KTO KARATAY ÜNİVERSİTESİ

FACULTY OF ENGINEERING AND NATURAL SCIENCES

- **DEPARTMENT:** MECHATRONICS ENGINEERING
- **CLASS:** 4ND YEAR
- **COURSE:** ROBOTİCS
- **NAMES:** EMRE MERT – MEVLÜT ESAT
- **SURNAMES:** BİLAL - SELVİ
- **NUMBERS:** 211455005 - 21904031
- **PROJECT:** RIM AND HUBCAP ASSEMBLY
- **ACADEMICIAN:** ASSOC. PROF. HÜSEYİN ALP

  RESEARCH ASSISTAN SİNAN İLGEN

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INTRODUCTION

- WHAT IS THE ROBOTICS ?

Robotics is a branch of science and engineering focused on designing, building, and utilizing machines that can assist humans, mimic their actions, or even replace them in performing various tasks. These machines are known as **robots** and are developed by integrating different fields of technology [1].

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AREAS OF USE

- Nowadays, the areas of use of robots are becoming increasingly widespread, and while this proliferation is causing some people to lose their jobs, it also means new job opportunities for others [2]. Some of the areas of use are as follows:
- **Industry:** Production lines, assembly, welding processes.
- **Medicine:** Surgical robots, prosthetics, rehabilitation devices.
- **Entertainment:** Game consoles, animation robots.
- **Space and Research:** Mars exploration robots, submarine robots.
- **Daily Life:** Cleaning robots, smart home systems.

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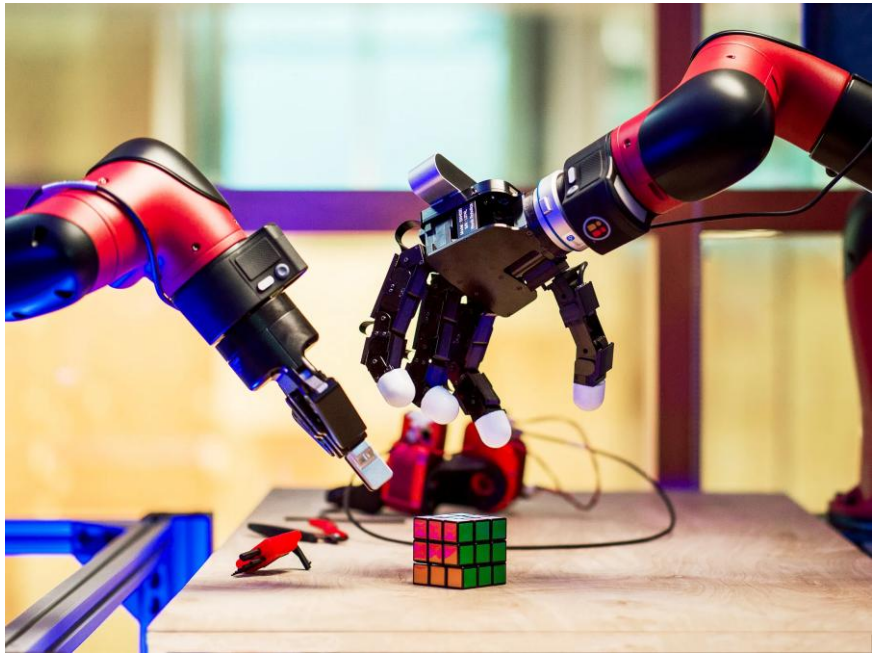
ADVANTAGES OF ROBOTS

- It speeds up business processes.
- It minimizes human error.
- It provides safe work in hazardous environments.
- It facilitates repetitive work.
- It increases product and service quality.
- It increases efficiency with uninterrupted work.
- It provides cost savings in the long term.



- Robots are divided into two groups: fixed-based and mobile-based.

Fixed-Base Robots:

These robots are anchored to a specific location and perform tasks without changing their position. They are commonly used in production lines or designated work areas.

Mobile-Base Robots:

These robots have a movable platform or base, allowing them to navigate freely in various environments and terrains.

