# DESIGN AND FABRICATION OF AUTOMATED WATER DISPENSER

**A PROJECT REPORT**

***Submitted by***

**DEEPAKRAM .S (927622BME011)**

**DHINESHKUMAR .S (927622BME012)**

**DHIVYA .P (927622BME013)**

***in partial fulfillment for the award of the degree***

***of***

BACHELOR OF ENGINEERING

**IN**

**MECHANICAL ENGINEERING**

**M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR**

ANNA UNIVERSITY: CHENNAI 600 025

**MAY 2024**

# M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

## BONAFIDE CERTIFICATE

Certified that this project report " **DESIGN AND FABRICATION OF THE AUTOMATED WATER DISPENSER"** is the bonafide work of **"DEEPAKRAM.S (927622BME011), DHINESHKUMAR.S (927622BME012), DHIVYA.P (927622BME013)"** who carried out the project work during the academic year 2023 – 2024 under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

| | |
|---|---|
| **SIGNATURE** | **SIGNATURE** |
| Dr. M. LOGANATHAN M.E.,Ph.D. | Dr. K. RAJU M.E, Ph.D. |
| **HEAD OF THE DEPARTMENT** | **SUPERVISOR** |
| Professor | Associate Professor |
| Department of Mechanical Engineering, | Department of Mechanical Engineering, |
| M.Kumarasamy College of Engineering, | M.Kumarasamy College of Engineering, |
| Thalavapalayam, Karur-639113. | Thalavapalayam, Karur-639113. |

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This project report has been submitted for the end semester project viva voce examination held on _____

INTERNAL EXAMINER EXTERNAL EXAMINER

# DECLARATION

We affirm that the Project titled **"DESIGN AND FABRICATION OF AUTOMATED WATER DISPENSER "** being submitted in partial fulfillment of for the award of Bachelor of Engineering in Mechanical Engineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis of which a degree or award was conferred on an earlier occasion on any other candidate.

| Student name | Signature |
|---|---|
| 1. DEEPAKRAM. S | _____ |
| 2. DHINESHKUMAR. S | _____ |
| 3. DHIVYA. P | _____ |

Name and signature of the supervisor with date

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We glad to thank all the Teaching and Non-Teaching Faculty Members of Department of Mechanical Engineering for extending a warm helping hand and valuable suggestions throughout the project.

Words are boundless to thank Our Parents and Friends for their constant encouragement to complete this project successfully.

## INSTITUTION VISION & MISSION

**Vision**

- To emerge as a leader among the top institutions in the field of technical education.

**Mission**

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- Maintainmutuallybeneficialpartnershipswithouralumni,industryandprofessionalassociations.

## DEPARTMENT VISION, MISSION, PEO, PO & PSO

**Vision**

- To create globally recognized competent Mechanical engineers to work in multicultural environment.

**Mission**

- To impart quality education in the field of mechanical engineering and to enhance their skills to pursue careers or enter into higher education in their area of interest.
- To establish a learner-centric atmosphere along with state-of-the-art research facility.
- To make collaboration with industries, distinguished research institution and to become a centre of excellence.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduates of Mechanical Engineering will be able to

- PEO1: Graduates of the program will accommodate in sigh ful information of engineering principles necessary for the applications of engineering.
- PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry.
- PEO3: Graduates of the program will have practical experience and interpersonal skills to work both in local and international environments.
- PEO4: Graduates of the program will possess creative professionalism, understand their ethical responsibility and committed towards society.

# PROGRAM OUTCOME

The following are the Program Outcomes of Engineering Graduates: Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid the conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques ,resources,and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large , such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life- long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

# PROGRAM SPECIFIC OUTCOMES (PSOs)

**The following are the Program Specific Outcomes of Engineering**

**Graduates:** The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and develop innovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinary areas and make quality projects.

