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DR. M. S. SHESHGIRI COLLEGE OF ENGINEERING AND TECHNOLOGY

A Report on the Course Project of

Engineering Exploration (15ECRP101)

Titled

(RECORD BOT)

By

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Under the guidance of

Prof.Ravishankar Chikkangoudar

Centre for Engineering Education Research

Academic Year 2021-2022, Even Semester

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CERTIFICATE

This is to certify that the course project entitled "RECORD BOT" is carried out by the students Kavya K Morab (203), Chandrashekhar Katral (217), Ekata Honnegundi (218), Mohammad Toufiq (230) as part of Engineering Exploration Course (15ECRP101), during 2nd Semester of B.E program for the academic year 2021-22. The project report fulfils the requirements prescribed by KLE Technological University.

Guide	Division in charge
Prof .Ravishankar Chikkangoudar	Prof .Ravishankar Chikkangoudar

Examiner 1:	Examiner 2:

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DECLARATION

We hereby declare that the project work entitled “RECORD BOT” submitted as a part of Engineering Exploration Course during 2nd semester of academic year 2021-2022, is a record of an original work done by us under the guidance of Prof.Ravishankar Chikkangoudar. The project work and part of this report is not plagiarized to the best of our knowledge.

Date: 06/09/2022

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The pleasure that follows the successful completion of our exploration course project, titled "RECORDBOT" would remain incomplete without a word of gratitude to every single person who has contributed help for the completion of our course project.

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We are thankful to our CEER department for providing all the necessary materials for our project. We also thank all the non-teaching staff, lab instructors and lab associates who helped us throughout the project and continuously being with us to provide all the required materials. We thank all our wonderful and extremely supporting friends and seniors who gave us several ideas and helped us in many ways.

We express our gratitude towards our KLE TECHNOLOGICAL UNIVERSITY for providing us the opportunity to carry out the project and bestowing us a well-equipped laboratory for the conduction of our course project.

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Abstract:

This proposed work is an overview of how we can make use of servo motor to make joints of a robotic arm and control it using potentiometer. Arduino UNO board is programmed to control the servo motors and Arduino's analog input is given to potentiometer. This modelling resembles like a robotic crane or we can convert it into robotic crane using some tweaks. Robotic arm is one of the major projects in today automation industries. Robotic arm is part of the mechatronic industry today's fast growing industry. This project is a pick and place robotic arm. On large scale it can be used as in environment, which is either hazardous (e.g radiation) or not accessible. As the size of the robots scale down, the physics that governs the mode of operation, power delivery, and control change dramatically, restricting how these devices operate This also include it's characteristics like its extension, positioning, orientation, tools and object it can carry. This paper is on how we can make robotic arm with non-useful materials and its application for small purposes. This paper also says about its advantages, disadvantages, methodology. I conclude this paper by future enhancement.

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1. Problem Definition

1.1. Need Statement

Robotech Casting Ltd. company is interested to design and fabricate an automatic loading and unloading of molds into the machine, so as to increase the productivity and reduce the labour effort.

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

Table. 1 Questions asked to client

Sl. No.	Questions	Answers	O	C	F
01.	Should the machine be automatic or semiautomatic?	The machine should be automatic	✓		
02.	What should be the maximum weight of machine?	Approximate 2kg		✓	
03.	What should be the load capacity that a machine should carry?	Less than 100 grams		✓	
04.	Should the machine be user friendly?	Yes	✓		
05.	Machine should be fixed or portable?	Machine should be portable	✓		
06.	What should be the dimension of the machine?	1ft X 1ft X 1ft		✓	
07.	How many DOF needed for machine ?	Minimum 3		✓	
08.	Do you want the machine to be Record Each Step?	Yes			✓
09.	What other features are expected?	It should Hold The Object Accurately.			✓
10.	What other features are expected?	It should Playback the Each Recorded Steps.			✓
11.	What should be the budget?	It should be around Rs.4000		✓	
12.	Which color would you prefer for machine?	White or Blue		✓	

1.3. Objectives

Table. 2 Objectives

Sl. No	Objectives
01.	Machine should be automatic.
02.	Machine should be user-friendly.
03.	Machine should be portable.

