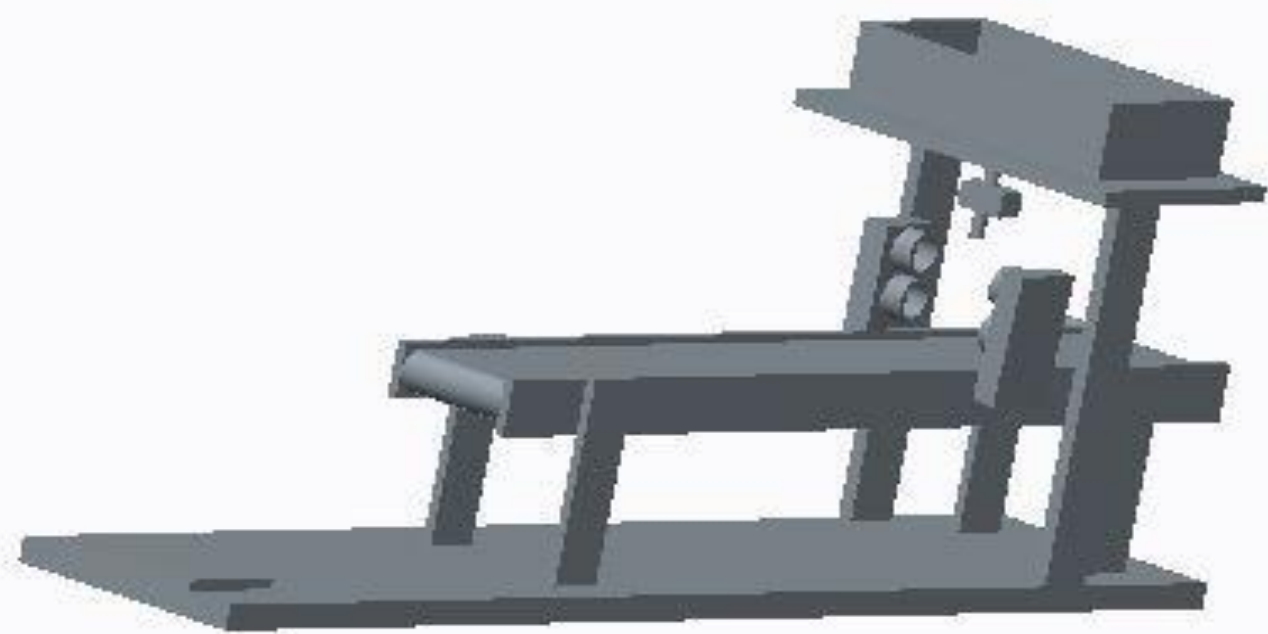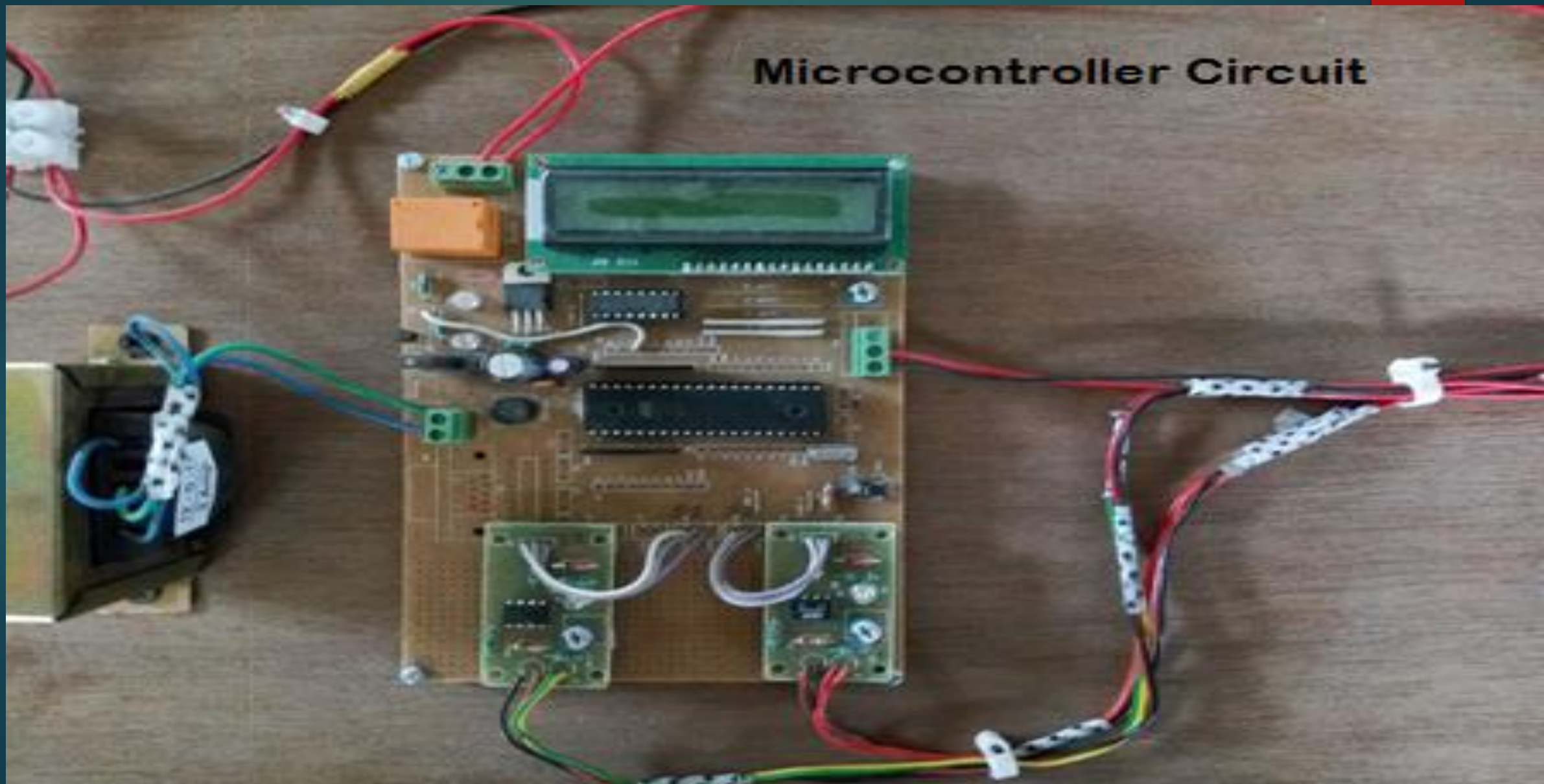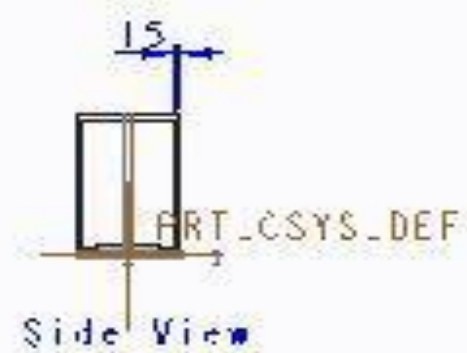
➢ Methodology