**Research oriented innovative ideas and methods:** To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems.

| Course Outcomes | At the end of this course, learners will be able to: | Knowledge Level |
|---|---|---|
| CO-1 | Identify the issues and challenges related to industry, society and environment. | Apply |
| CO-2 | Describe the identified problem and formulate the possible solutions | Apply |
| CO-3 | Design/ Fabricate new experimental setup/devices to provide solutions for the identified problems | Analyse |
| CO-4 | Prepare a detailed report describing the project outcome | Apply |
| CO-5 | Communicate outcome of the project and defend by making an effective oral presentation. | Apply |

## MAPPING OF PO& PSO WITH THE PROJECT OUTCOME

| Course Outcome | Program | | | | | | | | | | | | Program Specific Outcome | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO - 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CO - 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CO - 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CO - 4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CO - 5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |

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# ABSTRACT

In a present world of industrialization with modernization of societies, it has now become a challenging problem to meet the demand of the people. Presently the task to obtain the output and to meet the demand is one of the adversaries in a present scenario that we need to do something to improve and to be a part of this modernization. In this project, we are implementing an "Automated water dispenser" and are dedicating to the industries. In this project we are using PLC which is a brain of this entire project. The main work it will do is the filling and capping of the bottles used in industries for the various purpose such as pouring fluids (such as milk, water etc.) in a packing bottles, toxic chemical containers storing in bottles without any injuries.

The automated water dispenser is an innovative solution designed to provide efficient and hygienic water dispensing method in various settings, including homes, offices, public services and mainly used for small scale medicine industries and the soft drinks industries. This system leverages advanced technologies such as sensors and the micro controllers which is used to the correct level of the quantity. This automated water dispenser represents a significant advancement in water dispensing technology in future and also offering practical benefits for users and contributing to broader public health and sustainability goals.

# CHAPTER – 1
# INTRODUCTION

Filling is a task carried out by a machine that packages liquid products such as cold drinks or water. Traditional methods of bottle filling involved placing bottles onto a conveyor and filling only one bottle at a time. This paper aims filling bottles simultaneously. The filling and capping operation takes place in a synchronized manner. The entire system is more flexible and time saving. Water dispensers are essential appliances in homes, offices, and public spaces, providing convenient access to clean drinking water. Traditional water dispensers, however, often require manual operation, which can lead to hygiene issues and inefficient water use. In response to these challenges, the development of automated water dispensers has emerged as a promising solution. Automated water dispensers utilize advanced technologies such as sensors, microcontrollers, and automated control systems to offer touchless operation, ensuring a more hygienic and user-friendly experience. These devices are designed to deliver precise volumes of water, customizable to user preferences, and can integrate with filtration systems to maintain high water quality. By reducing human contact and optimizing water usage, automated water dispensers enhance convenience, promote better health practices, and contribute to environmental sustainability. This paper explores the design, functionality, and benefits of automated water dispensers, highlighting their potential to revolutionize the way we access and consume water in various settings.

# CHAPTER – 2
# LITERATURE REVIEW

Md. Liton Ahmed , Shantonu Kundu , Md. Rafiquzzaman - Automatic Bottle Filling System Using PLC Based Controller-In this paper a bottle filling machine is introduced using Programmable Logic Controller (PLC) based controller in automation industry. The main aim of the paper is to design and fabricate a small and a simple filling system using PLC. The belt conveyor is used for moving the bottle. A dc pump is set to tank to control the flow of water. The position of bottle is detected by infrared sensor so that pump can be functioned at right time. When bottle is under the tank, the pump is started.

Ms. Diptee Patil - Automatic Bottle Filling, Capping And Labelling System Using PLC Based Controller - In this paper, a bottle filling, capping and labelling machine is introduced using Programmable Logic Controller (PLC) based controller in automation industry. The main aimof the paper is to design and fabricate a small and a simple system using PLC. The belt conveyor is used for moving the bottle. A dc pump is set on tank to control the flow of water. The position of bottle is detected by proximity sensor so that pump can be functioned at right time. When bottle is under the tank, the pump is started and bottle is filled by water after which capping of the bottle takes place using piston rotation system and then labelling isdone. This machine proposed in this paper is cost effective and it can be used in small scale bottle filling systems such as coffee shops, juice shops and other beverage industries.

