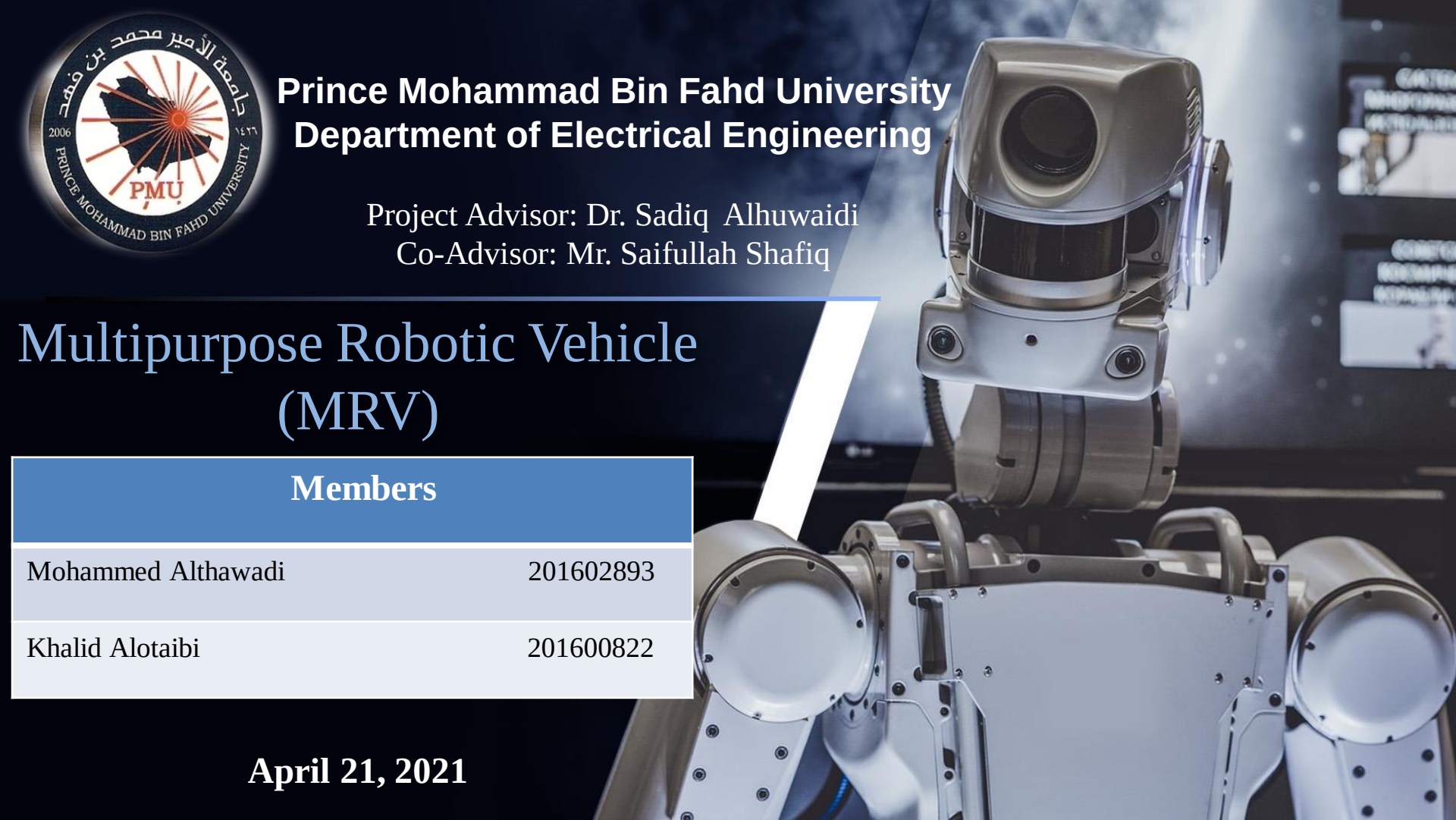


Prince Mohammad Bin Fahd University
Department of Electrical Engineering

Project Advisor: Dr. Sadiq Alhuwaidi
Co-Advisor: Mr. Saifullah Shafiq

Multipurpose Robotic Vehicle (MRV)

Members	
Mohammed Althawadi	201602893
Khalid Alotaibi	201600822

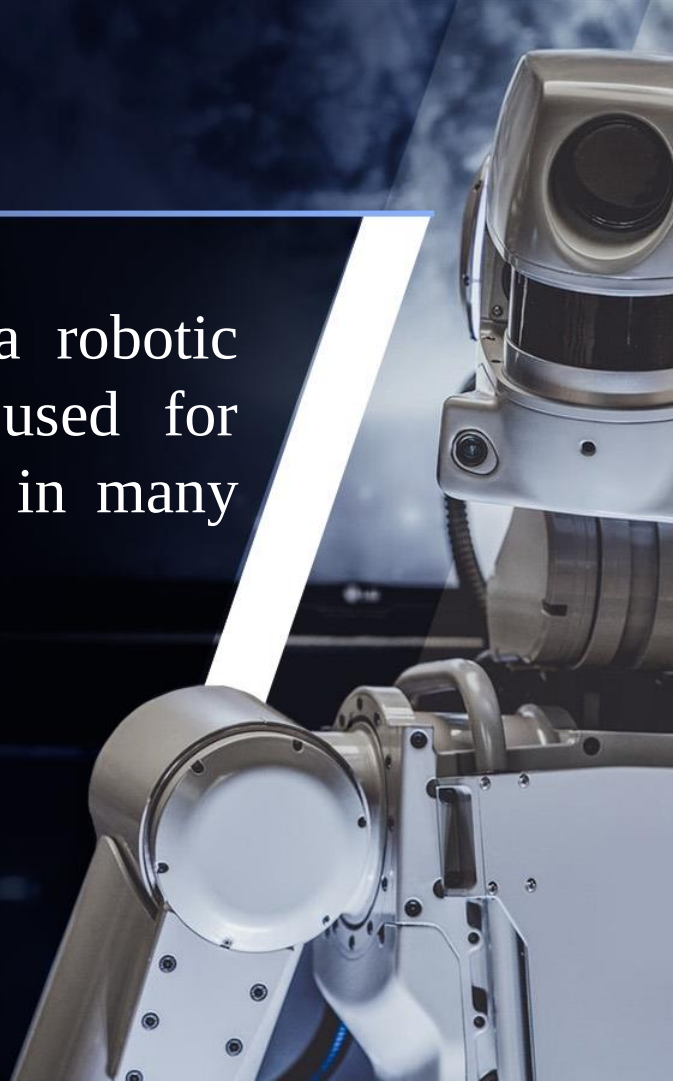
April 21, 2021

Outline

- **Project definition**
- **Project Objectives**
- **Project Specifications**
- **Design Constraints & Standards**
- **Project Architecture**
- **Background**
- **Design Subsystem 1**
- **Design Subsystem 2**
- **Design Subsystem 3**
- **Design Subsystem 4**
- **Design Subsystem 5**
- **Project Management & Team Work**
- **Impact of Project**
- **New Skills Acquired and Applied**
- **Budget estimate**
- **Video**
- **References**

Project Definition

Multipurpose Robotic Vehicle (MRV) is a robotic vehicle designed with an ability to be used for multiple proposes to extend its usefulness in many fields.