➢ Work Plan

Parameters	Jul	Au	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Project Definition	■									
Literature Survey	■	■	■	■	■	■	■	■		
Detailed Study of MicroController		■	■							
Design Of Different Parts				■	■					
Development of Experimental setup					■	■				
Analysis & Calculation					■	■	■			
Optimization							■	■	■	
Final report									■	■

Structure

REAL MODEL

Microcontroller Circuit

250
150
1200

100

Top View

PRT_CSYS_DEF

PRT_CSYS_DEF

50

Front View

PRT_CSYS_DEF

25

15

Side View

PRT_CSYS_DEF

Top View

Front View

Side View

880

10

10

PRT_CSYS_DEF

Top View

PRT_CSYS_DEF

57.33

200

50

PRT_CSYS_DEF

Front View

50

10

PRT_CSYS_DEF

Side View
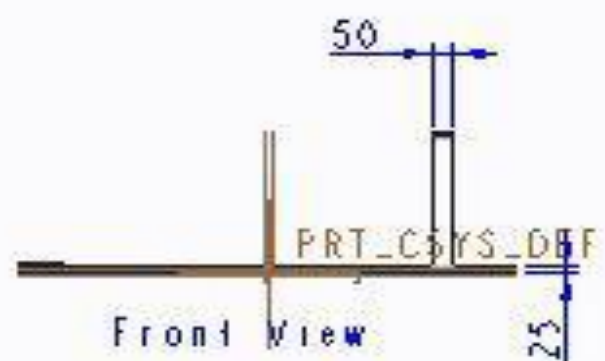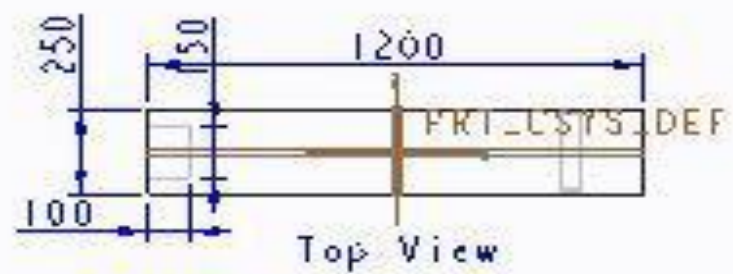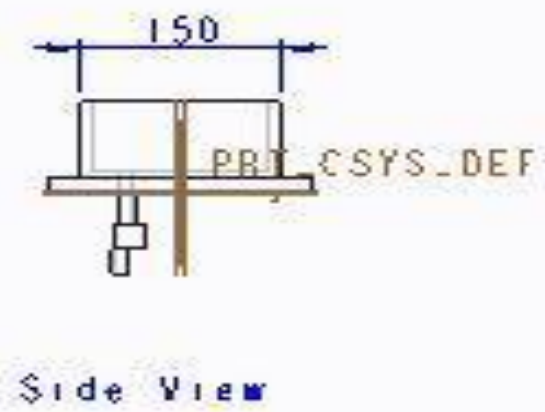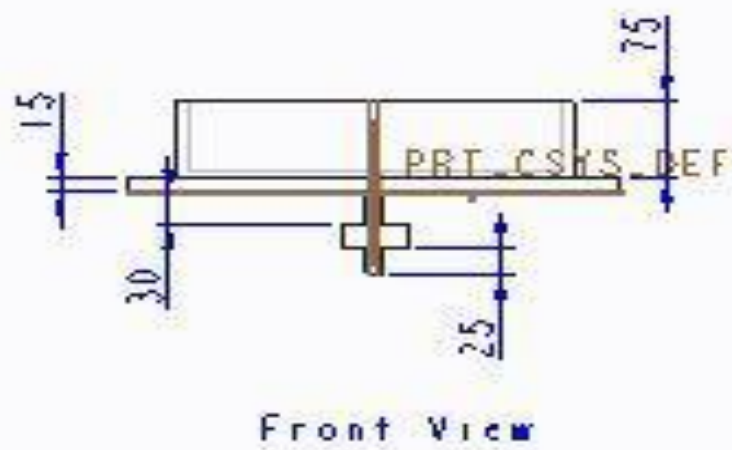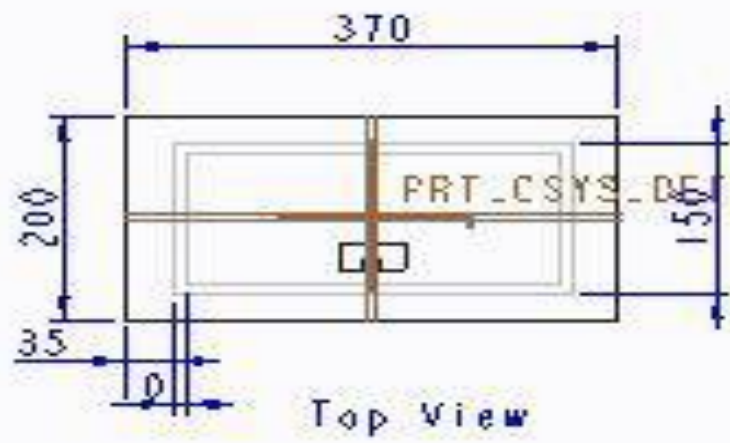
Components

