A Report on the Course Project of

Engineering Exploration (22ECRP101)

Titled

AUTOMATIC FILLING MACHINE

By

ABHISHEK TIMMANAGOUDAR	820
VEERESH DOMANAL	858
RIYA KAKATIKAR	832
SHRUSHTI HULBUTTE	812

Under the guidance of

PROF. NIRANJAN MUCHANDI

Centre for Engineering Education Research

Academic Year 2023-2024, Odd Semester

Centre for Engineering Education Research

CERTIFICATE

This is to certify that the course project entitled “AUTOMATIC FILLING MACHINE”is carried out by the students Abhishek Timmanagoudar (820), Veeresh Domanal (858), Riya Kakatikar (832), Srushti Hulbutte (812) as part of Engineering Exploration Course (15ECRP101), during 1st Semester of B.E program for the academic year 2023-24. The project report fulfils the requirements prescribed by KLE Technological University.

_____	_____
Guide	Division in charge
Prof. Niranjan Muchandi	Prof. Niranjan Pattar
_____	_____
Examiner 1:	Examiner 2:

DECLARATION

We hereby declare that the project work entitled “AUTOMATIC FILLING MACHINE” submitted as a part of Engineering Exploration Course during 1st semester of academic year 2023-2024, is a record of an original work done by us under the guidance of Niranjan Muchandi Sir. The project work and part of this report is not plagiarized to the best of our knowledge.

Date:

Abhishek Timmanagoudar	Veeresh Domanal	Riya Kakatikar	Shrushti Hulbutte
(820)	(858)	(832)	(812)

ACKNOWLEDGEMENT

In the culmination of our exploration course project, the Crankshot ,we extend our heart felt acknowledgments to those who have significantly contributed to its realization.

Foremost, we express deep appreciation to our respected Principal Dr. S. F. Patil and Engineering Exploration coordinator Prof. S. B. Kulkarni, whose support and insightful feedback greatly influenced the project's success. We thank our Project Guide, Prof. Niranjan Muchandi, for his invaluable guidance throughout the project's development. We thank our technical support staff, Mr. K. S. Loni and Mr. S. V. Kambi , provided indispensable assistance in practical aspects.

The involvement of all the staff members added valuable external perspectives, whose interdisciplinary insights enhanced the project's scope.

Acknowledgment is extended to our seniors (peer students), whose experiences and advice contributed significantly to our project's development. Personal thanks are due to my family for their unwavering support, and friends, for their encouragement and understanding.

This acknowledgment is tailored to reflect the specific contributions of each individual mentioned in the context of

the Crankshot project at the university, emphasizing the collaborative nature of the endeavour.

Abstract:

Title: Automatic Ground Nut Filling Machine: “PRECISION DISPENSER”.

Our model introduces an innovative design for an Automatic Filling Machine, intended to streamline and enhance the efficiency of packaging processes in the industry. The machine integrates cutting-edge technology, employing precision sensors, conveyor systems, and automated weighing mechanisms to accurately fill various types of grains, dry fruits, ground nuts etc, into packaging containers. The system's modular design allows for customization, catering to different product sizes and packaging requirements. Efficiency tests demonstrate a significant reduction in manual labour and packaging time, while maintaining high accuracy and consistency in filling quantities. This innovation holds promise for optimizing the production and packaging workflows within the industry, fostering improved productivity and cost-effectiveness.

An automatic filling machine holds significant importance in the food industry for streamlining production, enhancing efficiency, and ensuring accuracy in the filling process. It minimizes human error, increases productivity, and maintains consistency in the

quantity of filled products. This machine helps reduce operational costs by cutting down on manual labour and optimizing the use of raw materials. Additionally, it meets high hygiene standards crucial in food processing, ensuring clean and safe packaging of dry fruits, thereby improving overall product quality and consumer satisfaction.

In conclusion we can say employing an automatic filling machine, the food industry benefits from heightened efficiency, precise filling, cost-effectiveness, and improved product quality. This conclusion emphasizes the machine's role in enhancing production processes, reducing errors, optimizing resource utilization, maintaining hygiene standards, and ultimately meeting consumer demands for reliable, high-quality products. Overall, its implementation promises a more efficient and competitive landscape within the food processing industry.

Table of Contents:

List of Figures

List of Tables

1. Problem Definition

1.1. Need Statement

A Belagavi based manufacturing industry requires an Automatic Filling Machine to address challenges related to accuracy and labour costs offering precise filling while reducing labour dependency and maintaining hygiene standards.

1.2. Questions asked to client / users for arriving at Objectives, Functions and Constraint.

Sl. No.	Questions	Answers	Objective	Constraint	Function
1.	What is budget allocated for acquiring the machine?	Its around 3500.	-	Yes	-

2.	What are the specific products that need to be filled using this machine?	We need to fill various grains.	-	-	yes
3.	What is the expected timeline for implementing the machine?	Within two months.	-	Yes	-
4.	What should be the size of the machine?	Dimensions 1.5ft X 1.5ft X 1.5ft.	-	yes	-
5.	Have we conducted a cost-benefit analysis to determine the potential savings in labour costs?	Yes we can save 30% in labour costs annually with new machine.	-	yes	-

6.	What is the environmental impact of The Automatic Filling Machine?	We are exploring eco-friendly options for machines operation and packaging materials.	-	-	yes
7.	What are the specific technical specification and capabilities you are looking for in this machine?	We need a machine with a speed of at least 2 containers per minute.	-	yes	-
8.	Should the machine be fixed?	It should be portable.	yes	-	-
9.	How will we ensure the Automatic Filling Machine	It should facilitate easy cleaning and sanitization to maintain hygiene.	yes	-	-

	meets hygiene standards?				
10.	What's the expected impact on our workforce with the implementation of the new machine?	Some employees will need to be trained to operate and maintain the machine.	-	-	Yes
11.	What other features are expected?	It should be user friendly and easily transportable.	yes	-	-
12.	What should be the weight of the machine?	Not more than 2 kg.	-	Yes	-
13.	Does the machine require any indications?	Yes it should have an indicator to detect completion of process.	-	-	yes

1.3. Objectives

Sl. No	Objectives
1.	Reduce Labour Costs.
2.	Maintain Hygiene Standards.
3.	Improve filling accuracy.
4.	User friendly.

Problem definition 1.1

Design a automatic filling machine. Which is able to do accurate and Hygienic filling process,It should be user friendly.

1.4. Constraints

Sl.No	Constraints
1.	Cost of machine should be within 3,500.
2.	The machine should meet hygiene and safety regulations.
3.	Machine should be able to fill at least 2 bottles per minute.
4.	Machine should made up of non toxic materials.
5.	It should weigh approximately to 2 kg.
6.	It should fill at least 2 container per minute

Problem definition 1.2

Design an automatic filling machine, which is able to do accurate and hygienic filling process, it should be portable and user friendly.It should be able to fill at least one bottle per minute,

budget to build should not exceed Rs. 3,500 and it should work for 3 hours continuously.