Project Objectives

i. Design a compact and maneuverable chassis for the MRV

ii. Implement robotic arm for maximum efficiency and usefulness

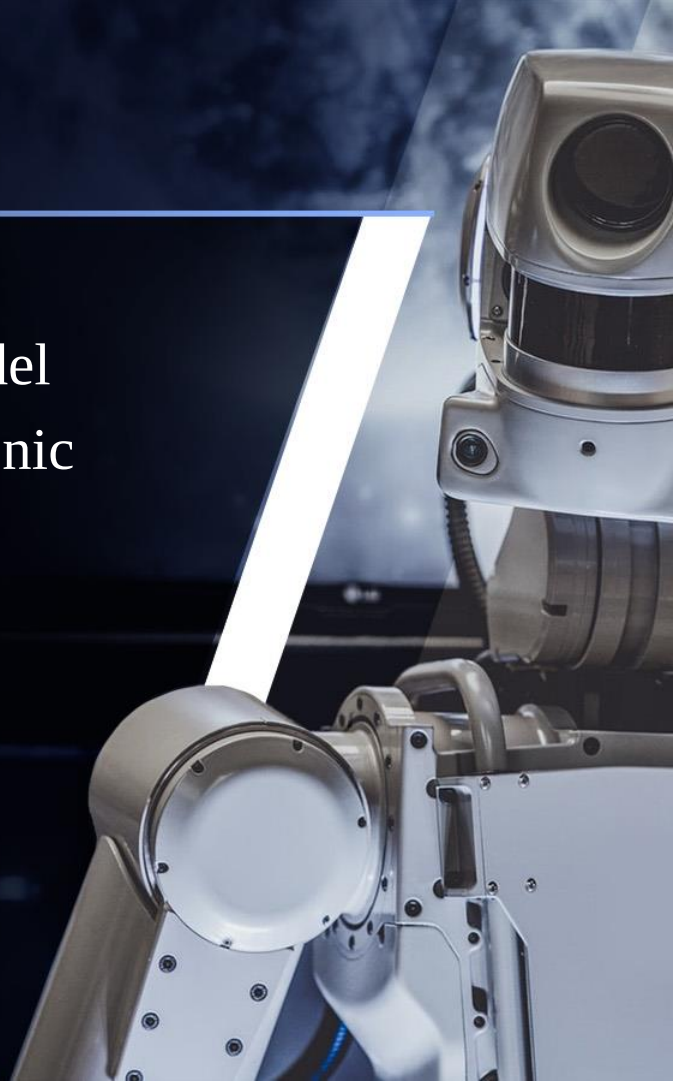
iii. Program automatic and wireless manual control mode

iv. Implement battery charging with a solar panel

v. Execute video streaming subsystem

Project Specifications

1. Controlled wirelessly by a communication model
2. Automatic mode for free roaming using ultrasonic sensors
3. Obstacle avoidance
4. Robotic arm for picking objects
5. Live video streaming using Pi camera
6. Battery charging using a solar panel



DESIGN CONSTRAINTS & STANDARDS

Sustainability

- Solar Energy to recharge the battery
- Manufacturing lifetime was considered by choosing the most generic parts possible with multiple providers to ensure a long manufacturing lifetime

Manufacturability

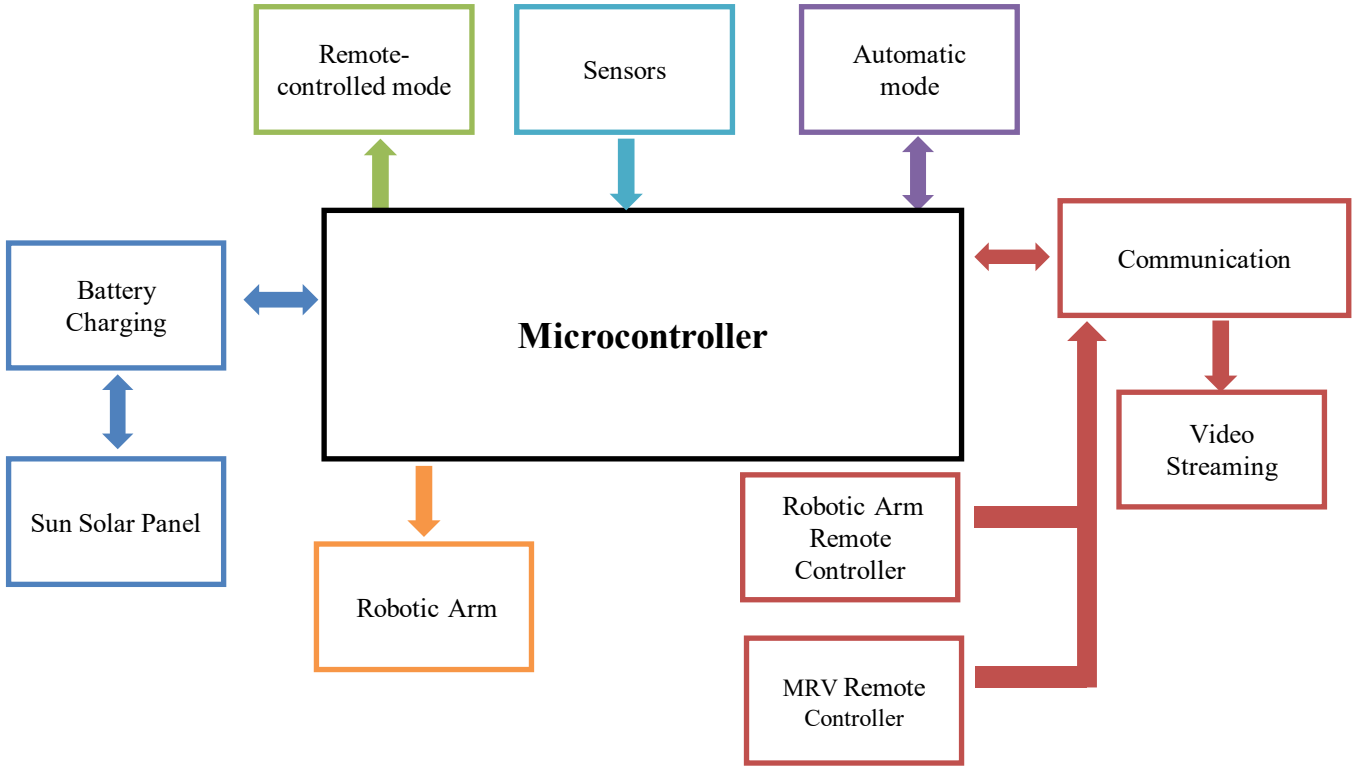
- The ability of a system to be produced with as few resources possible

Safety

- Safety of wireless communications
- The current delivered to the DC motors should not exceed 5 Amp

•A block diagram for the MRV is shown in Fig. 1.