Dr. Pankaj Prajapati , Sachin Singh , Saurabh Gupta, Shivani Srivastava- Automatic bottle filling and capping system using PLC:- In a present world of industrialization with modernization of societies, it has now become a challenging problem to meet the demand of the people. Presently the task to

obtain the output and to meet the demand is one of the adversaries in a present scenario that we need to do something to improve and to be a part of this modernization. In this project, we are implementing an “Automatic Bottle Filling and Capping” and are dedicating to the industries. In this project we are using PLC which is a brain of this entire project. The main work it will do is the filling and capping of the bottles used in industries for the various purpose such as pouring fluids (such as milk, water etc.) in a packing bottles, toxic chemical containers storing in bottles without any injuries. The objective here will be to meet the demand and to develop the “Automatic bottle filling and capping system using PLC”. The project is developed in accordance to meet the requirements in the industrial automation. Also, since the project uses the PLC, it’s maintenance is less as compared to the devices which obtains the same output but uses the controller other than PLC. The conveyer belt will move and shift the filled bottle with an unfilled bottle. A sensors used at the conveyer is used to sense the amount of fluid filled in a bottle and replace the next bottle with the existing position of the bottle. The software on which the program here will be written to run is LogixPro. The cost of this project is very less(after installing a PLC in industries) and it requires a little skillful labor to use PLC.

Mohammed Shariqbaig Mirza , Vatsal.J.Soni , Jay.S.Gohel , Mohammed Anas Khan A.Pathan and Dr. Mudit M. Saxenar - Automatic bottle filling and capping system using PLC:- The project is about filling different size bottles with the fluid and identifying the empty bottle during the process and automatically removing the line through air pressure.PLC is the major element of the whole process. It is a powerful device to control the production system. It is used as a digital computer to automate industrial activities. The advantages of using PLC are smooth operation, low cost, and high filling speed. To improve filling accuracy, it is necessary to apply PLC in an automatic filling system. This system can be made with Arduino but flexibility will be less. The Arduino programming

language is more complex than PLC ladder logic. The PLC ladder logic is symbol-based that’s why it can be changed easily. The ladder logic can be changed easily so they use PLC instead of Arduino. The liquid filling machine works when the pressure is high. This can be classified as liquid pressure filling, which means the liquid flows into the bottle based on its weight when the amount of pressure of the liquid reservoir is equal to the amount of air present in the bottle. These liquid fillers are easy to control and fill the exact amount of liquid into gallons or containers. There is a filling mechanism that allows the machine to adjust the different sized bottles without replacing parts and also has a "No Bottle-No Fill" mechanism which means the machine will automatically stop the process when there is no bottle available on the belt.

# CHAPTER – 3

# MATERIALS AND METHODS

## 3.1 MATERIALS USED:

### TABLE 3.1.1.MATERIAL USED

| S.No | DESCIRPTION | QTY | MATERIAL |
|---|---|---|---|
| 1 | DC MOTOR | 1 | ELECTRICAL |
| 2 | HOSE | 2m | PLASTIC |
| 3 | BEARING | 12 | STAINLESS STEEL |
| 4 | FRAME, SHAFT | AS PER REQUIRED | MILD STEEL |
| 5 | CONVEYOR BELT | 1 | MILD STEEL,PLASTIC |
| 6 | DC PUMP | 1 | PLASTIC |
| 7 | PLY WOOD | 1 | WOOD |
| 8 | CIRCUIT | 1 | ELECTRICAL |
| 9 | RELAY, MOTHER BOARD, PROXIMITY SENSOR | 1 | ELECTRICAL |

## 3.2 DC MOTOR:

It is a device that converts electrical energy into mechanical energy. It runs upon the faraday's law. It is used to move conveyor belt.

DC motor capacity: 12V

**FIGURE 3.1.PHOTOGRAPHY OF DC MOTOR**

## 3.2 HOSE :

A hose coupling is a connector on the end of a hose to connect, it with another hose or with a tap or a hose appliance, such as an irrigation sprinkler.

Max pressure:$10 \times 10^{5}$ $N/m^2$

Outer diameter: 6 mm = $6 \times 10^{-3}$m

Inner diameter:3.5 mm = $3.5 \times 10^{-3}$m

**FIGURE 3.2.PHOTOGRAPHY OF HOSE**

## 3.4 ARDUINO BOARD:

It is totally operates the whole sensor of the system. It have the main function for the process.