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MATERIALS

- PETG Filament (500 Turkish Lira)
- Adhesive (65 TL)
- Bolts (150 TL)
- Socket for assembly (135 TL)
- Voltage regulator (30 TL)
- Floor Platform (50 TL)
- Reducer DC Motor (35 TL)

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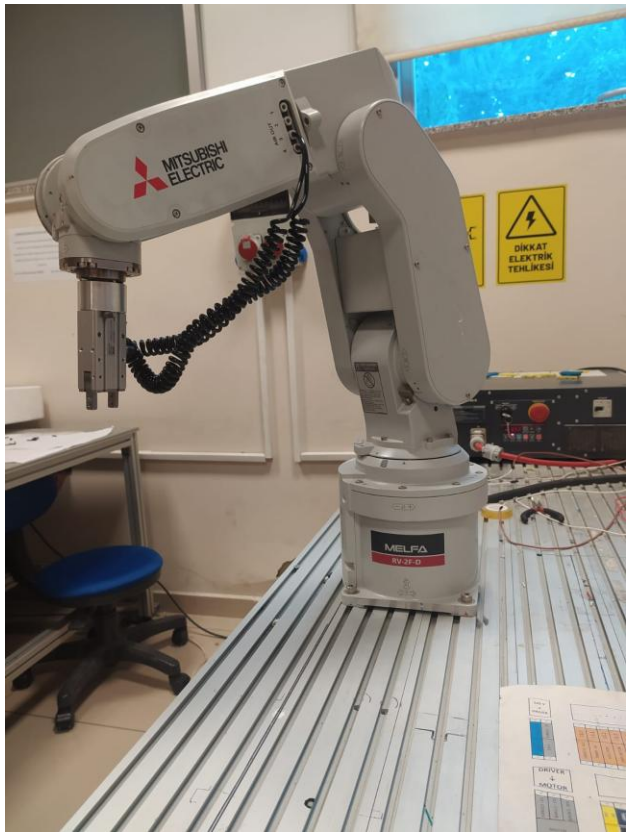
DESIGN

- **MANIPULATOR USED IN THE PROJECT**

- Mitsubishi RV-2F-D is an industrial robot manipulator manufactured by Mitsubishi Electric. This robot is a model used in a wide variety of industrial applications, providing high precision, reliability and efficiency. RV-2F-D is used especially in automatic production lines, assembly, welding, transportation and many other tasks. It has a load carrying capacity of 2 kg. It has 6 joints.
- The assembly platform of the project, the parts to be used and the gripper are designed to suit this robot arm.



- **PARTS DESIGNED FOR ASSEMBLY IN THE PROJECT**

- For these designed parts, the size of the ground platform to be used was first calculated and its width was considered to be approximately 40 cm and its length was considered to be 60 cm. In addition, the dimensions of the pneumatic gripper at the end of the robot arm were taken. According to these measurements, the axle, rim, hubcap, holding device to be attached to the gripper, motor housing to be attached to the gripper for assembly, bolt and wrench socket to assemble the bolt, etc. were designed and drawn in the Solidworks program by calculating their tolerances.
- These designed and drawn parts were printed and the project construction started. The gripper and the motor housing for assembly were attached, and a DC motor was attached to the motor housing. The points where the parts to be assembled were placed were determined and placed on the surface platform. These designed parts are shown in the pictures.