Project Architecture

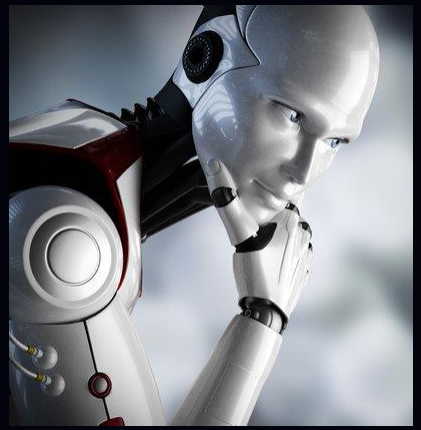


Background: Problem

- General vehicle-type robots are limited to a single functionality
- Multipurpose robots are adoptive and suitable for mass manufacturing

Background: Solutions

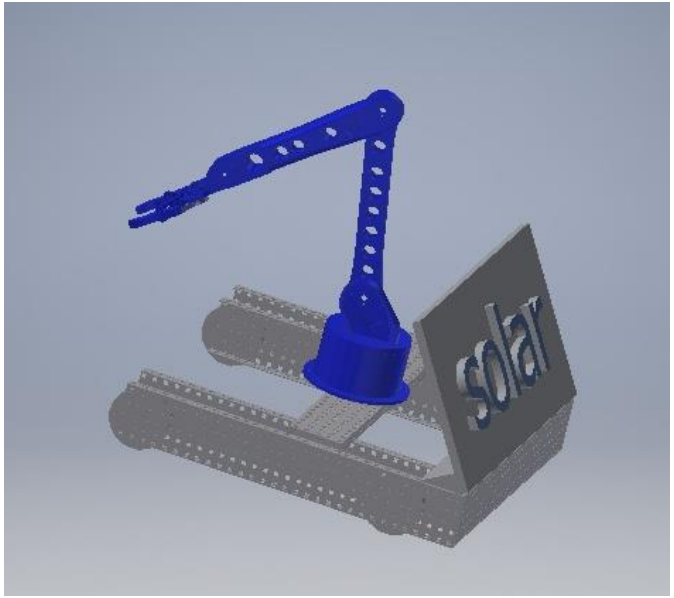
Customizable, adoptive and fluid functionality to tackle different engineering tasks in areas of safety, rescue, transportation, and others.