Problem definition 1.1

Design an automatic portable loading and unloading machine, which can increase the productivity, reduce the human efforts, decrease the production time and increase the quality.

1.4. Constraints

Table.3 Constraints

Sl. No	Constraints
01	The maximum weight of machine is 2kg.
02	The load capacity of the machine is less than 100 grams.
03	The dimension of machine is 1ft X 1ft X 1ft.
04	Minimum 3 DOF is needed for machine.
05	The budget should be around Rs.4000.
06	The color of machine is White or blue.

Problem definition 1.2

Design an automatic portable loading and unloading machine, which can increase the productivity, reduce the human efforts, decrease the production time and increase the quality. Machine must not exceed the weight of 2kg and having dimensions of 1ft X 1ft X 1ft and minimum 3 DOF, should be able to hold up to 100 grams, budget to build should not exceed Rs.4000 having color of White or blue.

1.5. Functions

Table.4 Functions

Sl. No	Functions
01	The machine to be Record Each Step.
02	The machine should Hold The Object Accurately.
03	The machine should Playback the Each Recorded Steps.

Problem definition 1.3

Design and fabricate an automatic portable loading and unloading machine, which can increase the productivity, reduce the human efforts, decrease the production time and increase the quality. Machine must not exceed the weight of 2kg and should be built within the dimensions of 1ft X 1ft X 1ft and minimum 3 DOF, should be able to hold up to 100 grams, budget to build should not exceed Rs.4000 having color of White or blue. The machine should be operated using Potentiometers and Push Buttons, It should to be record each step .It should playback the each recorded steps.

2.Conceptual Design

2.1. Establishing Functions

Table. 5 Establishing Functions

Sl. No	Functions from user perspective	Functions from the designer perspective
1	Semiautomatic or automatic	Semiautomatic
2	Holding the object	holding the object accurately
3	Movable	should be portable
4	Displace the object	Speed controlling
5	Display the light while recording and playback	Display with the LED
6	Follows the command	Aurdino based working
7	Rotating of the machine	Rotate the machine at desired degree