1.5. Functions

Sl. No	Functions
1.	Filling the bottle.
2.	Filling should be done cleanly.
3.	Indicate that process is completed to user.
4.	It should detect the level of grains filled in bottle.

Problem definition 1.3

Design an Automatic Filling Machine, which is able to do accurate and hygienic filling process, it should be portable and user-friendly. It should be able to fill at least two bottle per minute, budget to build should not exceed Rs.3,500 and it should work for 3 hours continuously. Machine should indicate the user after filling process is complete and Detect the level of grains filled in the bottle.

2.Conceptual Design

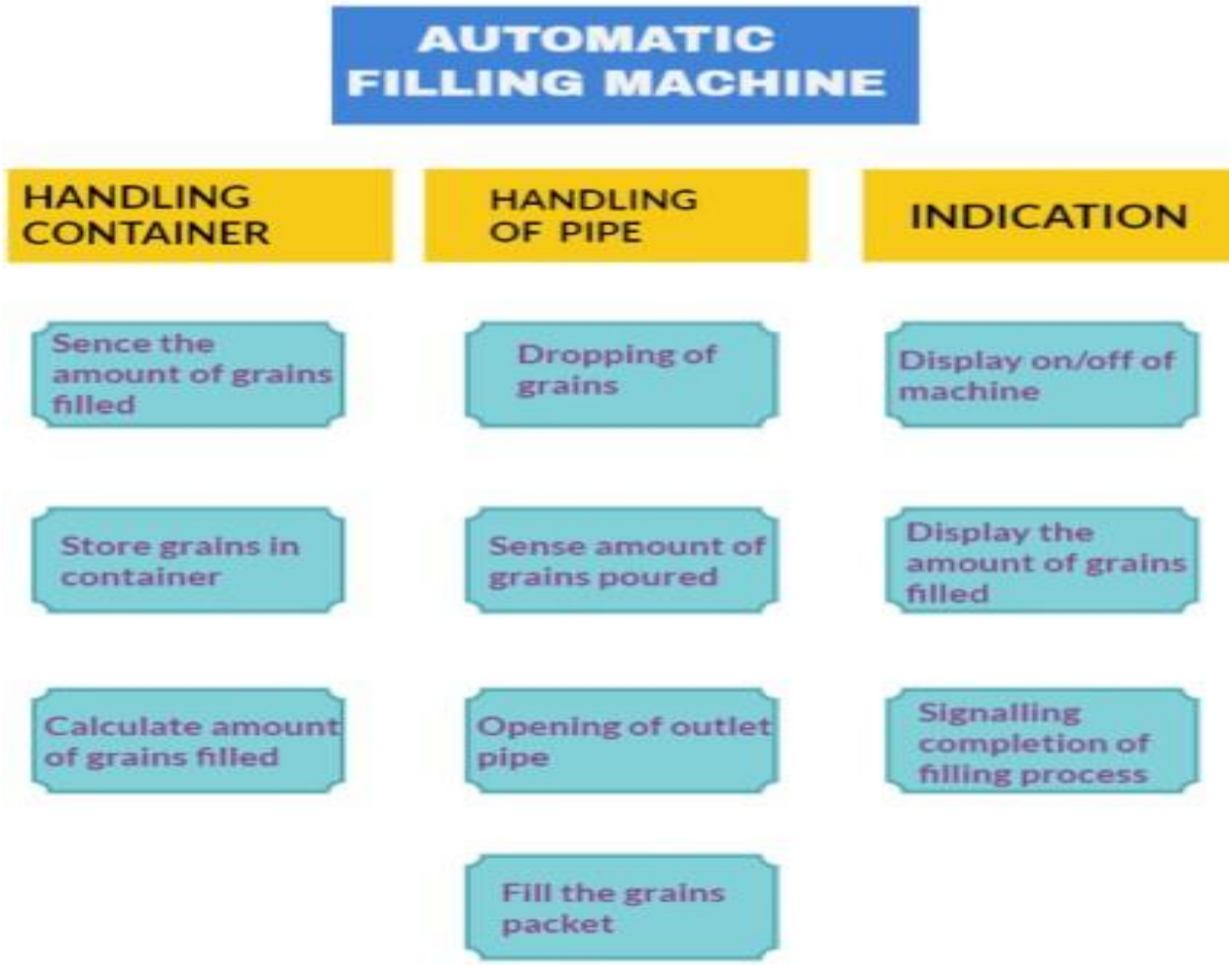
2.1. Establishing Functions

Sl. No	Functions from user perspective	Functions from the designer perspective
1.	Filling the container.	Filling.
2.	Storing the product.	Contain or Store the input product.

3.		Sense the position of the material.
4.		Open and close the lower opening of the input container.
5.		Sensing the availability of space.
6.		Supplying of the product to the filling machine.
7.		Alert after completion of work.
8.		Weigh the material while filling.
9.		Hold the filled container.
10.		Casing of the product.
11.		Move the filled containers.

12.		To detect completion of the process.
13.		Count number of fillings.

2.2. Functions Tree

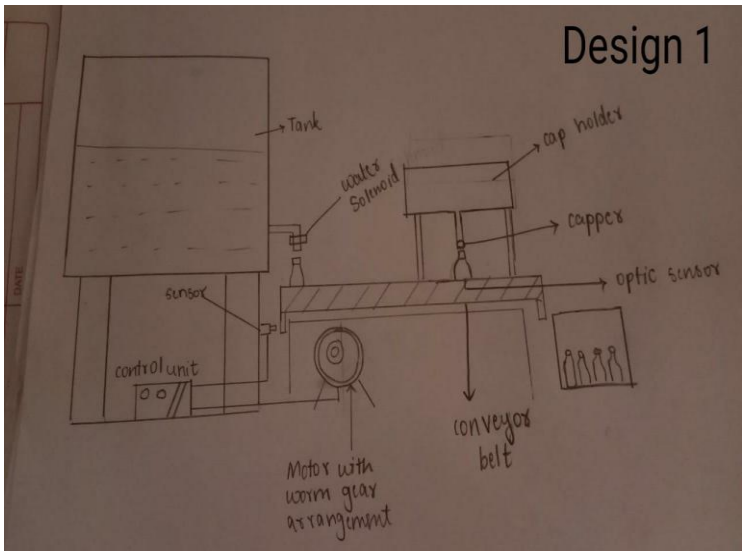
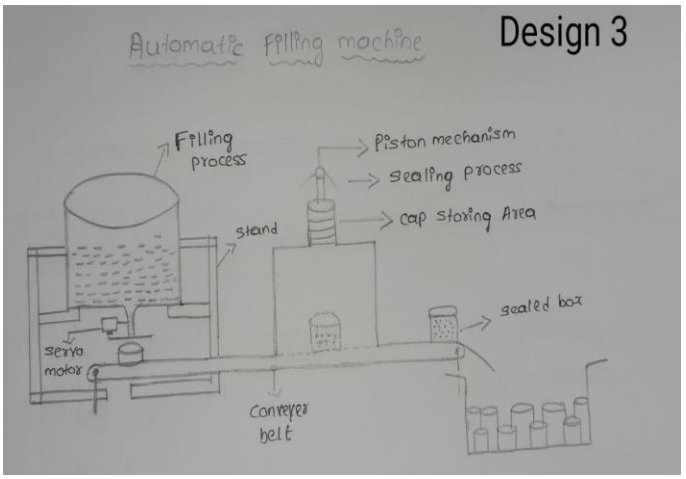