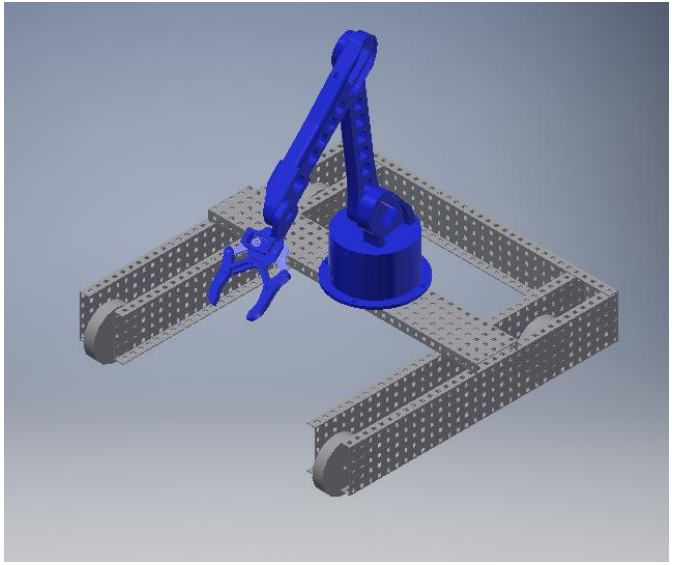


Design Subsystem 1

Chassis

Design Subsystem 1: Chassis

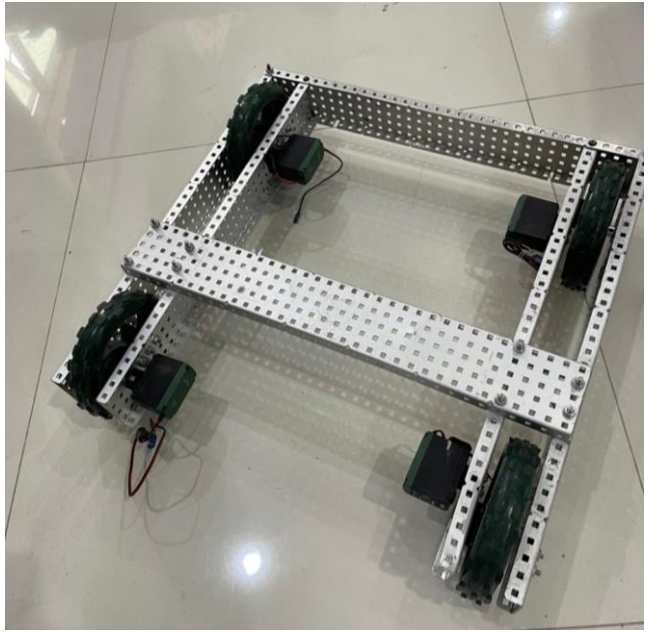


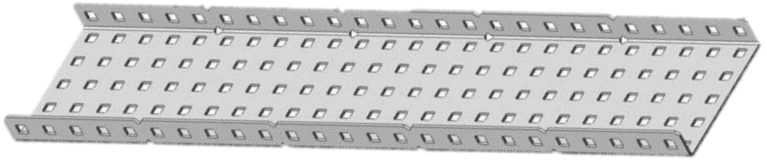


Chassis Design using Autodesk Inventor

AUTODESK® INVENTOR®

Design Subsystem 1 : Chassis

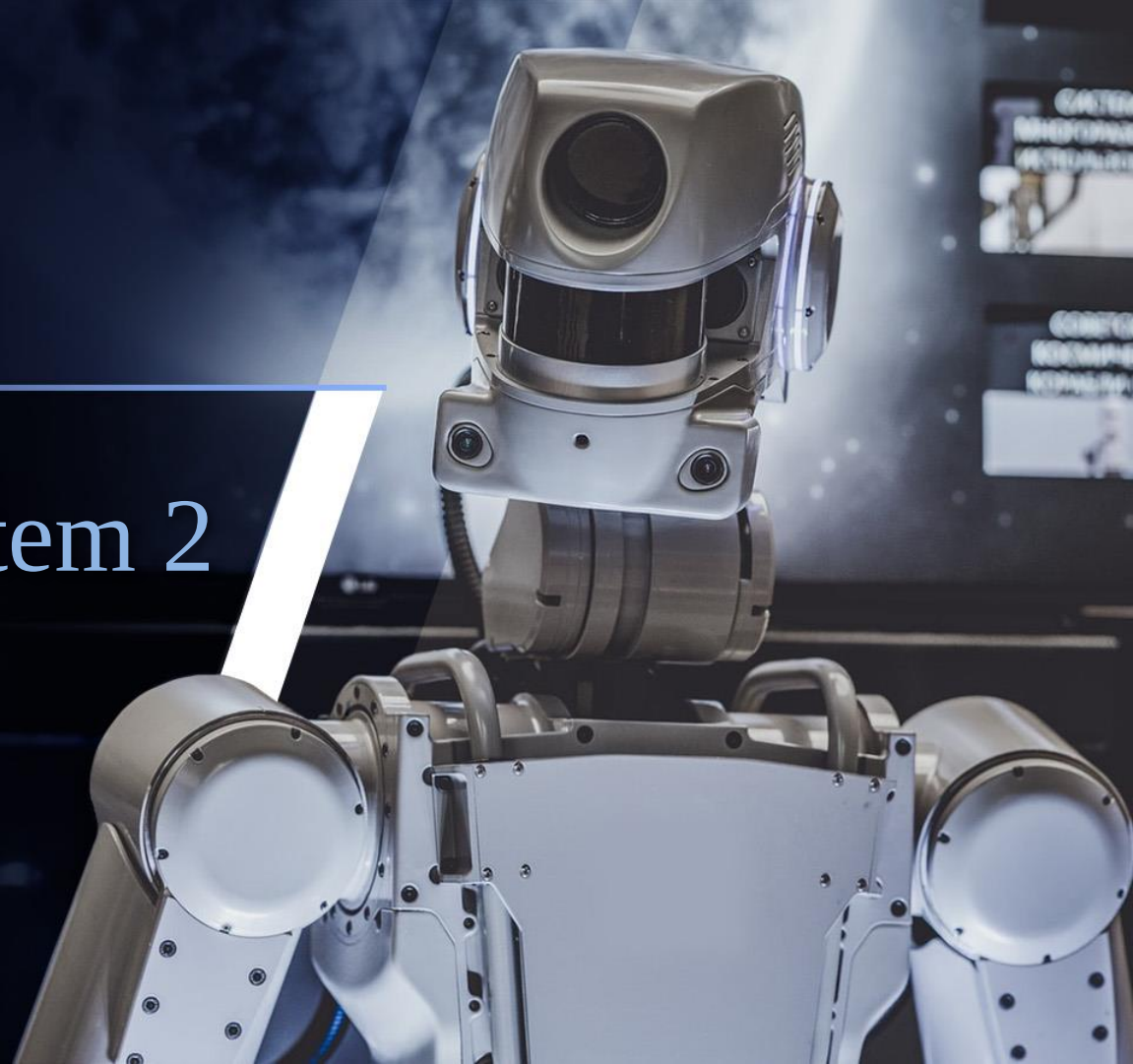




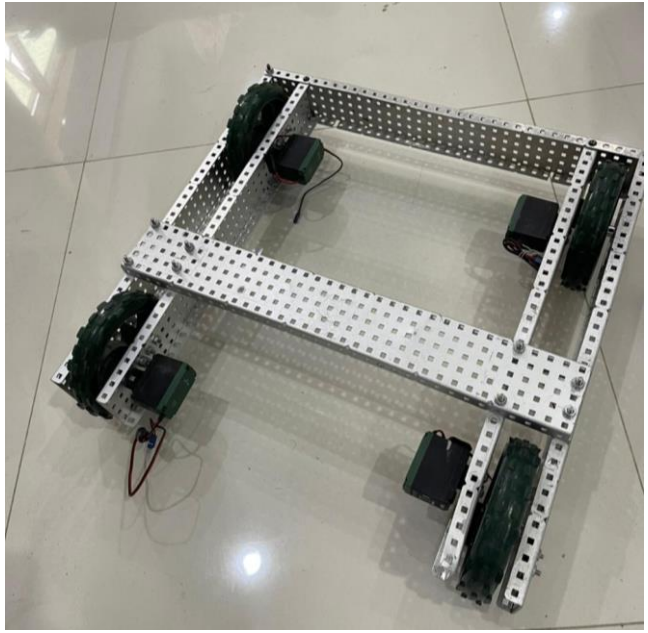
C channel 40X5X1 Aluminum

Design Subsystem 2

Motors



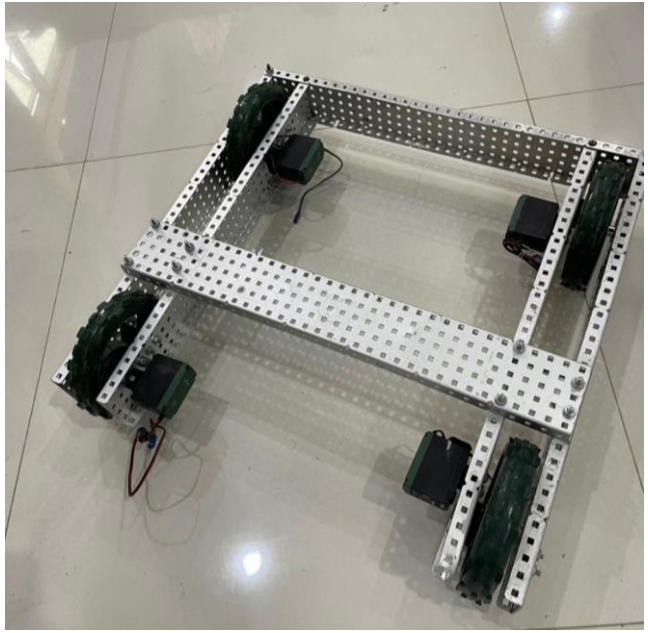
Design Subsystem 2: Motor



Description	As Shipped	High Speed Option	Turbo Option (not included)
Stall Torque	1.67 N-m [14.76 in-lb]	1.04 N-m [9.2 in-lb]	0.70 N-m [6.2 in-lb]
Free Speed	100 RPM	160 RPM	240 RPM
Stall Current	4.8 Amps		
Free Current	0.37 Amps		

2 wires motor 393

Design Subsystem 2: Motors

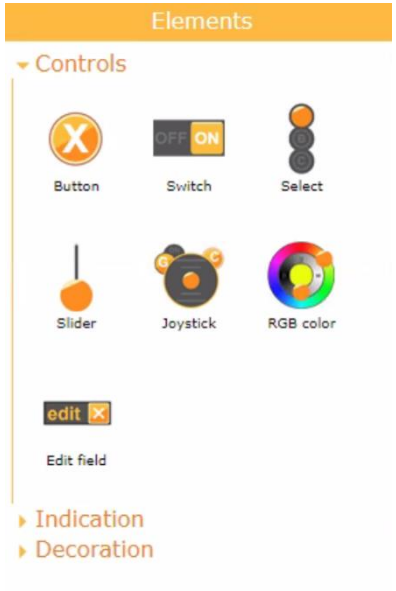


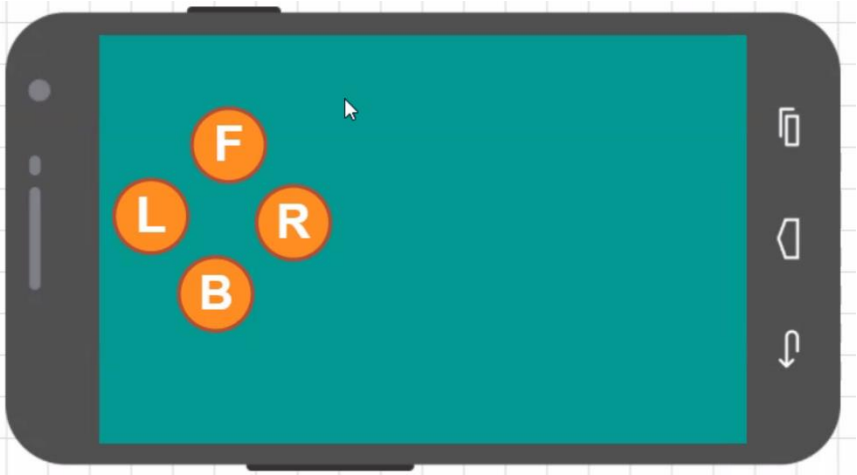
5" Diameter Wheels (276-1498)