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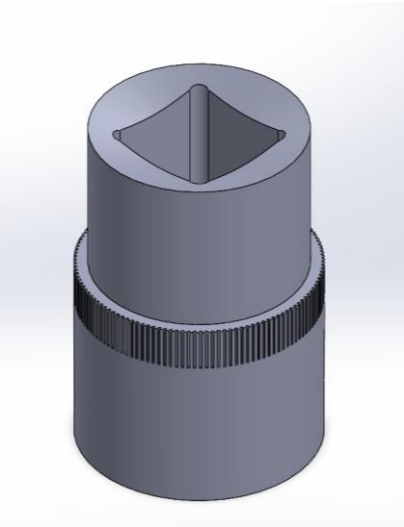
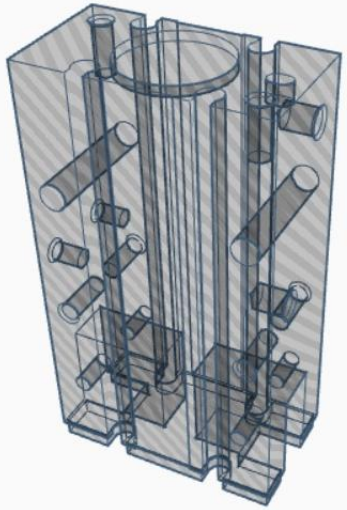
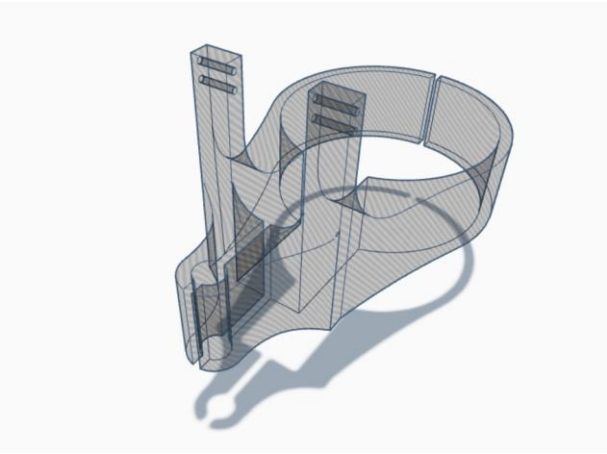
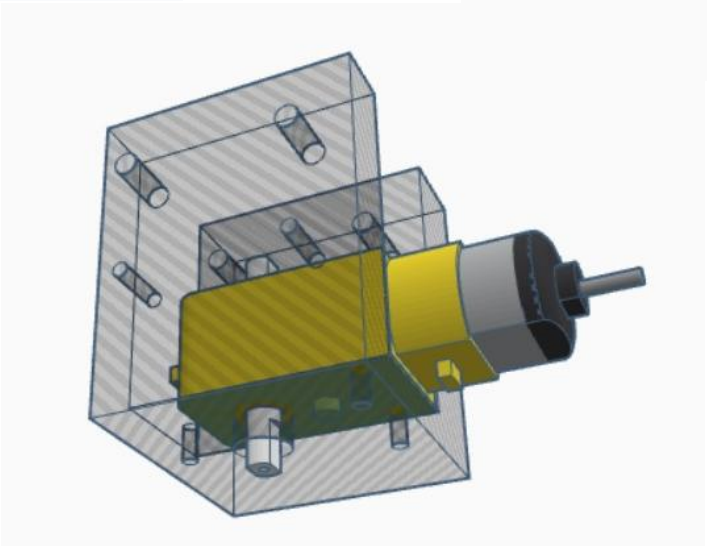
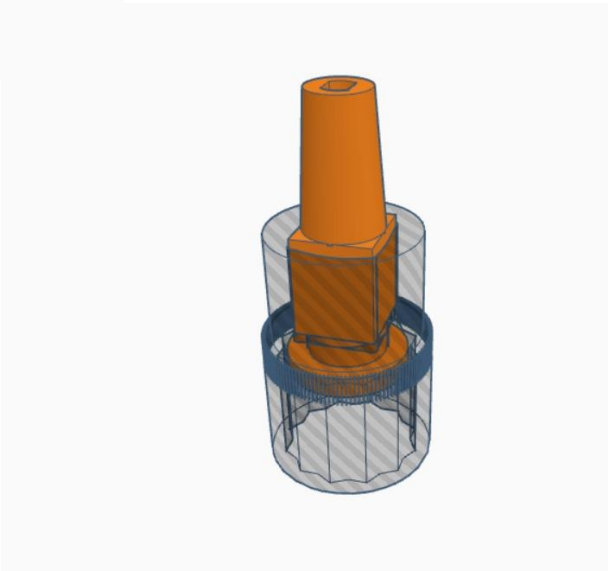
Design of the Gripper of The Manipulator