**FIGURE 3.3.PHOTOGRAPHY OF ARDUINO BOARD**

## 3.5 CONVEYOR BELT:

A conveyor belt uses a wide belt and pulleys and is supported by rollers or a flat pan along its path. Conveyors are durable and reliable components used in automated distribution.

Material: Plastic

Width : 25cm

**FIGURE 3.4.PHOTOGRAPHY OF CONVEYOR BELT**

### 3.6 BEARING:

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts.

**FIGURE 3.5.PHOTOGRAPHY OF BEARING**

### 3.7 DC PUMP:

A pump is a device used to raise, compress, or transfer fluids. The motors that power most pumps can be the focus of many best practices.

**FIGURE 3.6.PHOTOGRAPHY OF DC PUMP**

## 3.8 PROXIMITY SENSOR:

A proximity sensor is a non-contact sensor that detects the presence of an object (often referred to as the “target”) when the target enters the sensor's field.


**FIGURE 3.7.PHOTOGRAPHY OF PROXIMITY SENSOR**

## 3.9 RELAY :

A relay is an electrically operated switch.

Relays are used where it is necessary to control a circuit by a low-power signal**.**

The relay's switch connections are usually labeled COM, NC and NO:

**COM** = Common always connect to this, it is the moving part of the switch.

**NC** = Normally Closed, COM is connected to this when the relay coil is **off**.

**NO** = Normally Open, COM is connected to this when the relay coil is **on**.

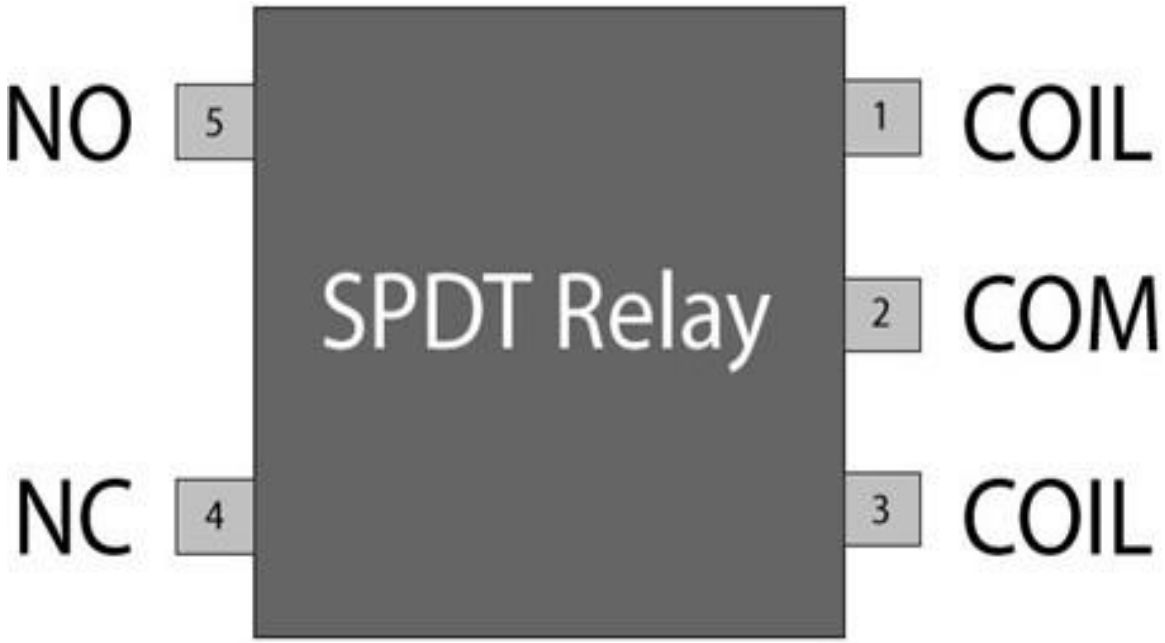


**FIGURE 3.8.PIN DIAGRAM OF RELAY SWITCH**

## 3.10 COST ESTIMATION:

### TABLE 3.10.1 COST ESTIMATION

| S.NO | DESCRIPTION | COST Rs: |
|---|---|---|
| 1 | DC MOTOR | 300 |
| 2 | HOSE | 300 |
| 3 | BEARING | 600 |
| 4 | FRAME, SHAFT | 700 |
| 5 | SHEET METAL,DISC | 1000 |
| 6 | CONVEYOR ROLLER,<br>CONVEYOR BELT | 700 |
| 7 | DC PUMP | 250 |
| 8 | PLY WOOD | 300 |
| 10 | RELAY,<br>MOTHER BOARD,<br>PROXIMITY SENSOR | 2000 |
| | TOTAL | 6150 |

## 3.11 PLC PROGRAM

```
const int ir1=A0,ir2=A1,ir3=A2,pump=2,conveyer=3;
int ir1v,ir2v,ir3v;

void setup()
{
Serial.begin(9600);
pinMode(A0, INPUT);
pinMode(A1, INPUT);
pinMode(A2, INPUT);
pinMode(pump, OUTPUT);
pinMode(conveyer, OUTPUT);
}

void loop()
{
if(digitalRead(ir1) == LOW)
{
  Serial.println("Tumler Detected");
  dispense();
}
else
{
  Serial.println("No tumler");
}
}

void dispense()
{
  while(digitalRead(ir2) == HIGH)
  {
    digitalWrite(conveyer, HIGH);
    Serial.println("Moving to pump");
  }

   digitalWrite(conveyer, LOW);
   Serial.println("PUMP STARTED");
   delay(5000);
```

```
  for(int j=5;j>=0;j--)
  {
   Serial.println("Pumping water");
   digitalWrite(pump, HIGH);
   delay(1000);
  }

  digitalWrite(pump, LOW);
  delay(3000);

  while(digitalRead(ir3) == HIGH)
  {
   digitalWrite(conveyer, HIGH);
   Serial.println("Motor Moving");
  }

  digitalWrite(conveyer, LOW);
}
```