(4) 5" Diameter Wheels

(160 grams)

Design Subsystem 2: Controller

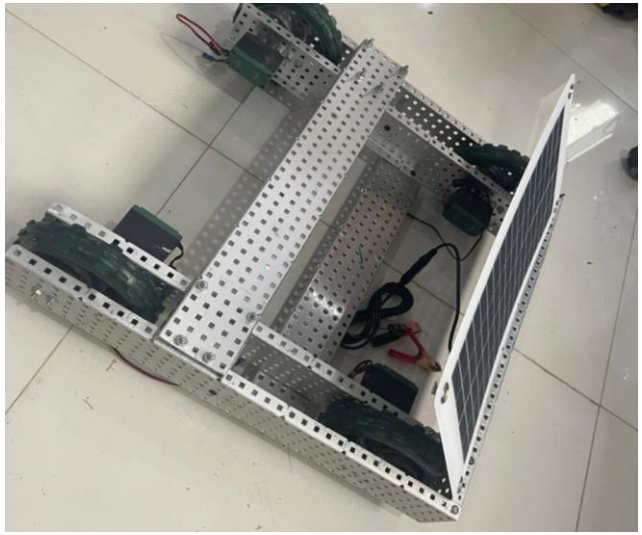


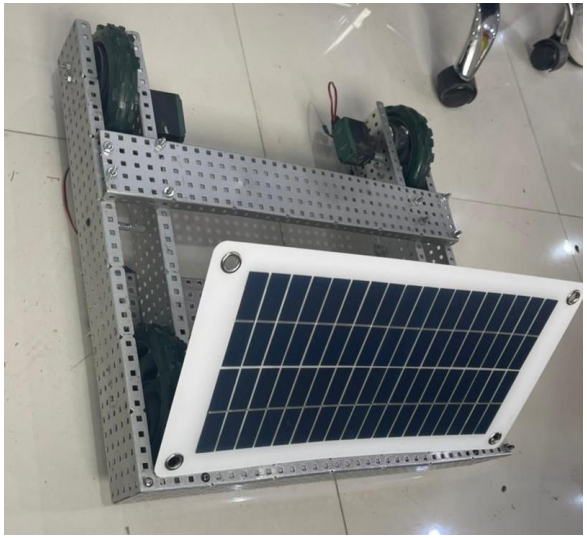


Design Subsystem 3

The Solar Panel

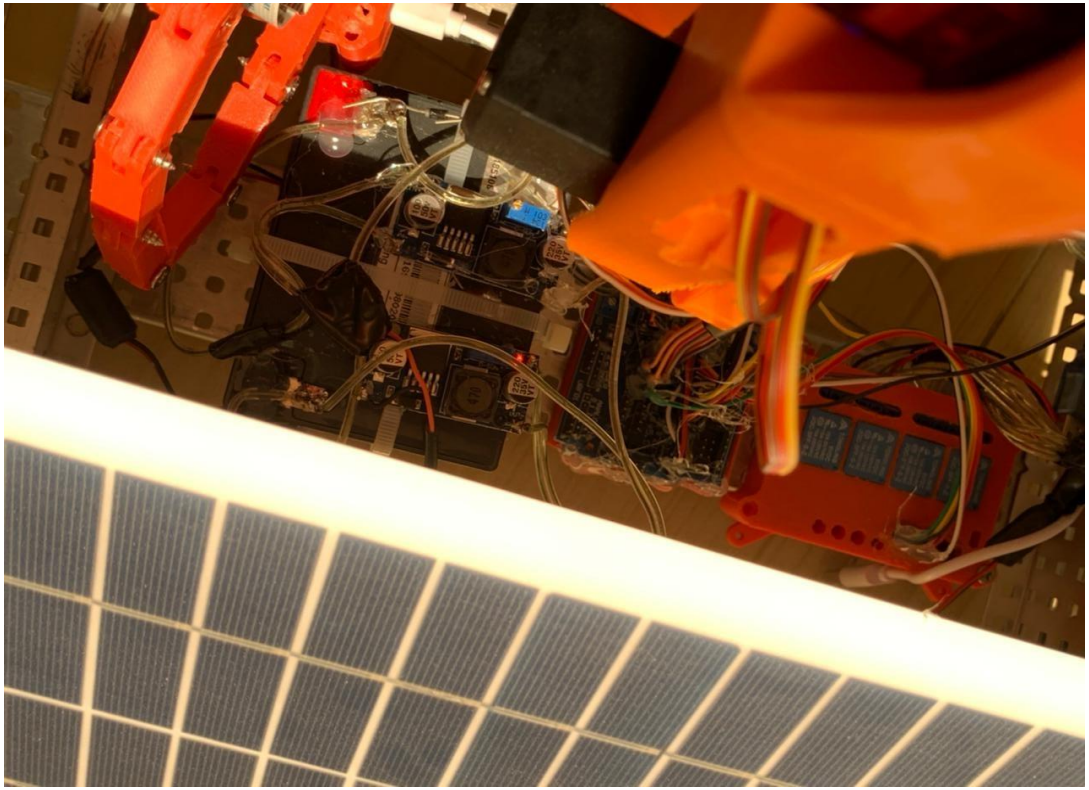
Design Subsystem 3: Solar panel





20 W 38 × 22 cm

Solar panel Subsystem



Battery Charging

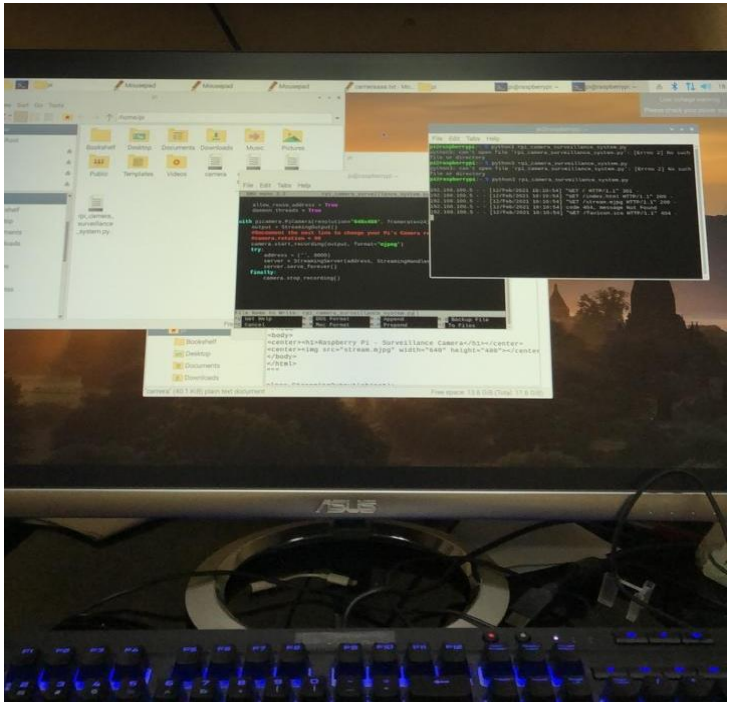