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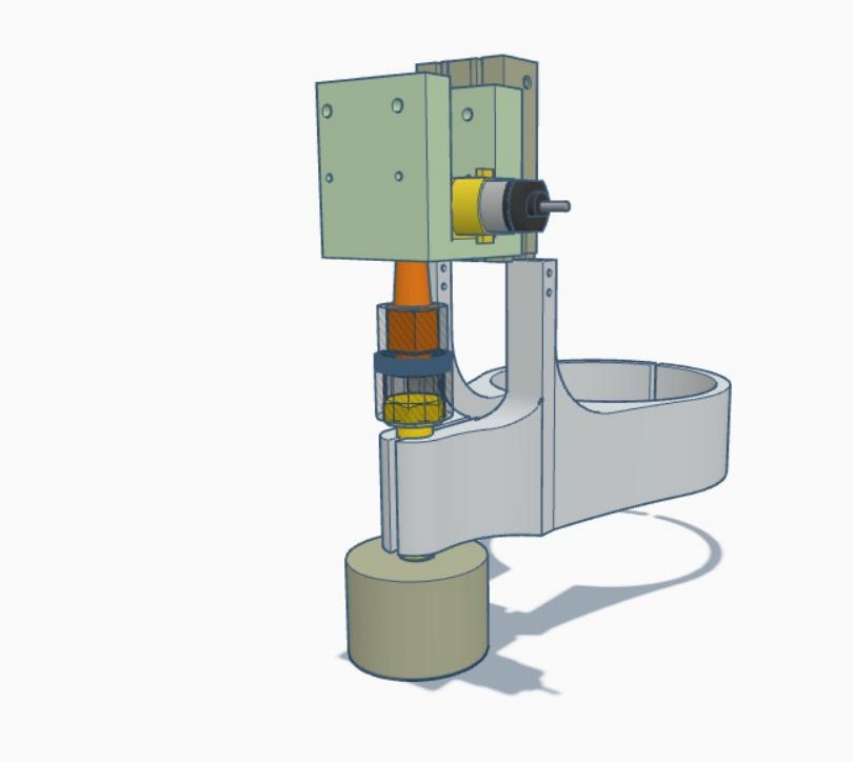
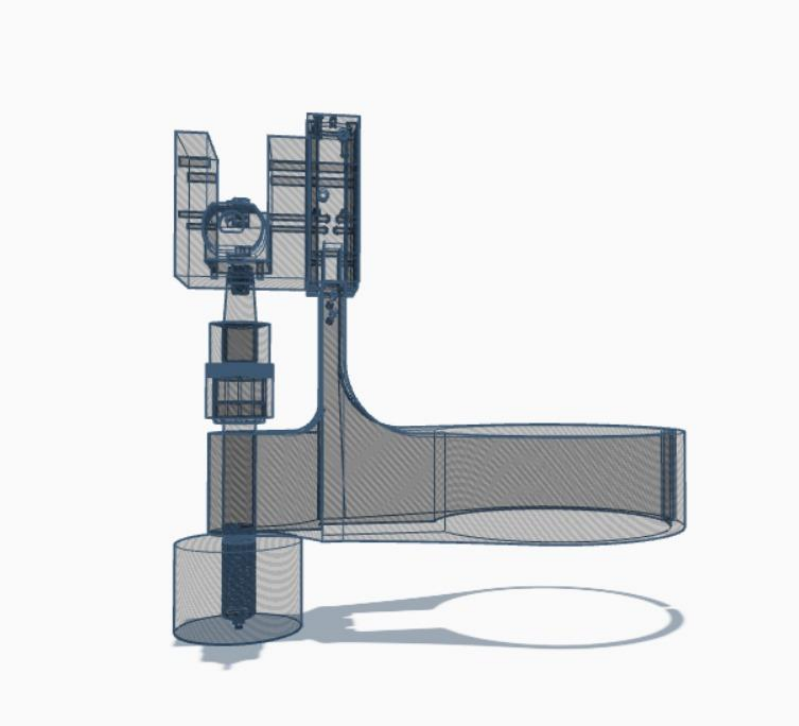
- The assembled form of the parts of the end of the manipulator shown on the previous page is as follows. As can be seen, the gripper is two-sided. One side holds and carries the rim and rim cover, while the other side holds and carries the bolt. There is a motor housing just above the part that holds the bolt, this motor housing is fixed to the pneumatic gripper. The dc motor is fixed to this motor housing, a housing is attached to the end of the motor, and a socket is attached to this housing to insert the bolt. After carrying the bolt, the assembly process will be carried out with this part.






2024
Robotic
Project


2024
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Project

Design of Rim Parts

- The rim, hubcap, axle, rim housing and bolt of this system, which will be implemented on the ground platform, are designed as follows.