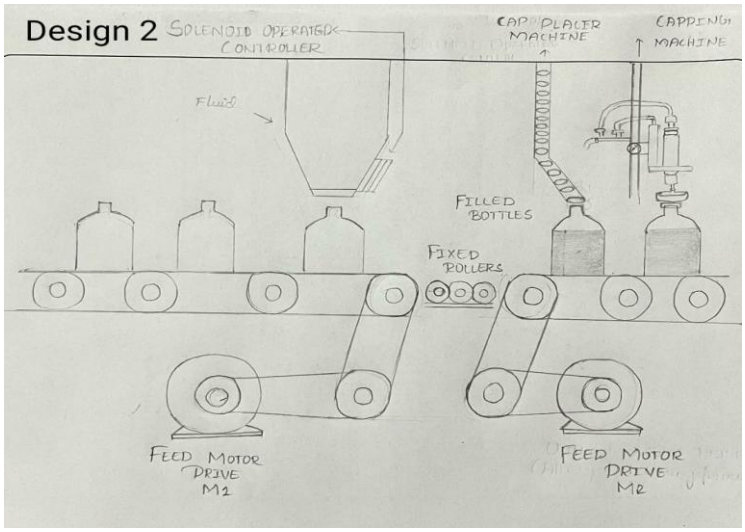
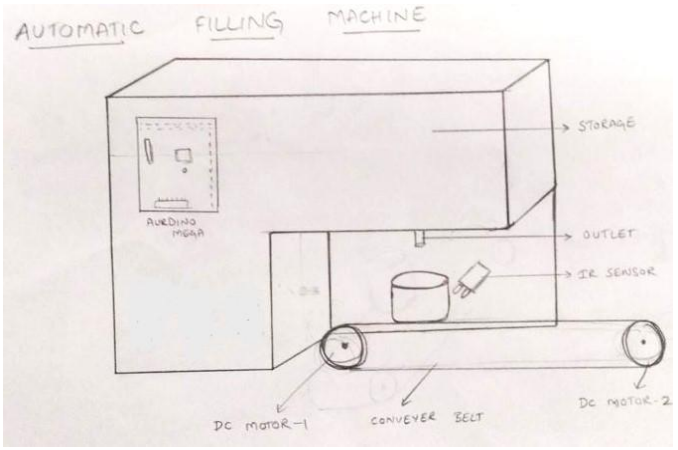
2.3. Morphological Chart

Morphological Chart

Serial No.	Sub-functions	Means 1	Means 2	Means 3
1.	Sense the bottles.	 Proximity Sensor	 Infrared Sensor	 Limit Sensor
2.	Hold the bottles.	 Cylindrical Holder	 Conveyer- Screw	 Clamp
3.	Move the bottles.	 Conveyer Belt	 Star Wheel	 Electric rotator
4.	Stop the bottles.	 PLC	 Manual stop button	 Braking system
5.	Filling the bottles.	 Discharge nozzle	 Servo meter	 Tap
6.	Fixing the caps.	 Cap fixer	 Head screw cap	 Spacers
7.	Holding the liquid and caps	 Bottle guide	 Hopper	 Cap Sorter

2.4. Generated Concepts

Concept 1	Concept 3
BY:SHRUSHTI HULBUTTE	**BY:ABHISHEK TIMMANAGOUDAR**
	

Concept 2	Concept 4
BY: VEERESH DOMANAL	**BY:RIYA KAKATIKAR**
	

3.Conceptual Evaluation and Product Architecture

3.1. Pugh Chart

Pugh chart for the 4 alternative designs shown in figures				
Design Objectives	**Weights**	**Design 1**	**Design 2**	**Design 3**
Safety	**5**	**Datum**	**-**	**++**
Ease of use	**8**	**Datum**	**+**	**+**
Portability	**6**	**Datum**	**0**	**-**
Use of standard parts	**7**	**Datum**	**+**	**+**
Cost	**9**	**Datum**	**_**	**0**
Score(+)		**0**	**15**	**25**
Score (-)		**0**	**14**	**6**
Total		**0**	**1**	**19**

Objectives	Weights
Safety	**5**
Ease of use	**8**
Portability	**6**

Use of standard parts	7
Cost	9

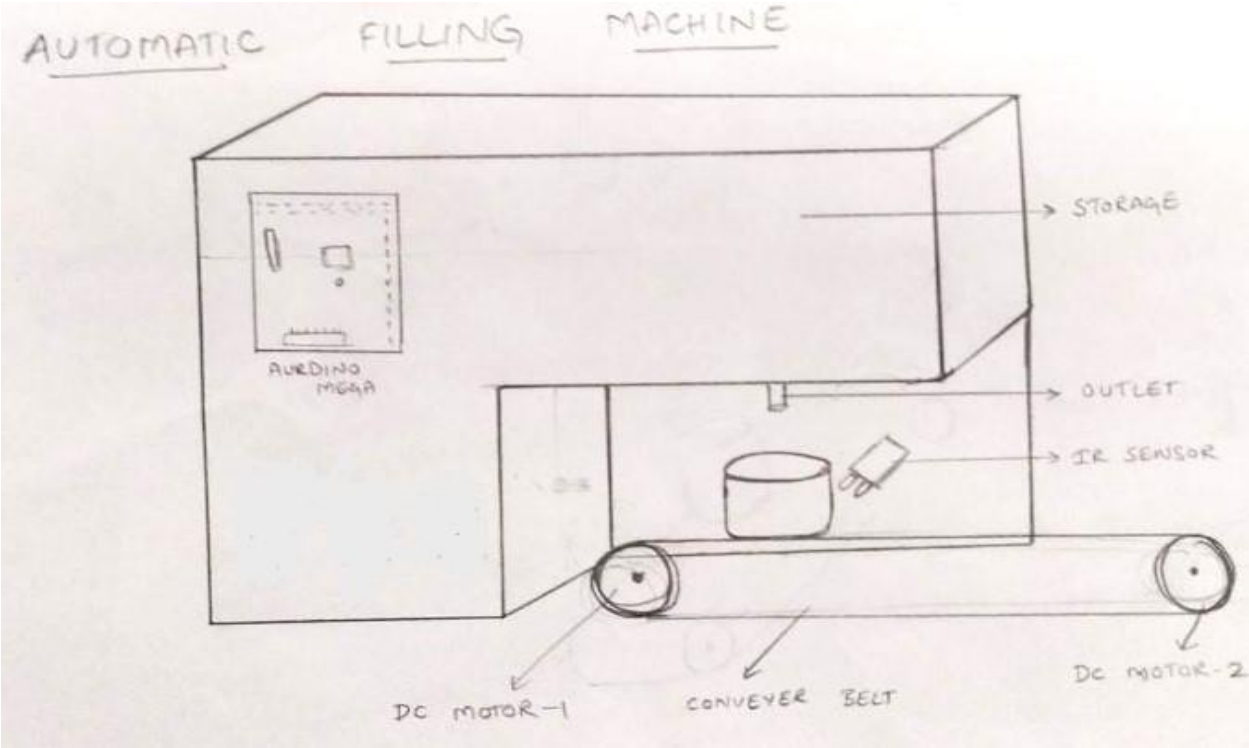
3.2. Justification for the Scores.