12V – 5Ah

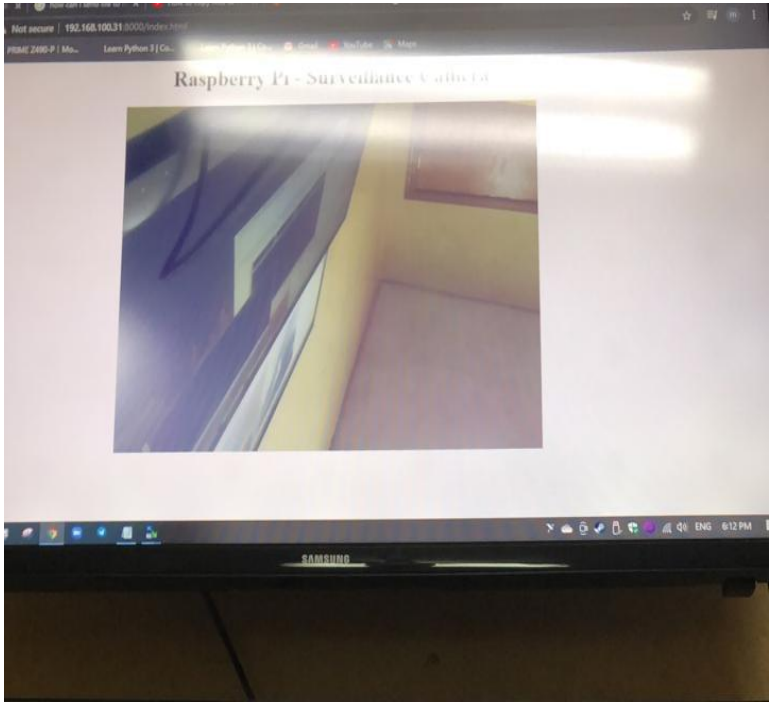
5.51 x 3.52 x 1.32 cm; 150 Grams

Design Subsystem 4

Live Video Streaming

Design Subsystem 4: Live Video Streaming

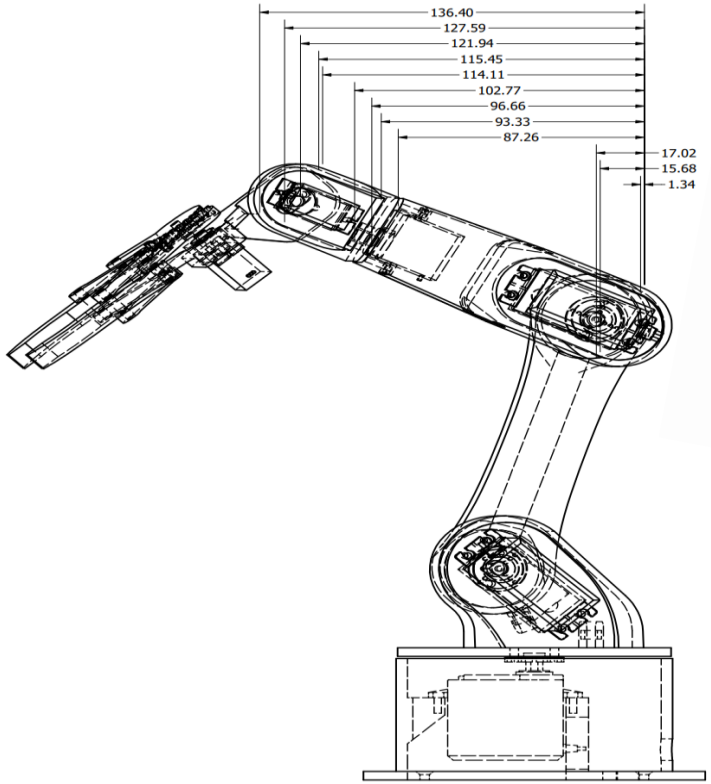


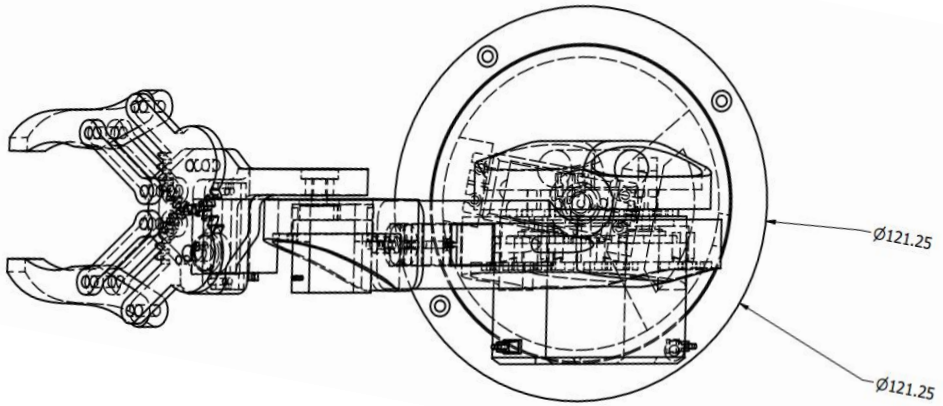


Design Subsystem 5

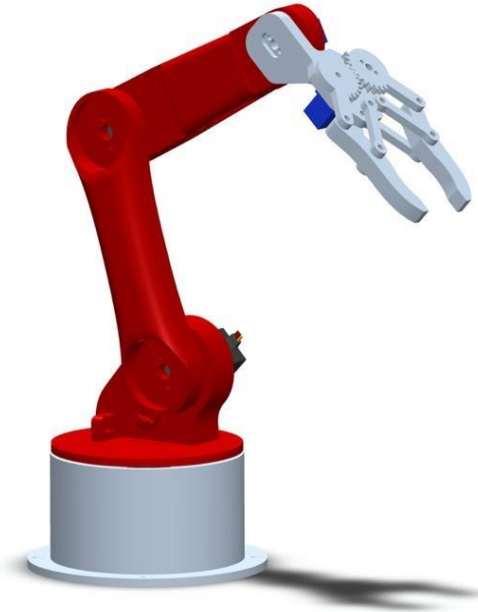
Robotic Arm