BELT CONVEYOR

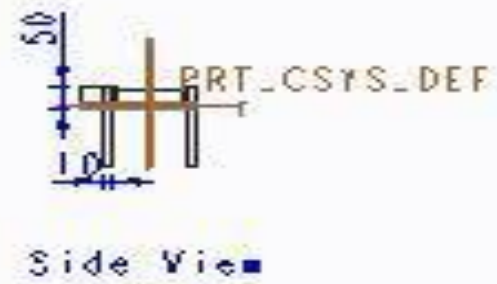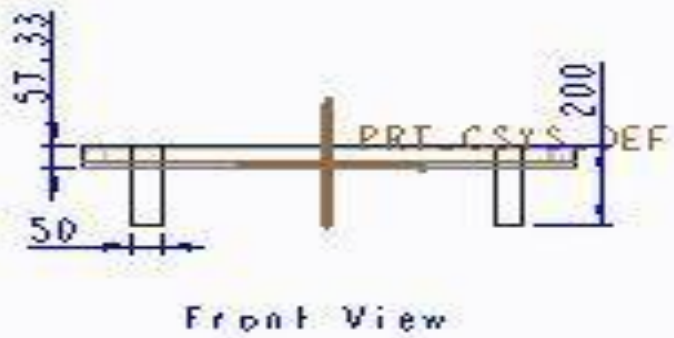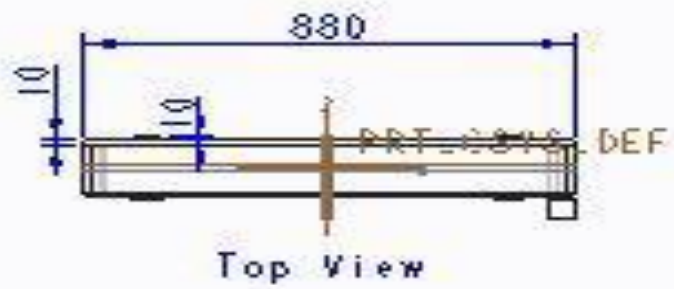➤ A Conveyor Belt is the carrying medium of automatic bottle filling machine.

➤ A Belt conveyor consists of two or more pulleys with an endless loop of carrying medium–the conveyor belt rotates about them.

SPECIFICATION

Length Of Belt : 80 inch
Width : 5 inch
Material : Resin

Rollers

No. Of Rollers : 5

➢ A DC motor is any of class of electrical machines that converts the direct current electric power into mechanical power.

➢ It produce rotary motion; a linear motor directly produces force and motion in a straight line.

➢ In Bottle filling machine the dc motor is used to rotate the conveyor belt at a desired speed which is fully controlled By Microcontroller.

SPECIFICATION

12 volt
30 r .p .m

SOLENOID VALVE

➢ A solenoid valve is an electromechanically operated valve.

➢ The valve is controlled by an electric current through a solenoid.

➢ In case of our mechanism we use a Two port, Size ½ valve.

SPECIFICATION

. 24 volt
½ Size Valve

INFRARED SENSORS

➢ infrared sensors are used for sensing the bottle when it is below the position of Nozzle.