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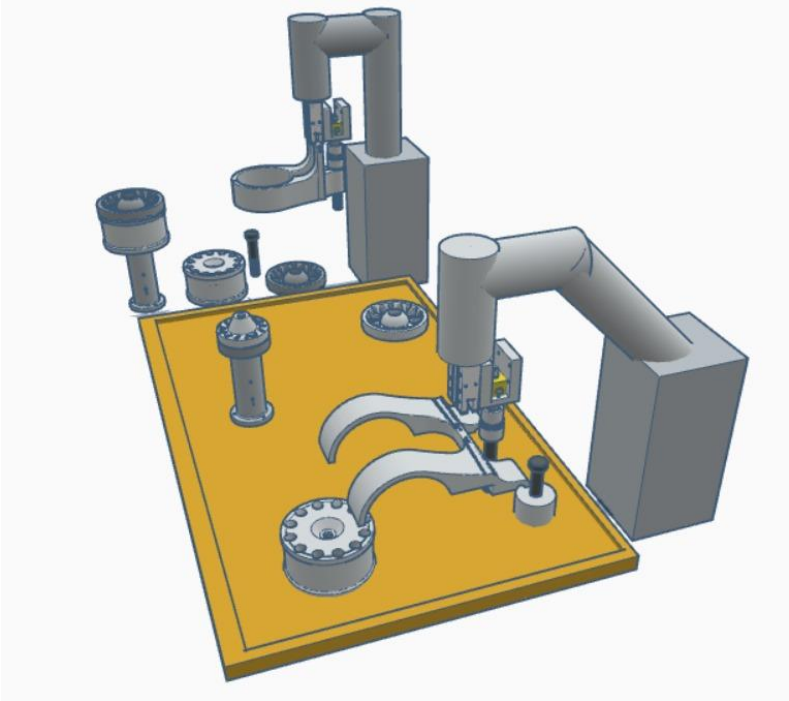
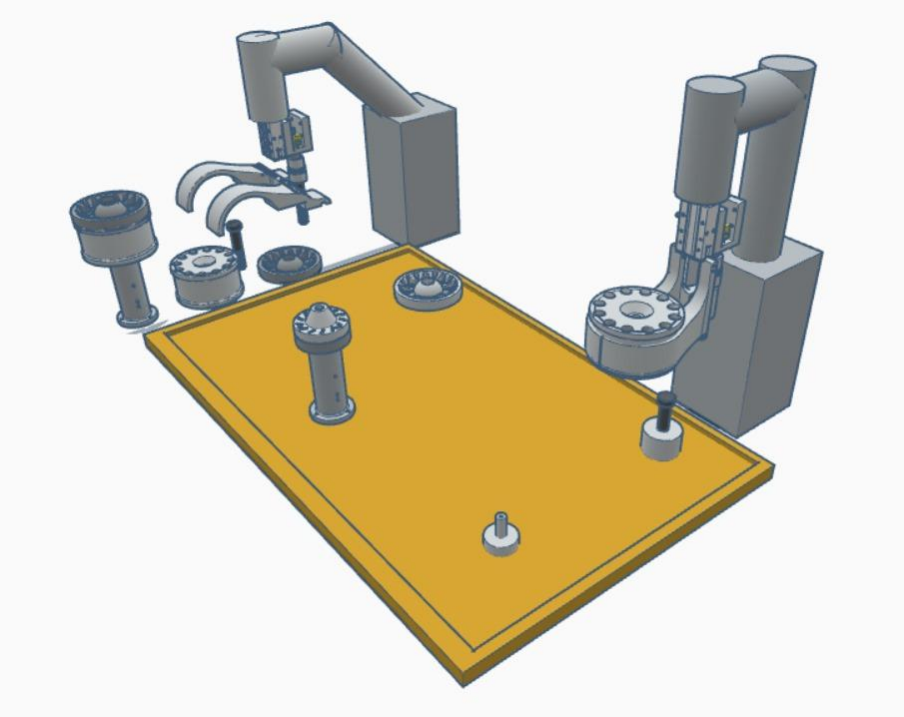
Final Design

- The assembled version of the project on the ground platform is as follows.