2.2. Functions Tree

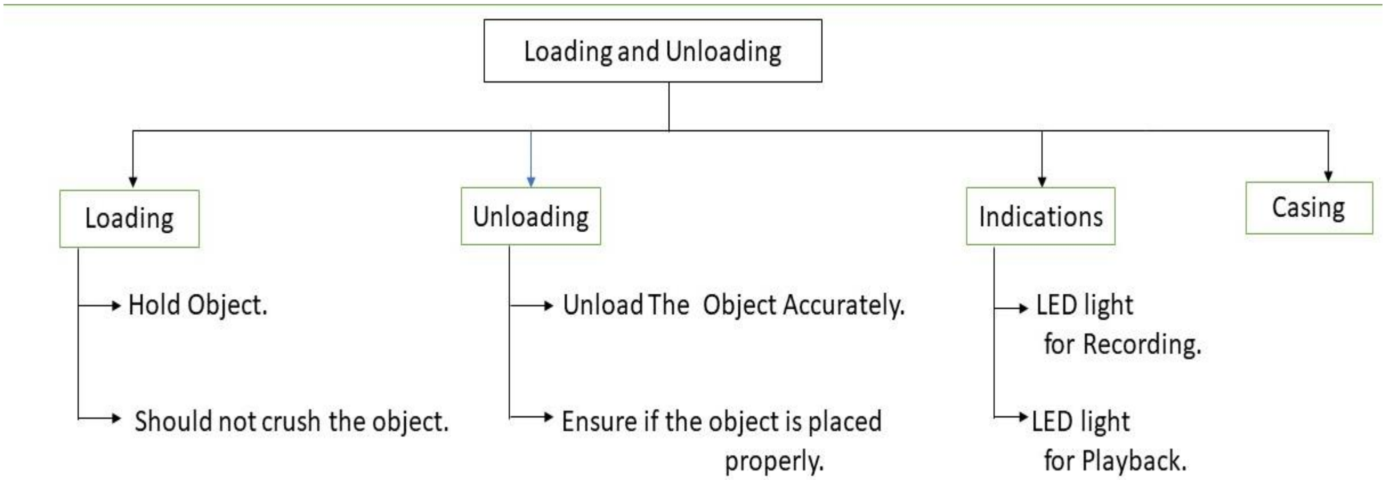


Fig. 1 Function tree

2.3. Morphological Chart

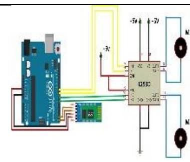
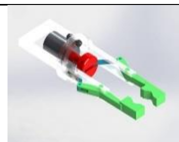
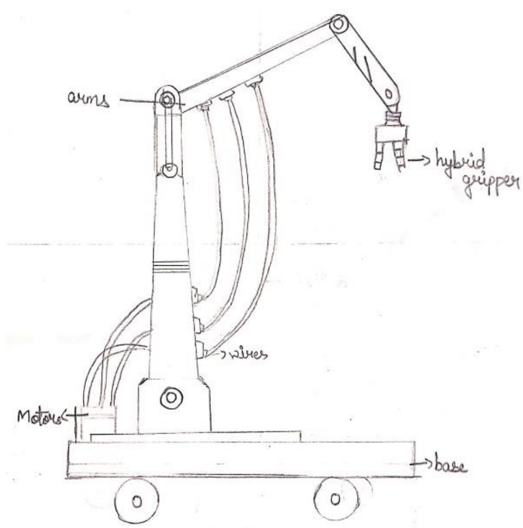
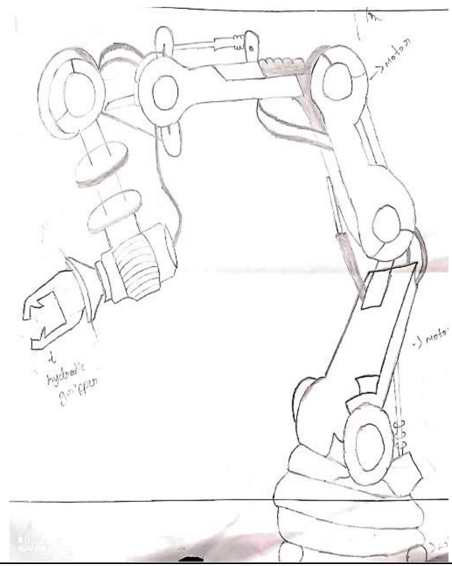
Sl.no	Sub-Functions	Mean 1	Mean 2	Mean 3	Mean 4
01	Operating Mode	 Remote	 Bluetooth	 Push Button	
02	Grabbing The Object	 Hydraulic Gripper	 Hybrid Gripper	 Vaccum Gripper	 Gripper
03	Movement Of Arm	 Servo Motor	 Stepper Motor	 DC Motor	
04	Indicators	 LED	 Digital Display	 Buzzer	