# CHAPTER – 4

# DESIGN OF AUTOMATED WATER DISPENSER

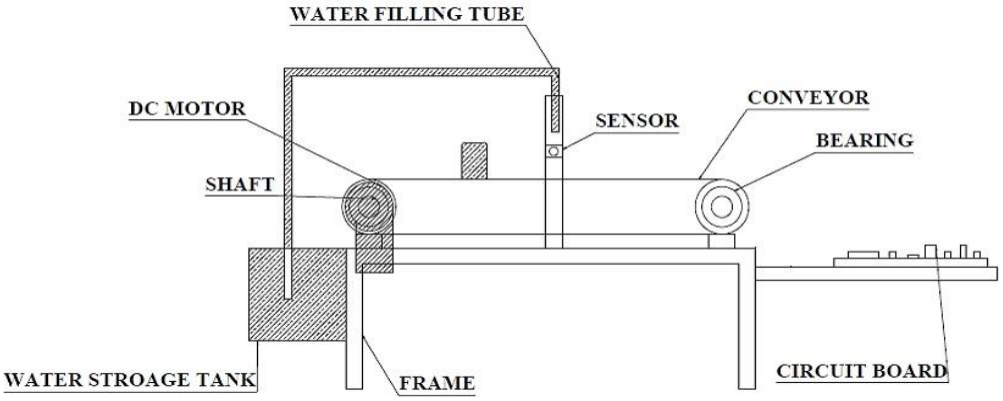


FIGURE 4.1.2D DIAGRAM OF AUTOMATED WATER DISPENSER

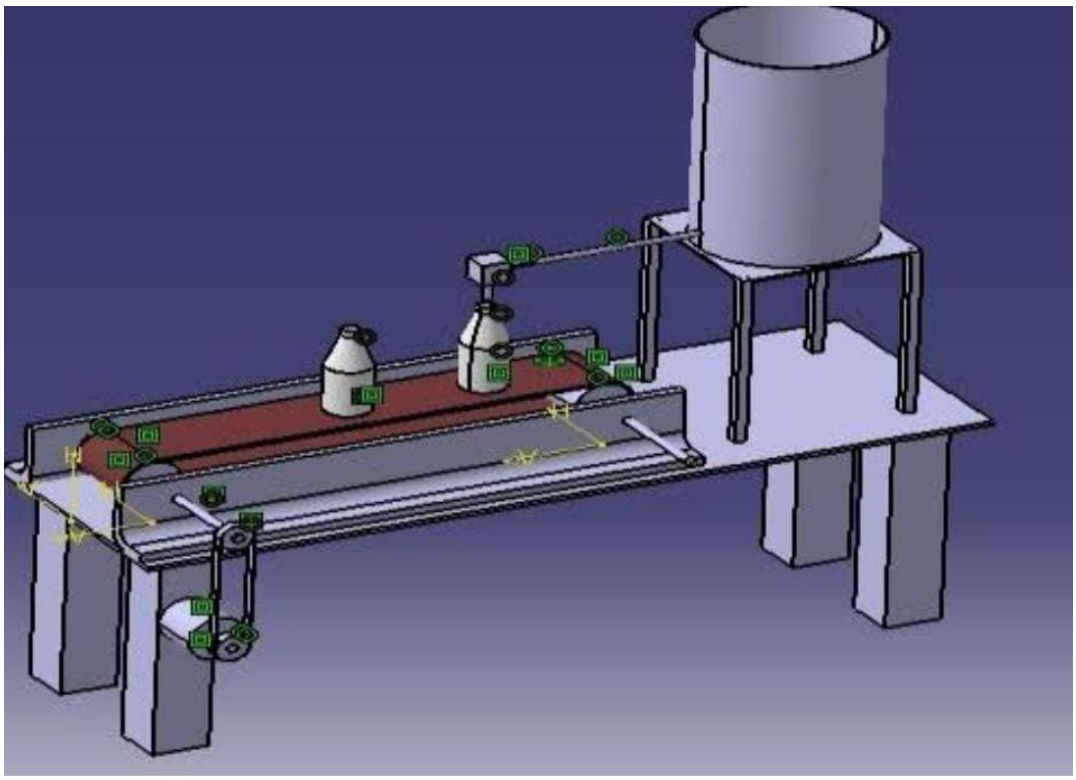

FIGURE 4.2.3D DIAGRAM OF AUTOMATED WATER DISPENSER

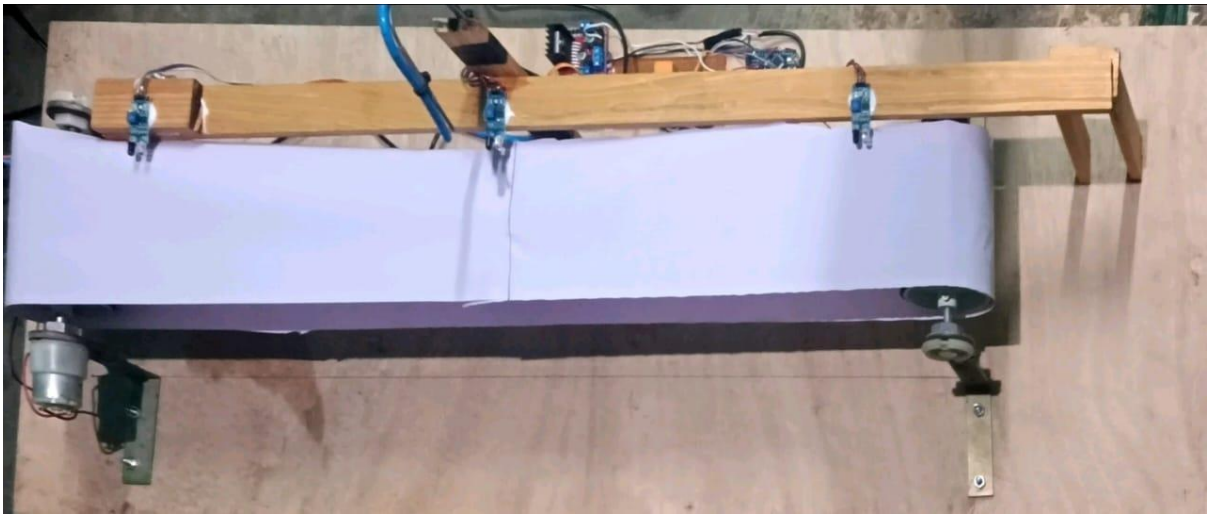

**FIGURE 4.3 AUTOMATED WATER DISPENSER TOP VIEW**

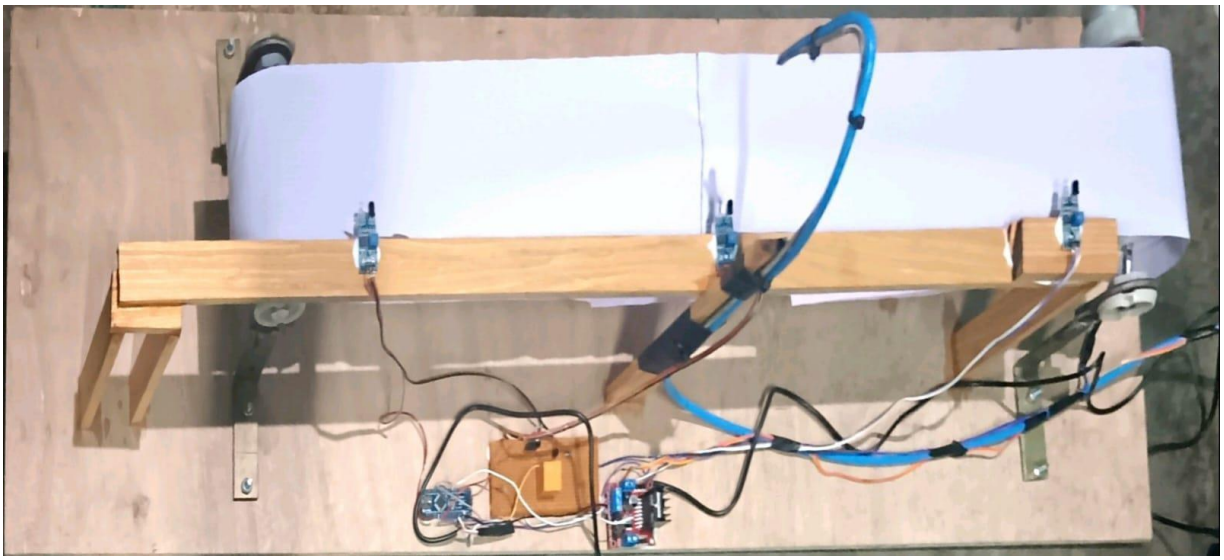

**FIGURE 4.4 AUTOMATED WATER DISPENSER BACK VIEW**

# CHAPTER - 5

## 5.1 WORKING PRINCIPLE

To develop an automatic bottle, filling system with a deduction mechanism using sensors. Automatic filling process for all the bottles simultaneously with a user defined selection for volume to be filled.