➢ This sensor is connected with a Microcontroller Then Microcontroller Give the command to the nozzle for filling the liquid to the corresponding Sensed Bottle.
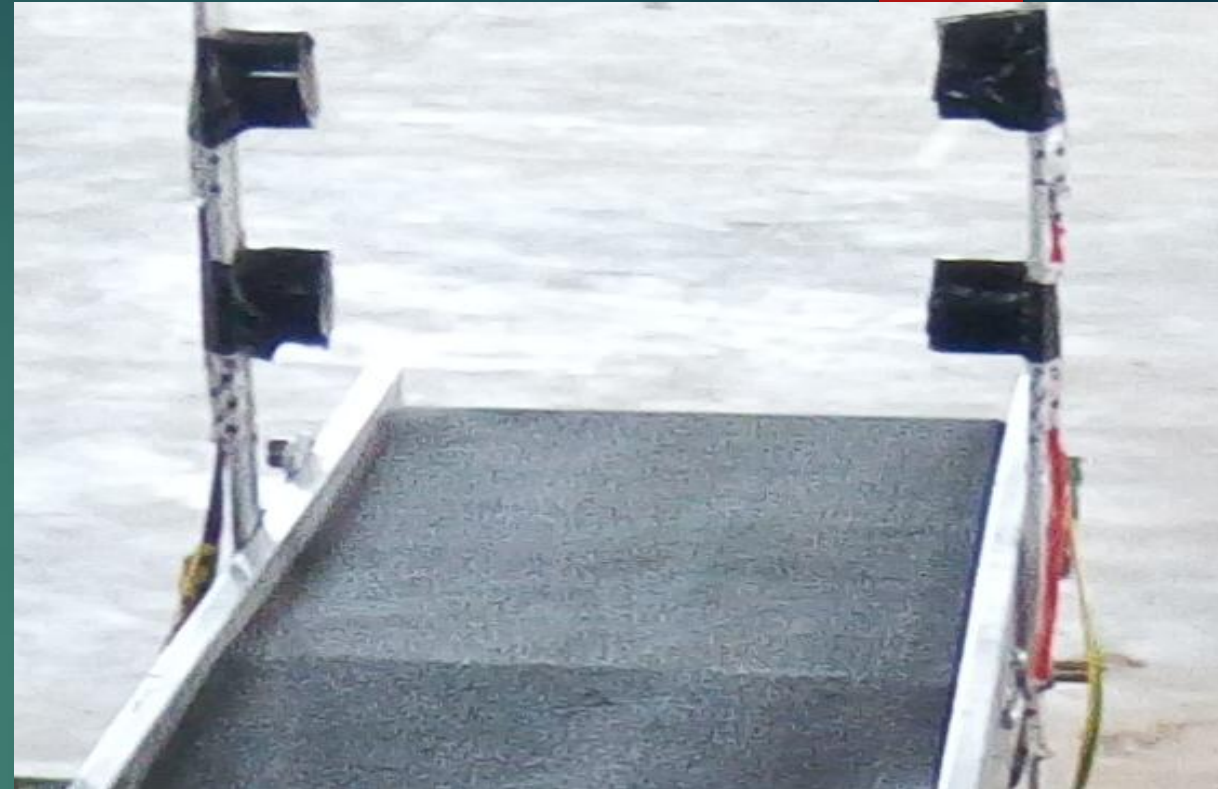
SPECIFICATION

12 volt

Micro Controller

Microcontroller is Controlling Device.

It is the Heart Of Bottle Filling Machine.

It is the small computer On a single integral circuit containing a Processor Core ,memory and Programmable input/output Peripherals.
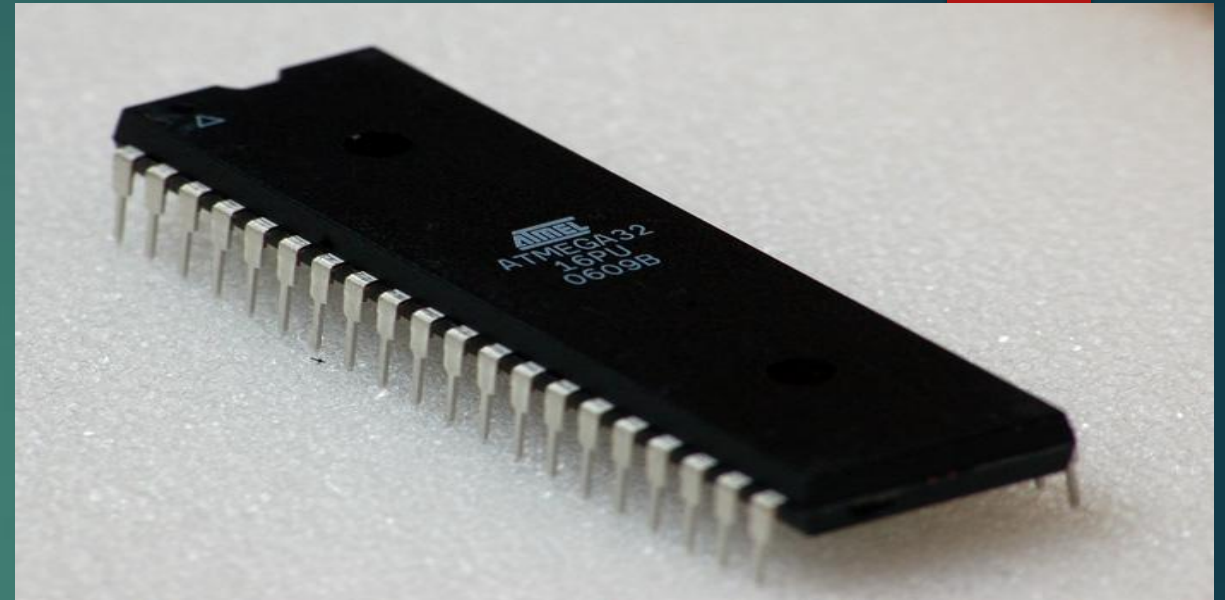
SPECIFICATION

ATMEL Micro Controller

TRANSFORMER

Transformer is a Device Which Convert the 230 voltage of Power supply into 12 voltage.