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ROBOT MANIPULATOR PROGRAMMING AND COORDINATES

```
1 Ovrd 10
2 M_out(13)=0
3 Mov p1
4 Dly 2
5 M_out(4)=1
6 Mov p2
7 Dly 2
8 Mov p3
9 Dly 1
10 M_out(4)=0
11 Dly 1
12 Mov p4
13 Dly 1
14 Mov p5
15 Dly 1
16 Mov p6
17 Dly 1
18 M_out(4)=1
19 Dly 1
20 Mov p7
21 Dly 1
22 Mov p8
23 Dly 1
24 M_Out(4)=0
25 Dly 1
26 Mov p9
27 Dly 1
28 Mov p10
29 Dly 1
30 Mov p11
31 Dly 1
32 M_out(4)=1
33 Dly 1
34 Mov p12
35 Dly 1
36 Mov p13
37 Dly 1
38 M_out(4)=0
39 Dly 1
40 Mov p14
41 Dly 1
42 Mov p15
43 Dly 1
44 Mov p16
45 Dly 1
46 M_out(4)=1
47 Dly 1
48 Mov p17
49 Dly 1
50 M_out(13)=1
51 Mov p18
52 Dly 2
53 Mov p19
54 M_out(13)=0
55 Dly 600
p1=(-116.940,278.020,515.980,178.360,-1.440,-47.950)(7,0)
p2=(-116.940,278.020,294.350,178.360,-1.440,-47.950)(7,0)
p3=(-108.380,395.630,225.580,178.370,-1.450,-47.950)(7,0)
p4=(-108.380,395.630,426.450,178.370,-1.450,-47.950)(7,0)
p5=(117.460,363.210,426.450,178.370,-1.450,-47.950)(7,0)
p6=(117.460,363.210,361.940,178.370,-1.450,-47.950)(7,0)
p7=(220.870,185.410,361.940,178.370,-1.450,-47.950)(7,0)
p8=(220.870,180.880,224.130,178.370,-1.450,-47.950)(7,0)
p9=(220.870,180.880,443.140,178.370,-1.450,-47.950)(7,0)
p10=(118.110,365.050,443.140,178.370,-1.450,-47.950)(7,0)
p11=(118.110,365.050,396.420,178.370,-1.450,-47.950)(7,0)
p12=(-96.250,324.610,396.420,178.370,-1.450,-47.950)(7,0)
p13=(-92.850,321.950,247.450,178.370,-1.450,-47.950)(7,0)
p14=(-92.850,315.900,460.610,178.370,-1.450,-47.950)(7,0)
p15=(100.120,419.790,460.610,178.990,2.730,125.810)(7,15728640)
p16=(99.370,418.850,420.670,178.980,2.720,125.820)(7,15728640)
p17=(101.100,423.820,444.410,178.750,2.500,119.530)(7,15728640)
p18=(101.100,423.820,367.360,178.750,2.500,119.530)(7,15728640)
p19=(101.100,423.820,432.510,178.750,2.500,119.530)(7,15728640)
```

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Motor Connection

- In the project, the dc motor used to assemble the bolt was supplied with a signal from the input-output table given by the teacher, output13 pin. As can be seen from the program on the previous page, the M_out(13) = 1 command was used to receive a signal and run the motor, and the M_out(13) = 0 command was used to stop the motor after assembly was completed.

Pin No.	Kablo Rengi 2D-CBL05	Çıkışlar	Power Supply, Common	
1 D	Turuncu/Siyah a		12V/24V: 5D-20D pinler için	+
2 D	Gri/Siyah a		12V/24V: 5D-20D pinler için	+
3 D	Beyaz/Siyah a		Reserved	
4 D	Sarı/Siyah a		Reserved	
5 D	Pembe/Siyah a	Output 15		
6 D	Turuncu/Siyah b	Output 14		
7 D	Gri/Siyah b	Output 13		
8 D	Beyaz/Siyah b	Output 12		
9 D	Sarı/Siyah b	Output 11		
10 D	Pembe/Siyah b	Output 10		
11 D	Turuncu/Siyah c	Output 9		
12 D	Gri/Siyah c	Output 8		
13 D	Beyaz/Siyah c	Output 7		
14 D	Sarı/Siyah c	Output 6		
15 D	Pembe/Siyah c	Output 5		
16 D	Turuncu/Siyah d	Output 4		
17 D	Gri/Siyah d	Output 3		
18 D	Beyaz/Siyah d	Output 2		
19 D	Sarı/Siyah d	Output 1		
20 D	Pembe/Siyah d	Output 0		