Fig. 2 Morphological Chart

2.4. Generated Concepts

<table>
<tr><th>Concept 1</th><th>Concept 3</th></tr>
<tr><td>
</td><td>
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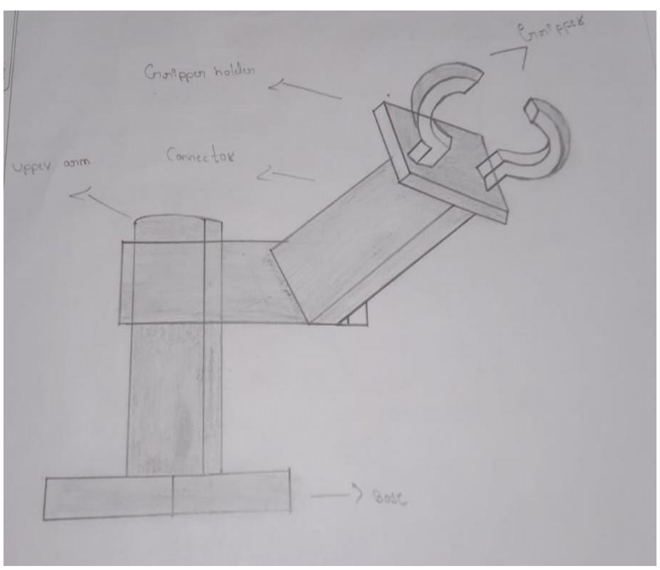
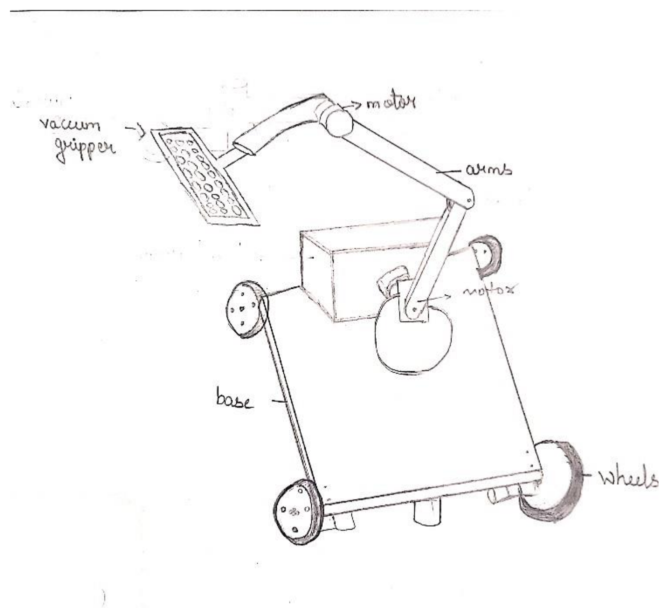
<tr><td>
</td><td>
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Table. 6 Generated Concepts

3.Conceptual Evaluation and Product Architecture

3.1. Pugh Chart

Design Objectives	Weights	Design 1	Design 2	Design 3	Design 4
Safety	9	+	++	-	Datum
Ease of use	6	-	+	+	Datum
Portability	5	-	+	-	Datum
Use of standard parts	5	+	+	0	Datum
Cost	7	-	-	+	Datum
Score(+)		14	34	13	0
Score(-)		-18	-7	-14	0
Total		-4	27	-1	0

Fig. 3 Pugh Chart

3.2. Justification for the Scores

Design no.	Objective	Score allocated	Justification for the score
01.	SAFETY	9	Compared to datum it is safer to use.
	EASE OF USE	-6	Compared to datum it is not easy to use.
	PORTABILITY	-5	It is a bit heavier compared to datum.
	USE OF STANDARD PARTS	5	Parts used are adequate.
	COST	-7	It is costlier compared to datum.
02.	SAFETY	18	Comparing to datum it is safer to use.
	EASE OF USE	6	As it has record and playback mechanism it is easy to use.
	PORTABILITY	5	Easily portable compared to datum.
	USE OF STANDARD PARTS	5	Adequate standard parts are used.
	COST	-7	It will be slightly costlier due to some machine parts.
03.	SAFETY	-9	It has hydraulic gripper which is a bit risky.
	EASE OF USE	6	It can easily be operated.
	PORTABILITY	-5	It is a bit heavier compared to datum.
	USE OF STANDARD PARTS	0	It is similar to datum.
	COST	7	Compared to datum it is affordable.
04.	SAFETY	DATUM	DATUM
	EASE OF USE	DATUM	DATUM
	PORTABILITY	DATUM	DATUM
	USE OF STANDARD PARTS	DATUM	DATUM
	COST	DATUM	DATUM