In this Project We use 2 Transformers

For Micro Controller

12 volt
2 Amp.

For Solenoid Valve

24 volt
5 Amp.

Calculation

Hardware Design

→ **Speed of the belt**

$$v = \frac{\pi DN}{60} \ \text{m/s}$$

$$= \frac{\pi \cdot 0.230 \cdot 30}{60}$$

$$= 0.361 \ \text{m/s}$$

→ **Length of the belt**

$$L = 2C + \frac{\pi(D+d)}{2} + \frac{(D-d)^2}{4C}$$

$$= 2 \cdot 0.85 + \frac{\pi(0.230+0.230)}{2} + \frac{1}{4 \cdot 0.85}(0.230 - 0.230)^2$$

$$= 1.7 \ \text{m}$$

*DETERMINE EFFECTIVE BELT PULL:-

*For roller belt

$T_e = F_r L (W_m + 2W_b + R_t C_t + R_p + C_p + R_i C_i) + (W_m) h\}/F_t$

$T_e = \{0.075 \times 1(1.5 + (2 \times 4) + (0.3 \times 16) + 0 + 0 + 0) + (1.5)0\}/0.85$

$T_e = 1.26$ N/m

Where,

T_e = Effective belt pull (kg)

L = Length of conveyor (m) = 1m

W_m = Weight of unit load (kg/m) = 1.5kg/m

W_b = Weight of belt (kg/m)

R_t = Unit weight of carrying roller less shaft (kg) = 0.3kg

R_p = Unit weight of pressure roller less shaft (kg) = 0

R_i = Unit weight of return roller less shaft (kg) = 0

C_t = No of carrying rollers per meter = 16

C_p =No of pressure rollers per meter =0

C_i =No of return roller per meter =0

h =Net change in elevation (m) =0

F_t =Terminal loss factor =0.85

F_r=Roller bed friction factor for average condition =0.075

The unit load weight is determined by the no of loads on conveyor.

W_m =No of loads on conveyor x weight/load

Torque

The torque requirement at the drive Roller to move the belt is

Torque = T_e x drive Roller diameter (m)

=1.26 x 0.23

=0.2898 N.m

Angular velocity

W = Velocity of belt = 0.361 m/s= $\pi DN/60$

W = (V X 60)/ (π X D)

   = (0.361 X 60)/ (3.14 X 0.23)

W = 29.98 r.p.m

➢ Advantages:-

1). High reliability

2). Small space requirements

3). Computing capabilities

4). Reduced costs

5). Expandability

6). High power Handling

7). Reduce Human Efforts

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➢ **Limitation:-**

➢ It can only fill approximately two bottles per minute, which is a little bit slow.

➢ The process can be efficiently used in water filling system. The types of fluid to be handled is mainly dictated by solenoid valve and nozzle used. So the range of fluid types is not so wide.

➢ Positioning of the solenoid valve is a critical issue and proper care needed.

➢ Another disadvantage is that there is no guide way for the bottles making the system susceptible to imbalance vibration. This system is constrained by height (max 6.7'' inch) of the bottle of a specific volume.

➢ **Conclusion:**

❑ 1.The system can perform the task of autonomous quality control system used in industrial production and it is most suitable for small Scale industries as definite process is set by programming.

❑ 2.Our aim of this work is to establish a flexible, economical, easily configurable, reliable system which makes our project eco friendly because all small components that are required will be taken from scraps This will make our project cheaper. Our project is giving us complete build up of embedded work done.

❑ 3. Designing Embedded system giving us intersecting experience in working with Microcontroller chip. Also our project is a combination of electronics and mechanical work.

❑ 4. This provides us knowledge and make us aware of what all factors we need to consider while designing a project based on automation

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