Design No.	Objective	Score Allocated	Justification for the Score
1	Power consumption		Datum for comparison.
		0	Datum for comparison.
	Portability	0	Datum for comparison.
	Maintenance	0	Datum for comparison.
	Cost	0	Datum for comparison.
2	Power consumption	5	Consumes more power.
	Ease of Use	8	It can be easily used without any complications.

	Portability	0	It is similar to design one in portability.
	Maintenance	7	High maintenance Annually.
	Cost	9	It costs more then design one.
3	Power consumption	6	Consumes more electricity.
	Ease of Use	5	It is complicated to use
	Portability	6	It is difficult to make portable.
	Maintenance	7	Low maintenance.
	Cost	0	It is expensive due to electronic devices.
4	Power consumption	9	Consumes suitable power supply.
	Ease of Use	8	It has switch buttons therefore easily used.
	Portability	10	Easily carried and not heavy.
	Maintenance	7	Low maintenance due to less electronic devices.
	Cost	9	Cost is less and fits our budget.

3.3 Selected Design

BY:RIYA KAKATIKAR



3.4 Product Architecture

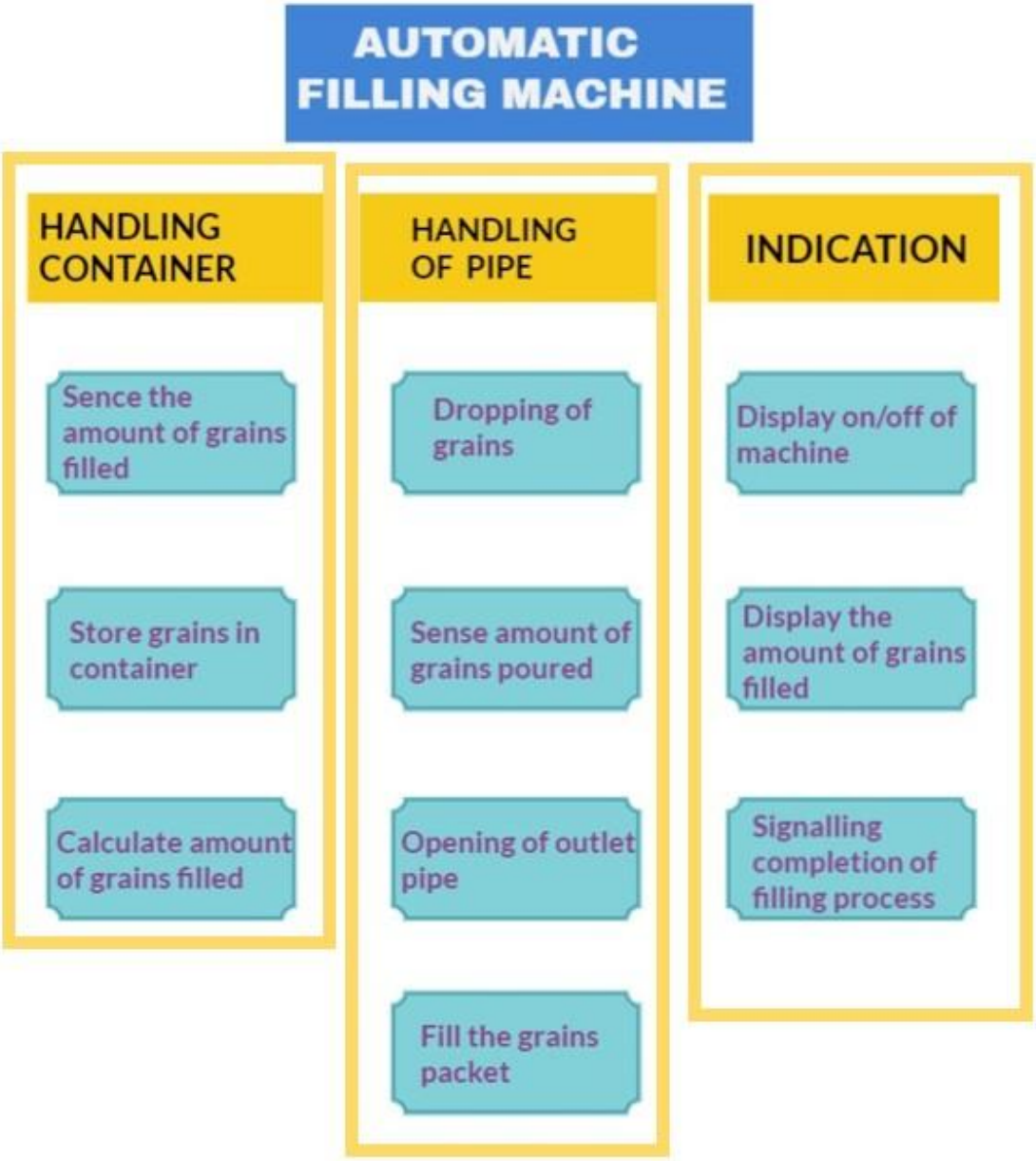
The Sub-systems which are identified from the Function Clustering Chart are as follows