Fig. 4 Justification for the Scores

3.3 Selected Design

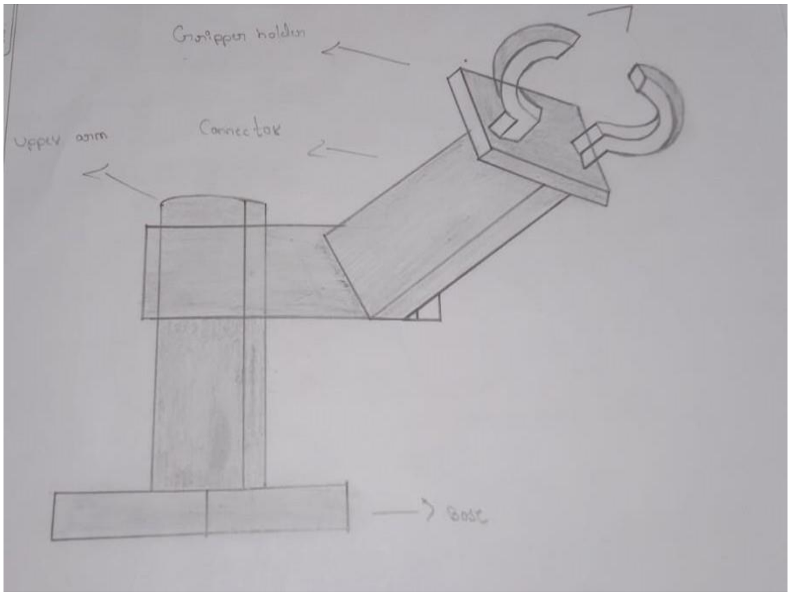

Fig. 5 Selected Design

3.4 Product Architecture

3.4.1 Function Clustering

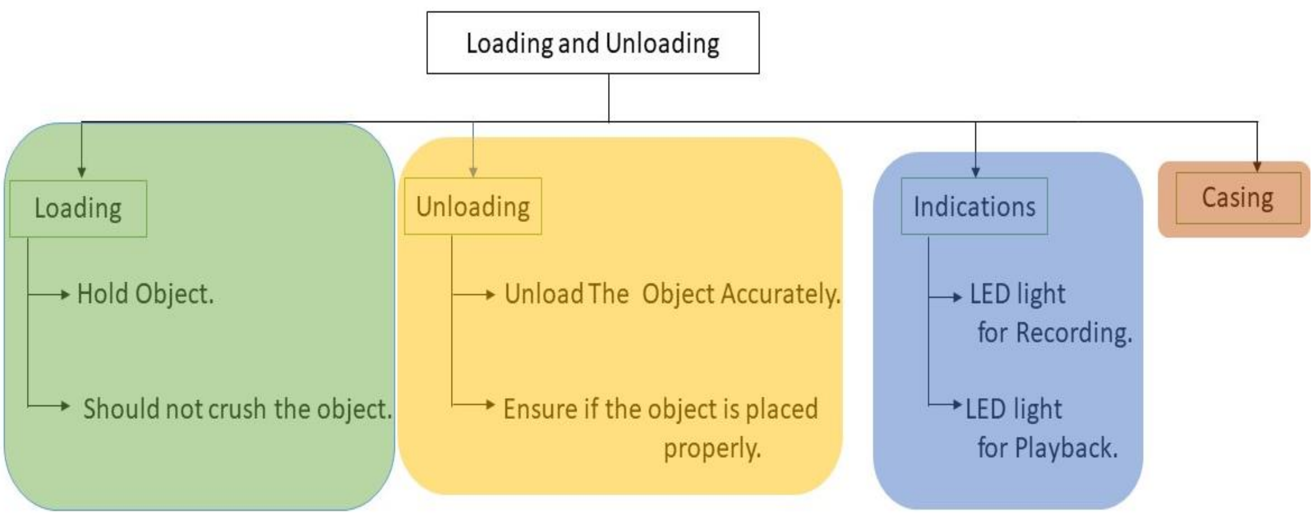

Fig. 6 Function Clustering

3.4.2 Interaction between subsystems

	Interactions	Unloading	Casing
Loading	Spatial	✓	X
	Data	X	✓
	Material	X	X

	Interactions	Loading	Casing
Unloading	Spatial	✓	X
	Data	X	✓
	Material	X	X

	Interactions	Loading	Unloading
Casing	Spatial	X	X
	Data	✓	✓
	Material	X	X

Table. 7 Interaction between subsystems

4.Implementation

4.1.Sprint 1 Implementation

4.1.1. 3D model of the sprint 1 subsystem