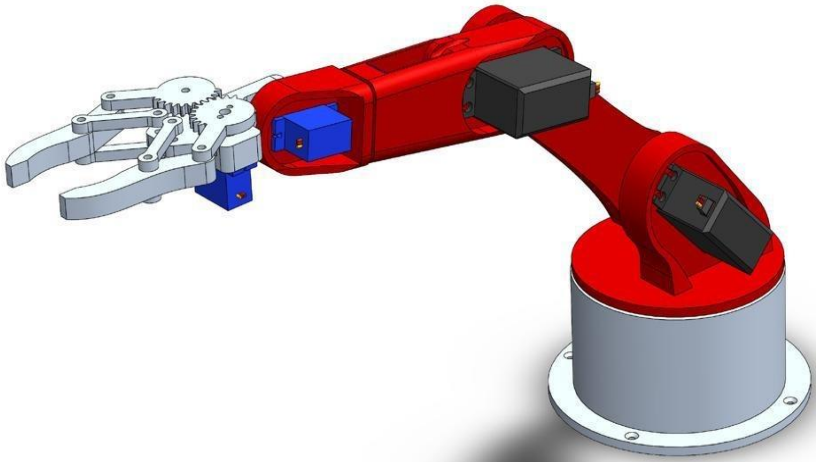
Design Subsystem 5: Robotic Arm



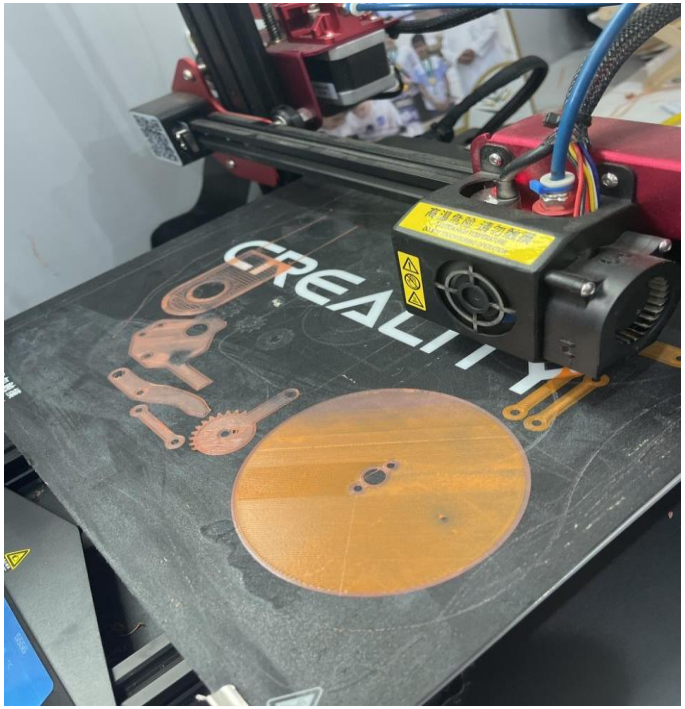


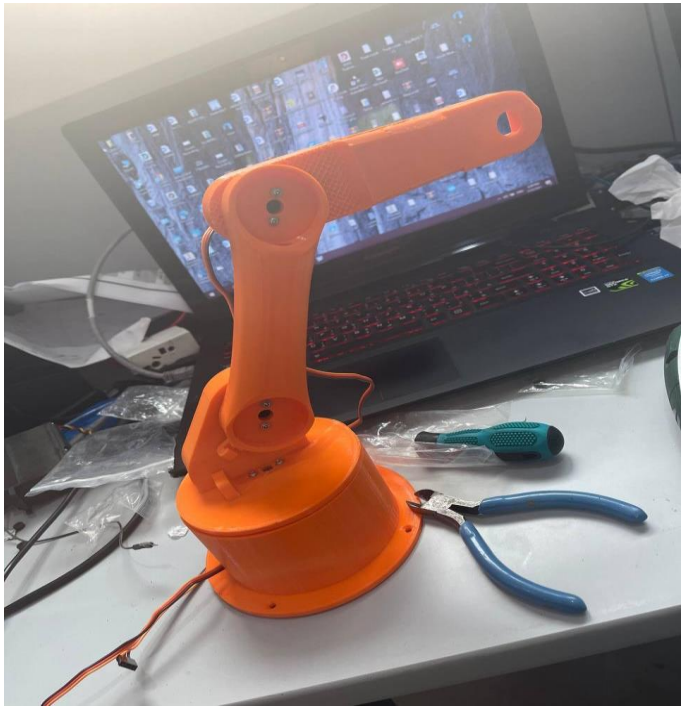
Design Subsystem 5: Robotic Arm





Design Subsystem 5: Robotic Arm



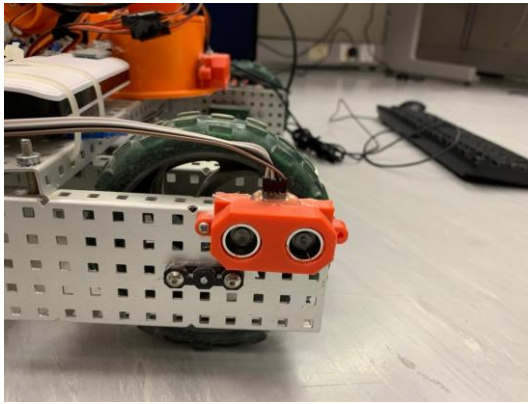


3D printed Robotic Arm

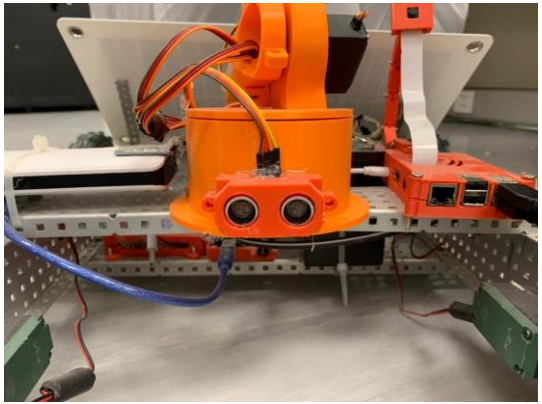
Design Subsystem 6