1.Handle Container

2.Filling

3.Indication

3.4.1 Function Clustering


AUTOMATIC FILLING MACHINE
HANDLING CONTAINER
Sence the amount of grains filled
Store grains in container
Calculate amount of grains filled
HANDLING OF PIPE
Dropping of grains
Sense amount of grains poured
Opening of outlet pipe
Fill the grains packet
INDICATION
Display on/off of machine
Display the amount of grains filled
Signalling completion of filling process

3.4.2 Interaction between subsystems

		Filling	Indication
Handling Container.	Material Interaction	No	No
	Data Interaction	Yes	Yes
	Spatial Interaction	Yes	No
Details: In summary, based on the provided information, there is no direct physical handling of the bottles (Material Interaction is "No"), there is interaction related to data (Data Interaction is "Yes"), and there is some form of spatial interaction (Spatial Interaction is "Yes"),			

		Handling Container	Indication
Filling.	Material Interaction	Yes	No
	Data Interaction	No	No
	Spatial Interaction	Yes	Yes
Details: In summary, during the filling process, there is direct physical interaction with the materials (Material Interaction is "Yes"), no direct interaction related to data (Data Interaction is "No"), and there is spatial interaction, possibly involving the			

arrangement or positioning of bottles (Spatial Interaction is "Yes").

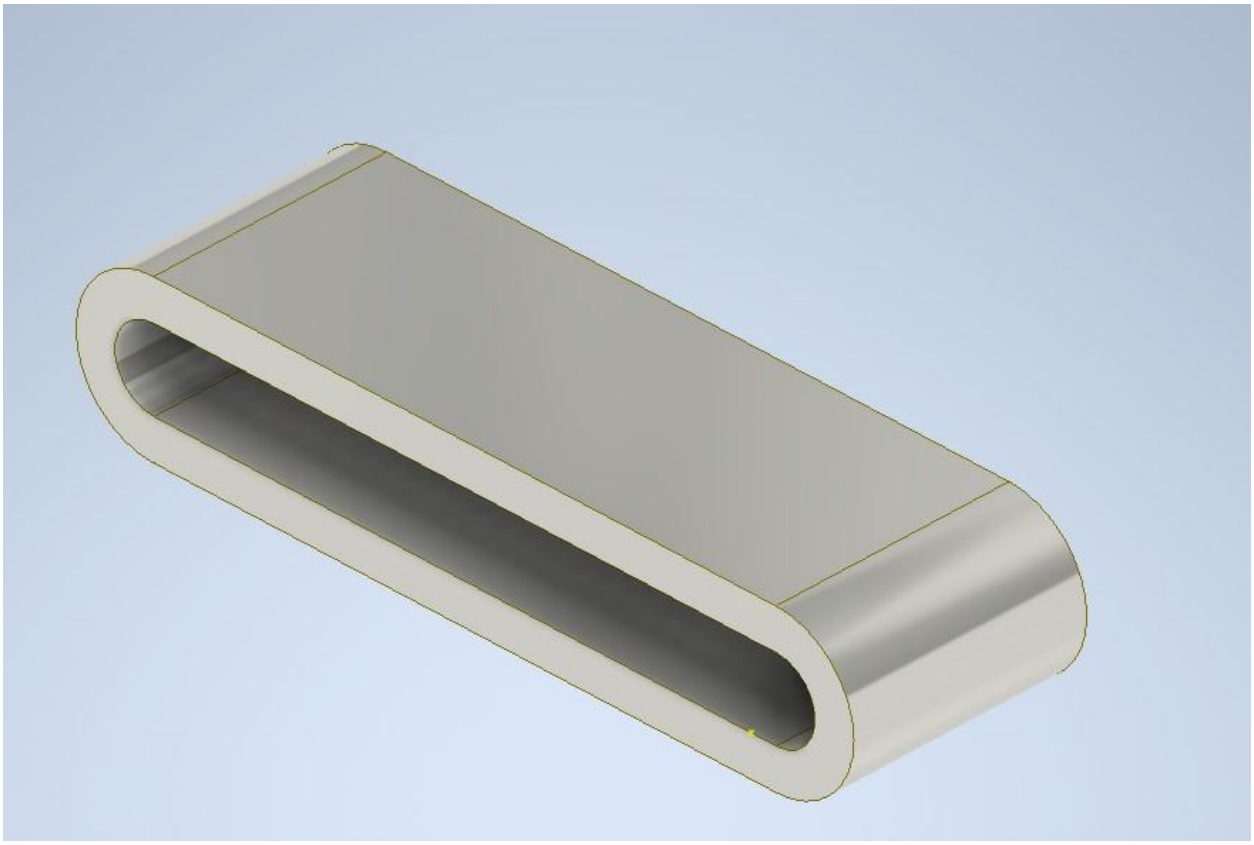
		Handling Container	Filling
Indication	Material Interaction	No	No
	Data Interaction	Yes	Yes
	Spatial Interaction	No	Yes

Details: In summary, during the indication process, there is no direct physical interaction with the materials (Material Interaction is "No"), there is interaction related to data (Data Interaction is "Yes"), and there is no spatial interaction (Spatial Interaction is "No").

4.Implementation

4.1.Sprint 1 Implementation

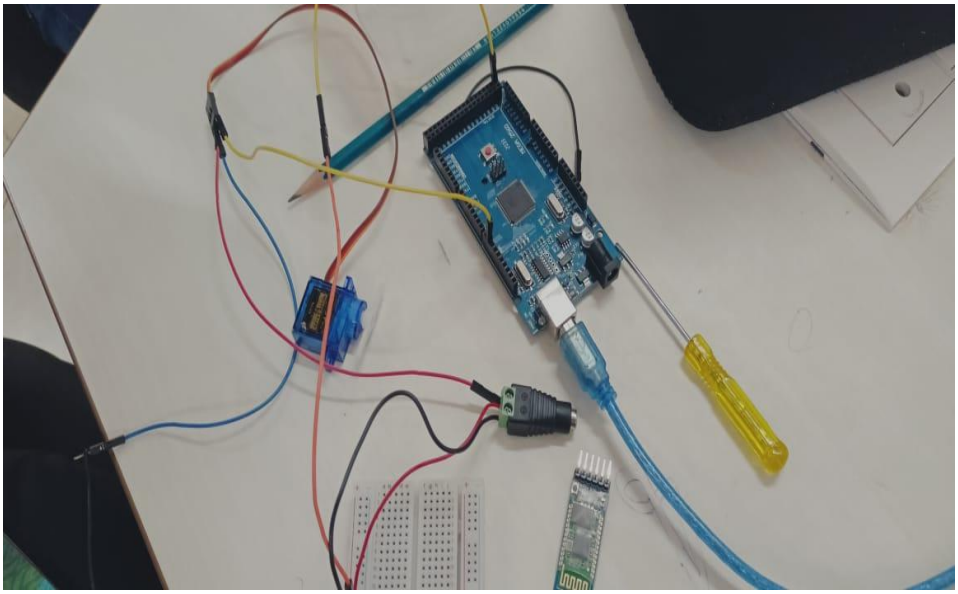
4.1.1. 3D model of the sprint 1 subsystem