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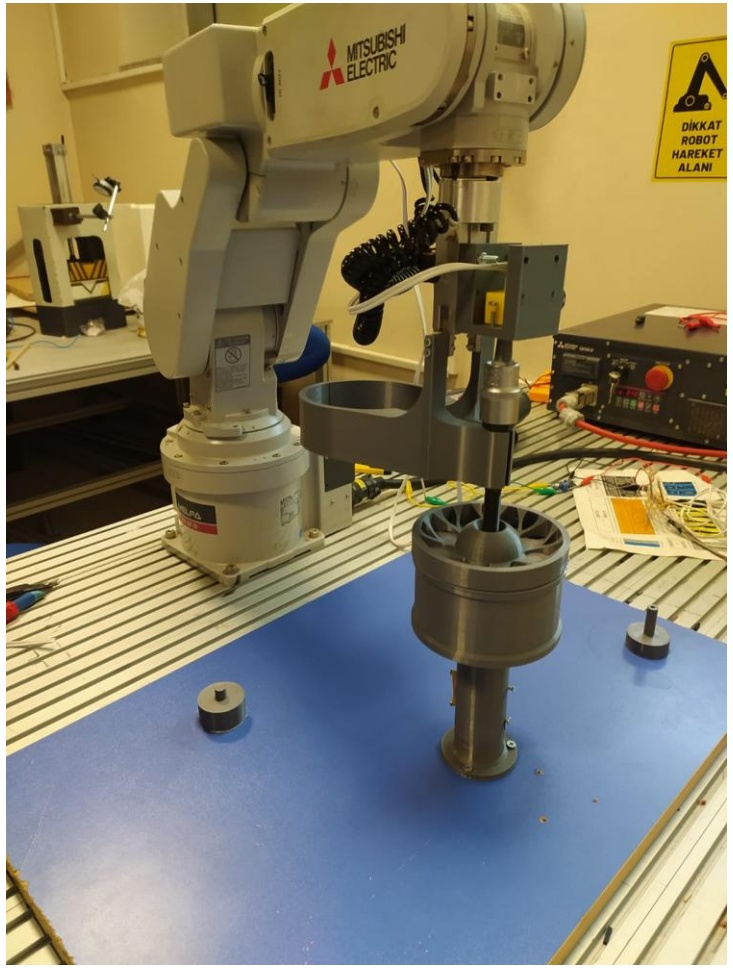
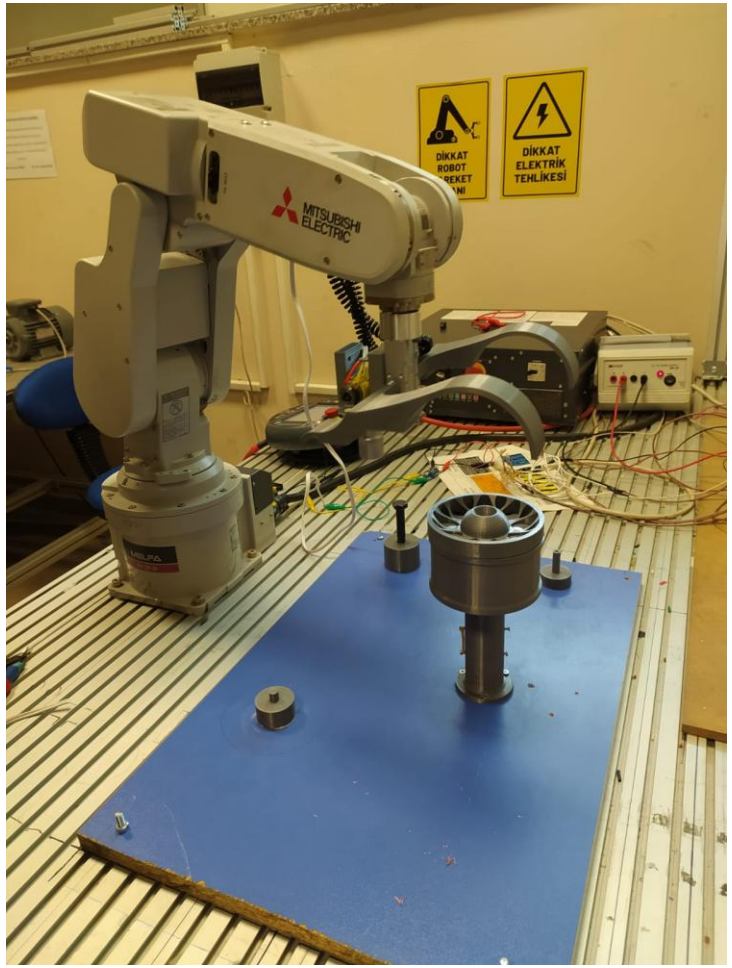
PROJECT PHOTOGRAPH