Bottles are kept in position in a carton over a conveyor belt; they are sensed to detect their presence. Proximity sensors are used for sensing the bottles. Depending on the output of the sensor the corresponding pumps switch on and filling operation takes place.

If the bottle is not present then the pump in that position is switched off, thereby avoiding wastage of the liquid. The filling operation is accompanied with a user-defined volume selection menu which enables the user to choose the volume of liquid.

The filling process is clone based on timing. Depending on the preset value of the timer the pump is switched on for that particular period of time and the filling is done.

## 5.2 ADVANTAGES

1. Smooth operation,
2. Low cost.
3. High filling speed.
4. To improve filling accuracy, it is necessary to apply PLC in an automatic filling system.
5. Accurately fills the input quantity.
6. Quick process.

## 5.3 APPLICATION

1. Pharmaceutical,
2. Chemical,
3. Food,
4. Beverages,
5. Water industries.
6. Used as a digital computer to automate industrial activities.

# CHAPTER – 6
# CONCLUSION

The main objective of this paper is to develop a bottle filling system based on certain Specifications. More features can be added to this system follows: Depending on the size, shape weight of the bottles, Filling implemented. Capping operation can be done using a piston arrangement.

# REFERENCE

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Automatic bottle filling and capping project for freshman engineering studemts – June 2005.

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