4.1.2. Bill of Materials(BOM) of the sprint 1

Sl.No.	Items	Quantity
01)	Acrylic sheets for base	l=40cm w=30cm
02)	Foam sheets	l=30cm w=20cm
03)	Motor clamp	2

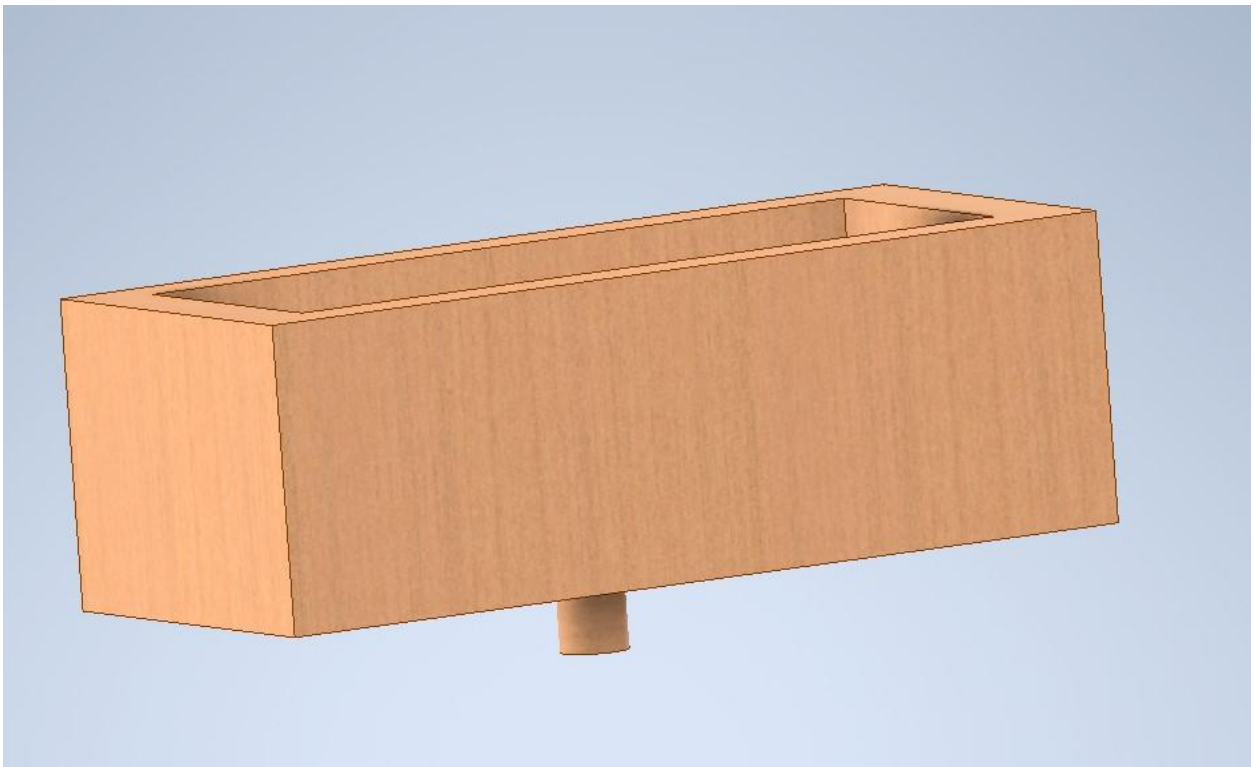
4.1.3. Circuit diagram of the sprint 1



4.1.5. Physical implementation image of the sprint

4.2.Sprint 2 Implementation

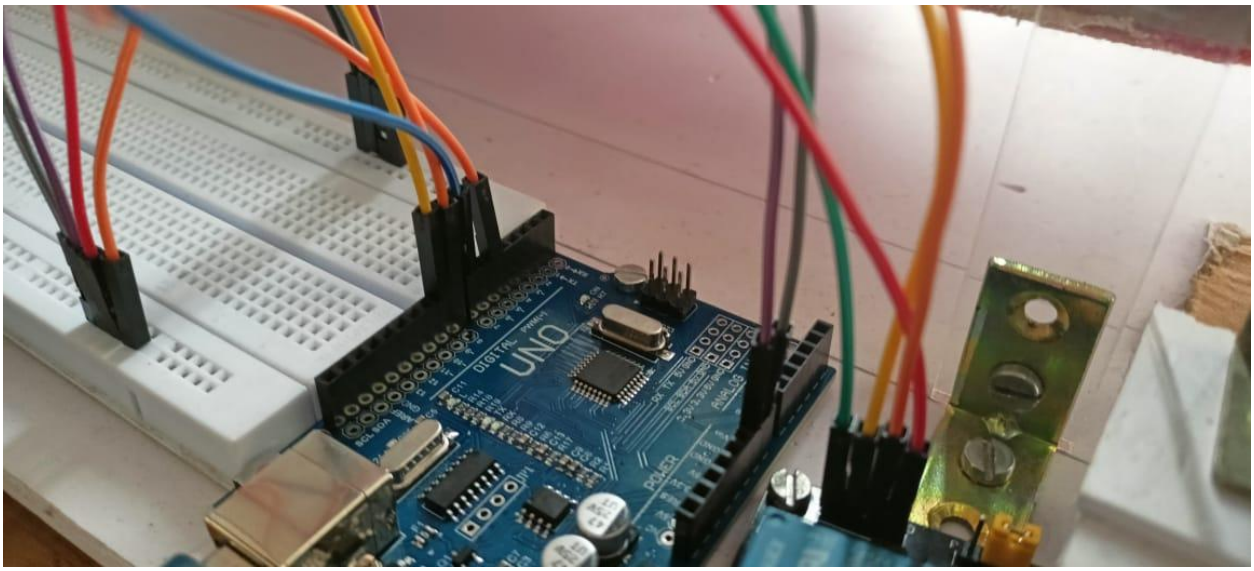
4.2.1. 3D model of the sprint 2



4.2.2. Bill of Materials (BOM) of the sprint

Sl.NO	ITEMS	QUANTITY
1]	Acylic sheet's for container	2
2]	Foam sheet Model Base	l =50cm W=50cm
3]	L-Clamps	14