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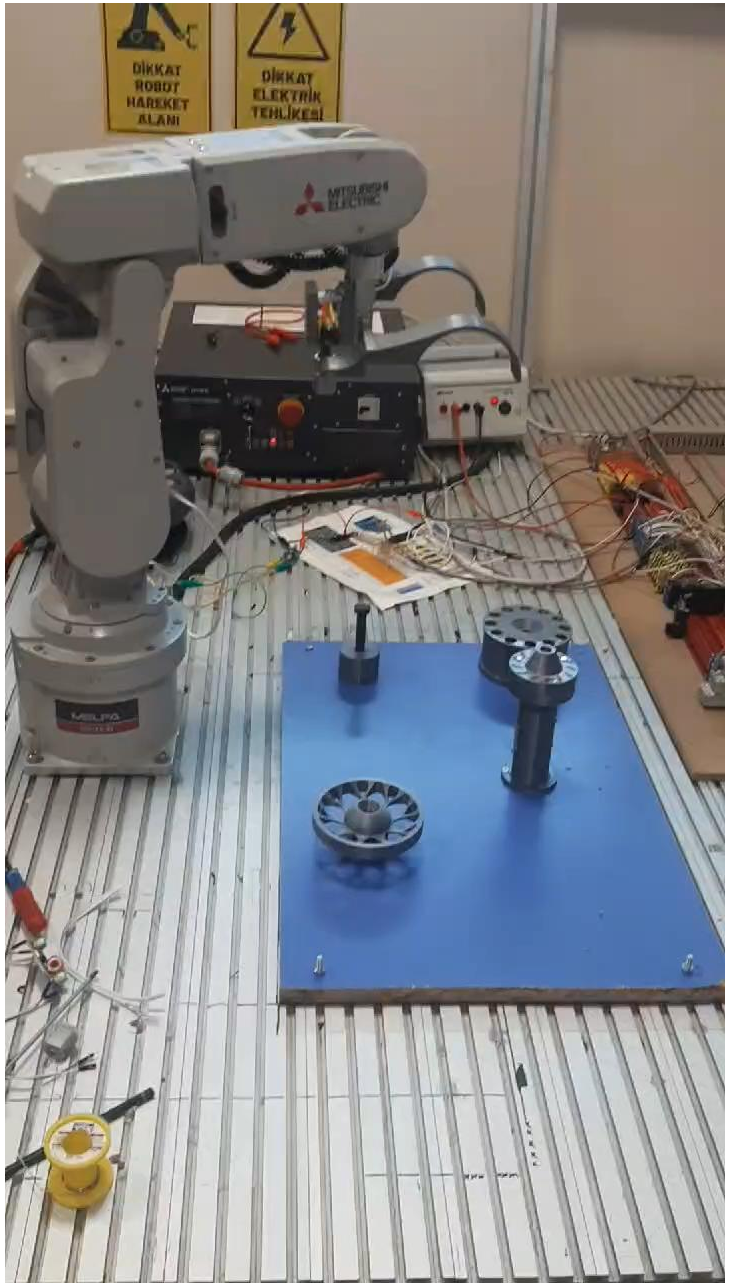
PROJECT VIDEO



RESULT AND COMMENTS

- In this project, the transportation and assembly of rim parts were successfully carried out using the Mitsubishi RV-2F-D manipulator. The gripper and rim parts designed in the SolidWorks program were precisely carried by the robot arm and made suitable for assembly.

- The programming phase was done with Mitsubishi's RT Toolbox3 software, and the robot arm was operated accurately and precisely. In this way, a system with high functionality and repeatability of the robot arm was created.

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REFERENCES

- [1] https://formant.io/resources/glossary/robotics/
- [2] https://etwinningonline.eba.gov.tr/lesson/robotlarin-kullanim-alanlari/