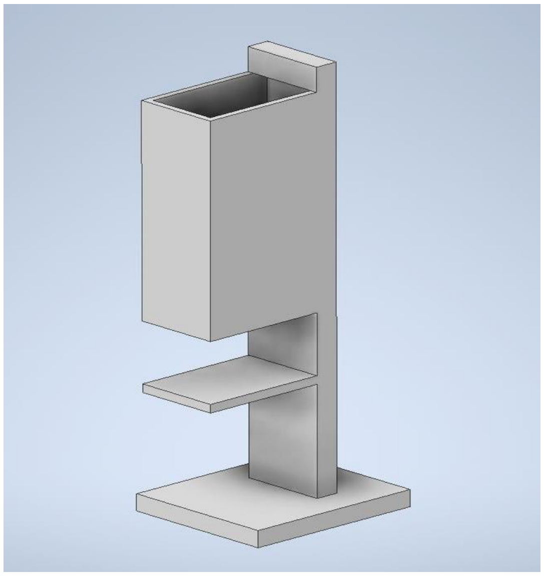

Fig. 7 3D model of the sprint 1

4.1.2. Physical implementation image of the sprint 1

Fig. 8 Physical implementation image of the sprint 1

4.2.Sprint 2 Implementation

4.2.1. 3D model of the sprint 2

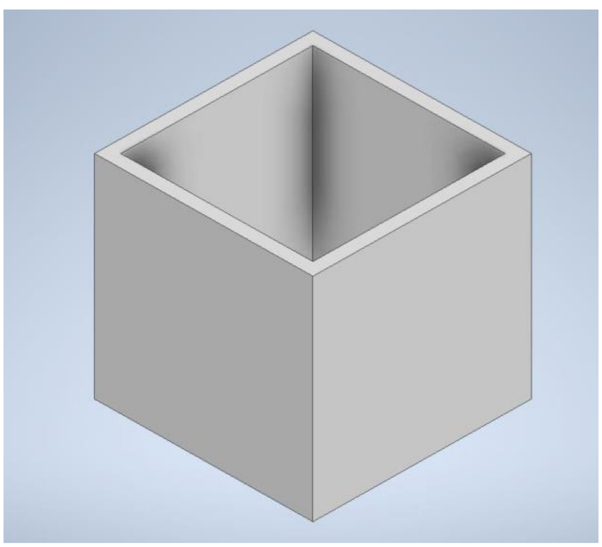

Fig. 9 3D model of the sprint 2

4.2.2. Physical implementation image of the sprint 2

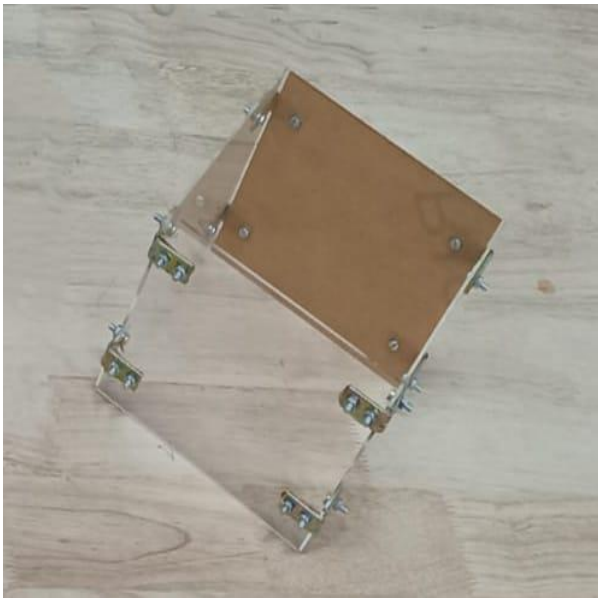

Fig. 10 Physical implementation image of the sprint 2

4.3.Sprint 3 Implementation

4.3.1. 3D model of the sprint 3 subsystem

Fig. 11 3D model of the sprint 3

4.3.2. Circuit diagram of the sprint 3