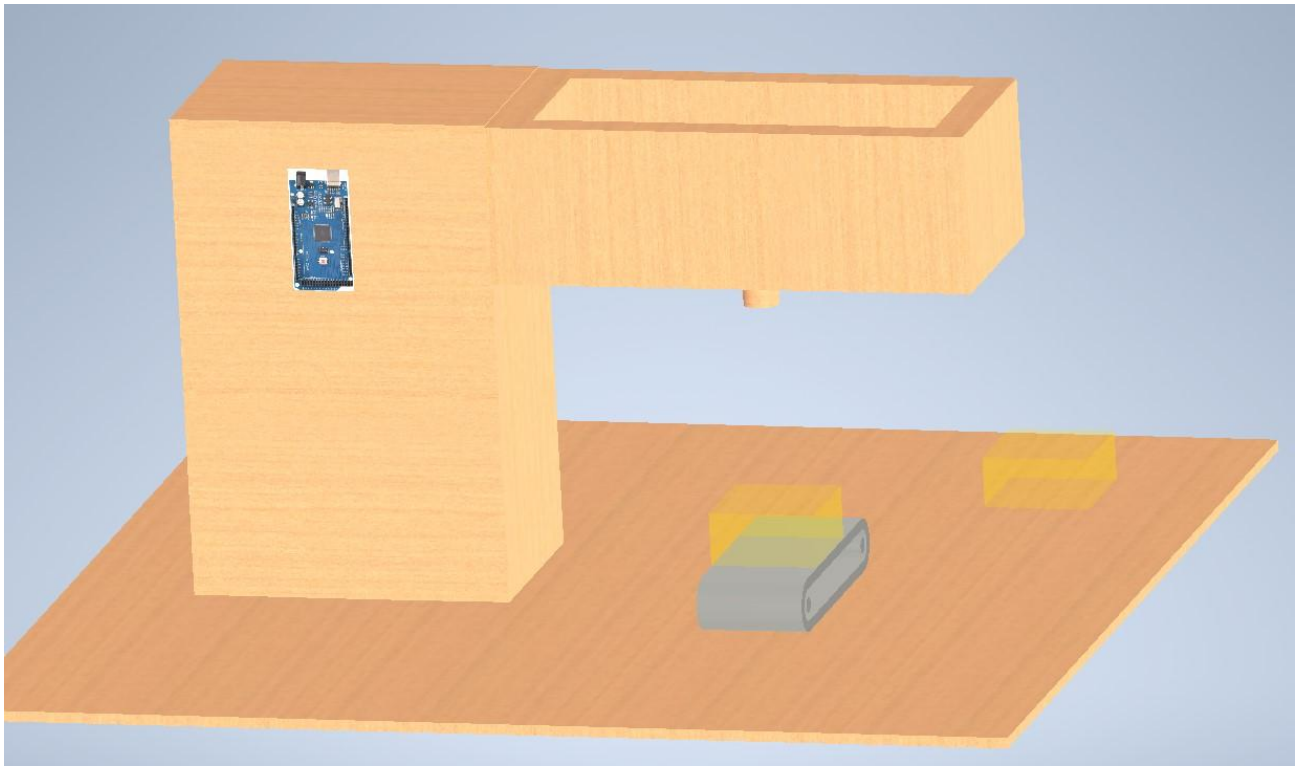
4.2.3. Circuit diagram of the sprint 2



4.2.5. Physical implementation image of the sprint 2

4.3.Sprint 3 Implementation

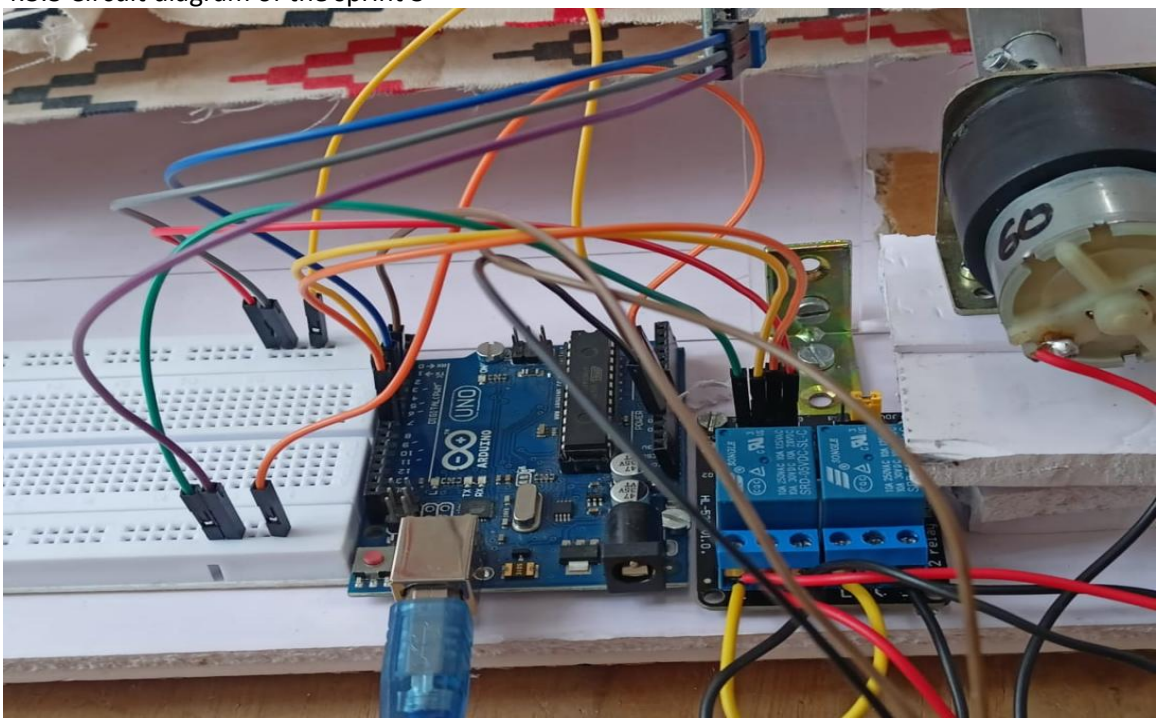
4.3.1. 3D model of the sprint 3 subsystem