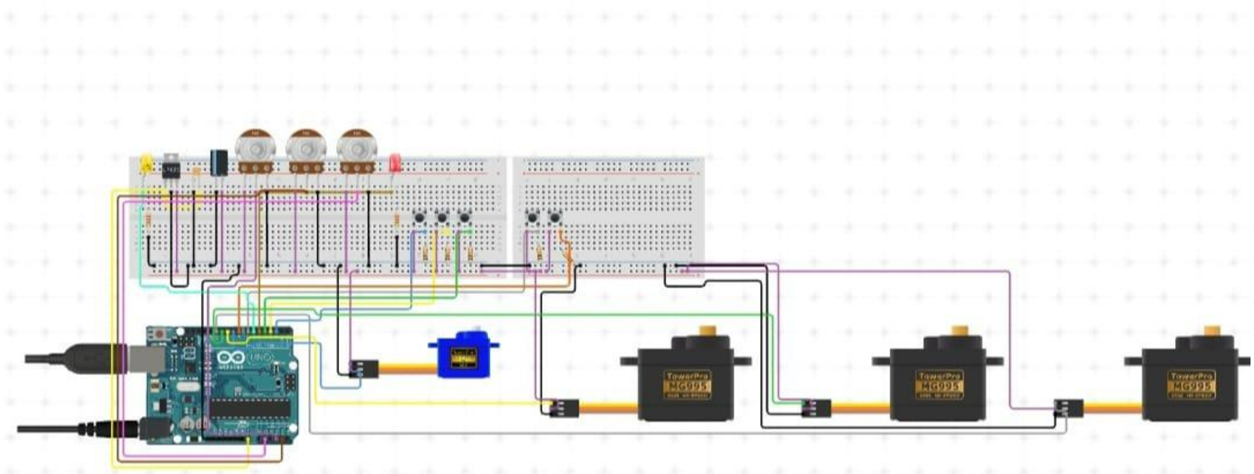

Fig. 12 Circuit diagram

4.3.3. Flow chart of the sprint 3

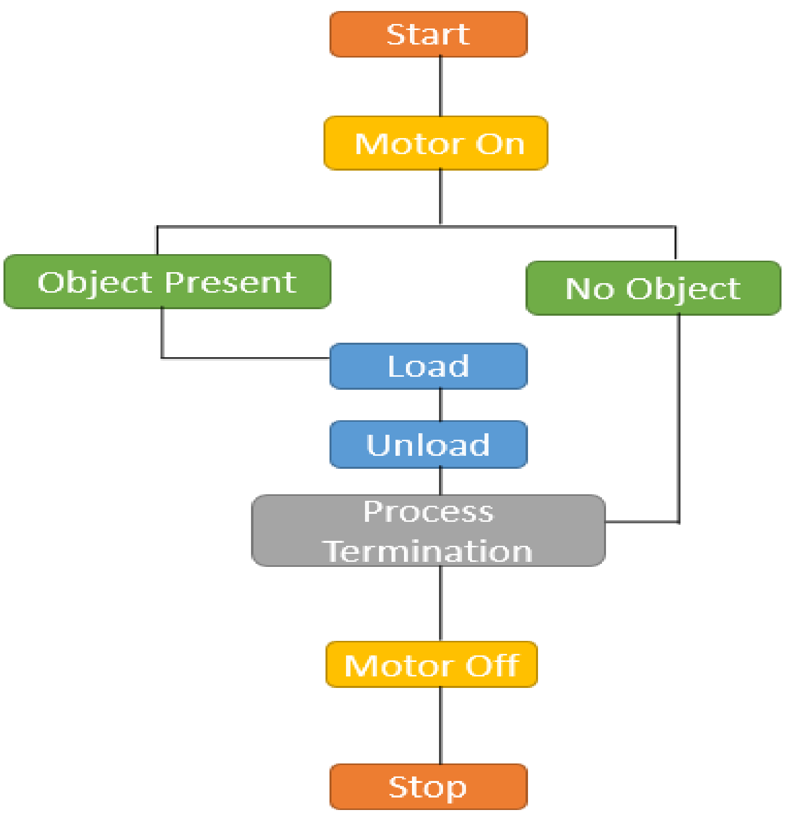

Fig. 13 Flow chart of the sprint 3

4.3.4. Physical implementation image of the sprint 3

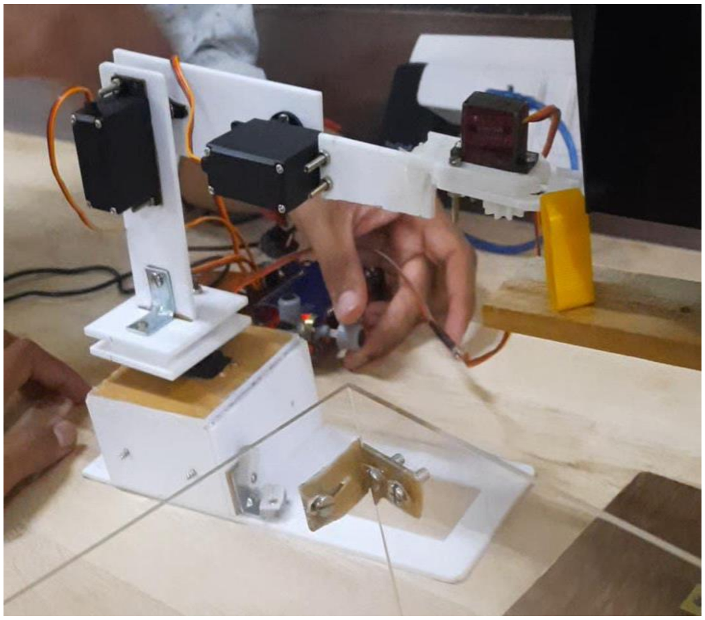

Fig. 14 Physical implementation image of the sprint 3

5.Statement of Expenditure

Sl. No	Item with description	Quantity	Price in Rs.
1	Arduino	1	700
2	MG996R	3	1200
3	MG90	1	300
4	Acrylic Sheet	1ft * 2ft	450
5	AR Cable	1	40
6	LED	2	05
7	Buttons	7	70
8	Motor Screw	12	40
9	Adapter	1	185
10	L-Clamp	5	25
11	Gripper	1	250
12	Potentiometers	3	90
13	Resistors	5	10
14	Wires	-	50
		Total	3415

Fig. 15 Statement of Expenditure

6. Limitations of Present work and Future Scope

Limitations:

- The robotic arm designed, can only hold upto 60 g. which is one of the limitations.
- The loading and unloading unit workspace is limited .
- It can replay the recorded movement of arm only a few times.
- It is not Bluetooth or wifi operated.

Future scope:

- By increasing the load carrying capacity we can increase the efficiency of the robotic arm.
- We can make it bluetooth operated or mobile operated to make it more advanced.

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