4.3.2. Bill of Materials (BOM) of the sprint 3

Sl.No	ITEMS	QUANTITY
1	L-Clamps	4
2	Motor-clamp	1
3	Pillars	6
4	Aluminium rod	4

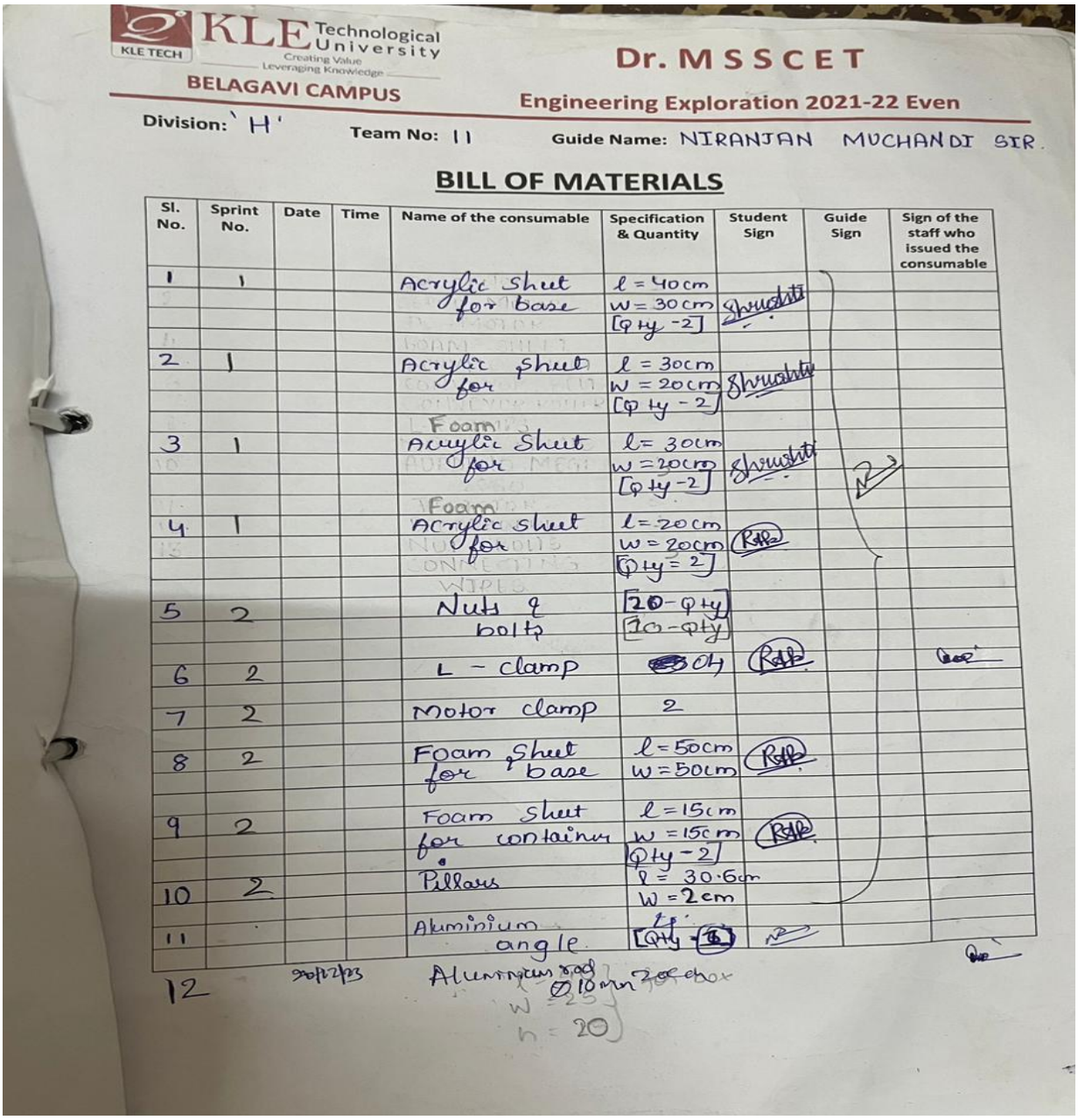
4.3.3 Circuit diagram of the sprint 3



4.3.4. Flow chart of the sprint

4.3.5. Physical implementation image of the sprint 3

Bill Of Materials



KLE Technological University
Creating Value
Leveraging Knowledge
KLE TECH

Dr. M S S C E T

BELAGAVI CAMPUS

Engineering Exploration 2021-22 Even

Division: 'H' Team No: 11 Guide Name: NIRANJAN MUCHANDI SIR.

BILL OF MATERIALS

Sl. No.	Sprint No.	Date	Time	Name of the consumable	Specification & Quantity	Student Sign	Guide Sign	Sign of the staff who issued the consumable
1	1			Acrylic Sheet for base	l = 40cm w = 30 cm [Qty -2]	Shruthi		
2	1			Acrylic Sheet for Foam	l = 30cm w = 20cm [Qty - 2]	Shruthi		
3	1			Acrylic Sheet for Foam	l = 30cm w = 20cm [Qty -2]	Shruthi		
4	1			Acrylic sheet for	l = 20 cm w = 20cm [Qty = 2]	Rahul		
5	2			Nuts & bolts	[20 - Qty] [20 - Qty]			
6	2			L - clamp	04	Rahul		
7	2			Motor clamp	2			
8	2			Foam Sheet for base	l = 50cm w = 50cm	Rahul		
9	2			Foam Sheet for container	l = 15cm w = 15cm [Qty - 2]	Rahul		
10	2			Pillars	l = 30.6cm w = 2cm			
11				Aluminium angle	[Qty - 8]			
12		30/12/23		Aluminium rod Ø10mm 2 pcs each	w = 25 h = 20			

5. Statement of Expenditure

Sl. No	Item with description	Quantity	Price in Rs.
1	**Acrylic Sheets and Foam Sheets**		
2	**Aluminium rods**		
3	**Nuts ,Bolts and Clamps**		
4	**Aurdino Uno**		
5	**Dc Motor,Servo Motor and IR sensor**		
6	**Relay, Wires and Bread Board**		
		Total	

6. Limitations of Present work and Future Scope

While automatic filling machines offer efficiency and consistency, they also have some drawbacks. Initial setup costs can be high, and maintenance expenses might accrue over time. They might require technical expertise for operation and regular maintenance. Also, in some cases, they might not be as flexible or adaptable to changes compared to manual processes. Moreover, they might be designed for specific tasks or products, making them less flexible than human operators who can adapt to various situations. Adjusting the machine for different products or containers might require reconfiguration or additional setup

time, which can be a limitation in industries with frequent product changes.

Lastly, if not properly maintained or operated, automatic filling machines could face technical issues that might require specialized knowledge or expertise to troubleshoot, potentially leading to downtime in production.

The future of automatic filling machines looks promising as industries continue to seek efficient, precise, and high-speed solutions for packaging. Advancements in technology, such as robotics, IoT integration, AI-driven controls, and sustainability-focused designs, are likely to enhance their capabilities further. Additionally, customization options, versatility across various products, and increased automation for seamless integration within production lines could drive their widespread adoption in diverse industries.

References:-

1-College Library resources

2- College LMS videos of Engineering Exploration Course Project

3 -LMS link - https://learn.klescet.ac.in/login/index.php

4-Internet - Database like Google Chrome

5- Github Link-

https://github.com/H-DIV-2023-2024-ODD/H11