Automatic mode

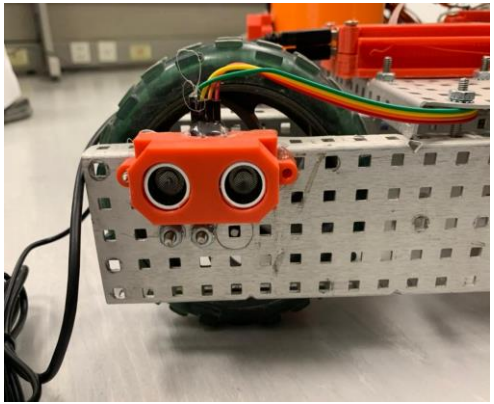
Design Subsystem 6: Automatic mode



Left side

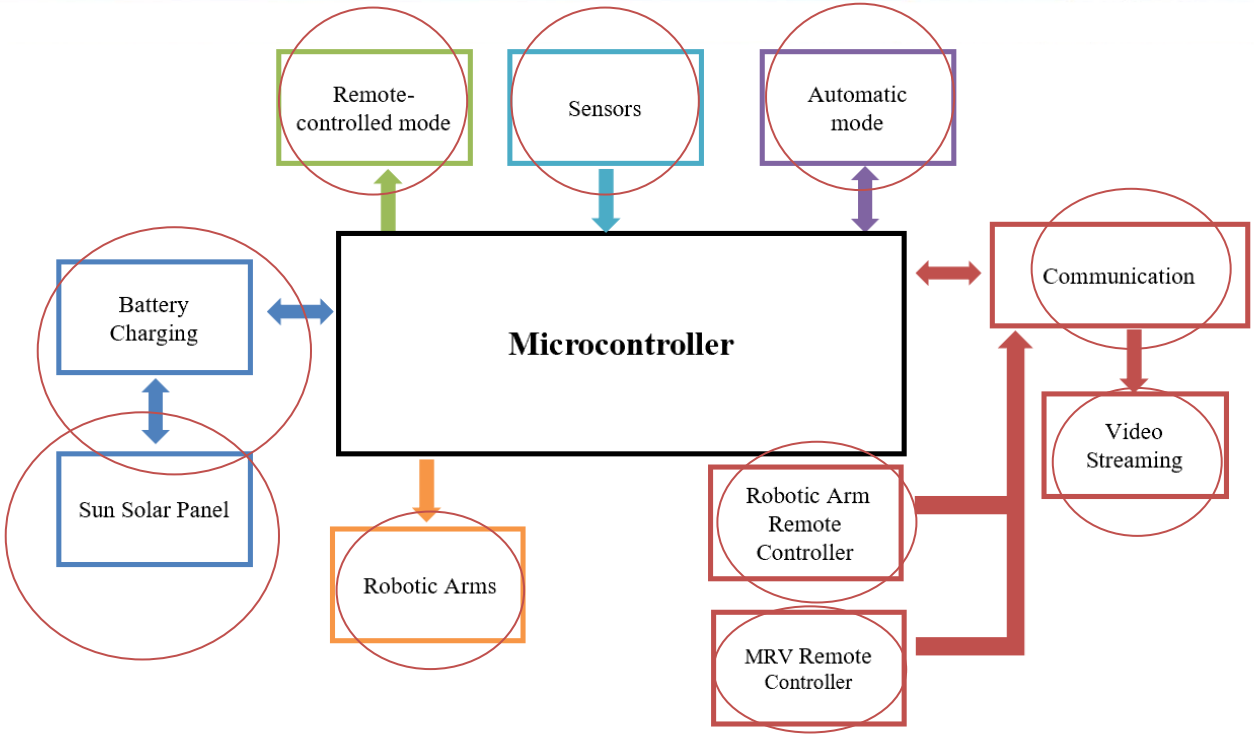


Front side

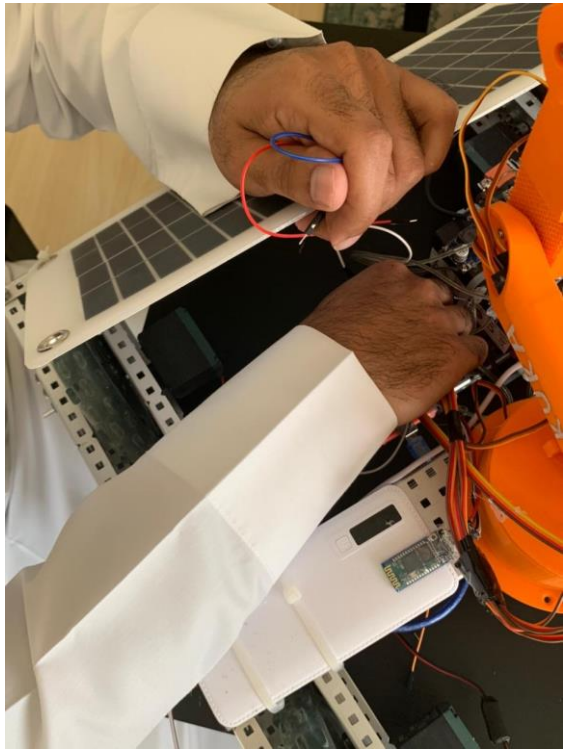


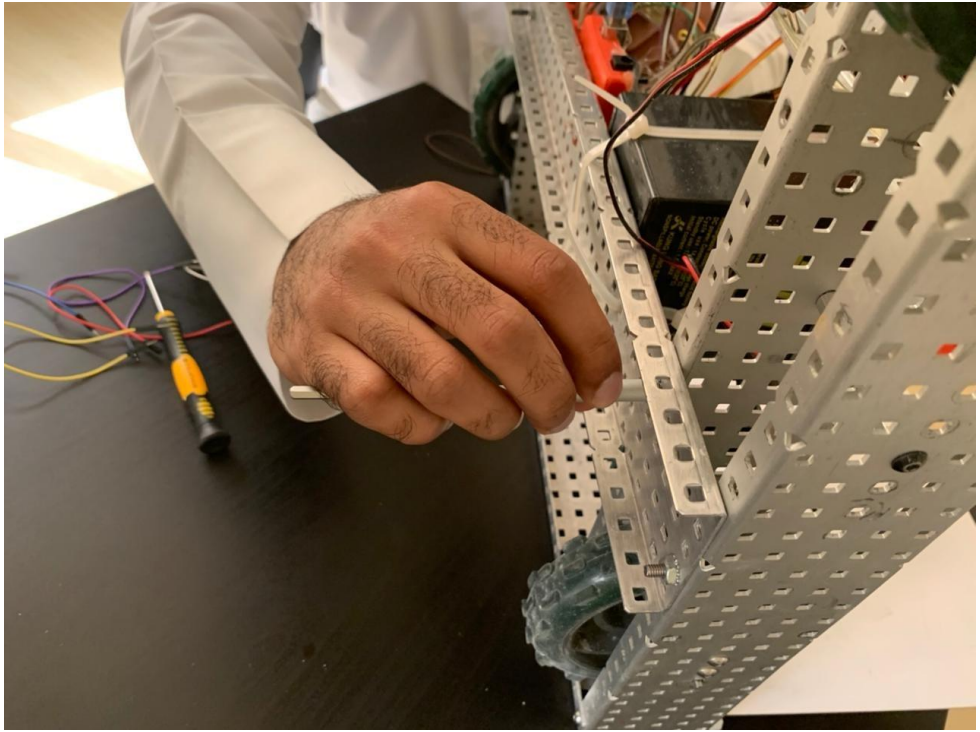
Right side

Completed Work

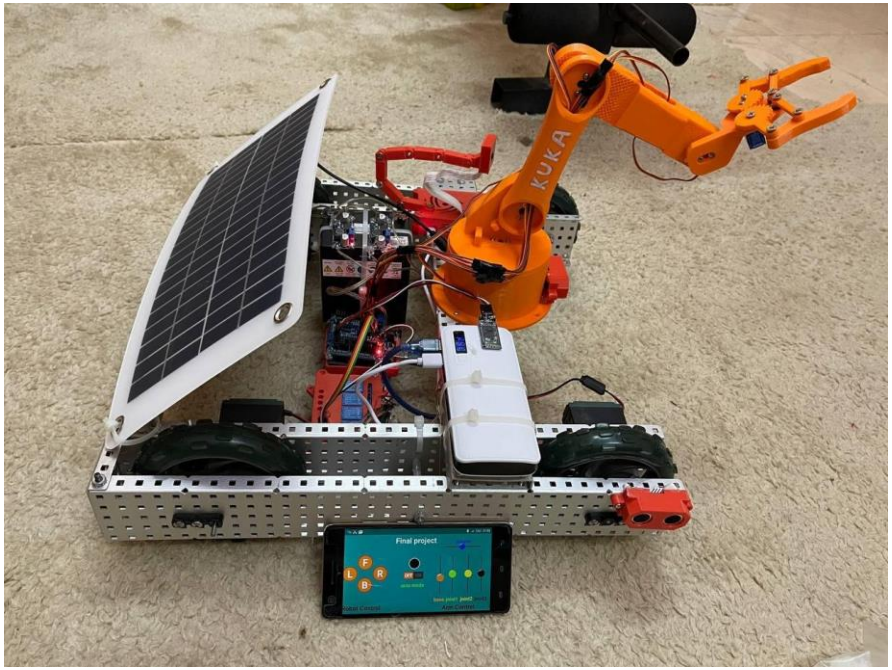


Project Management & Team Work



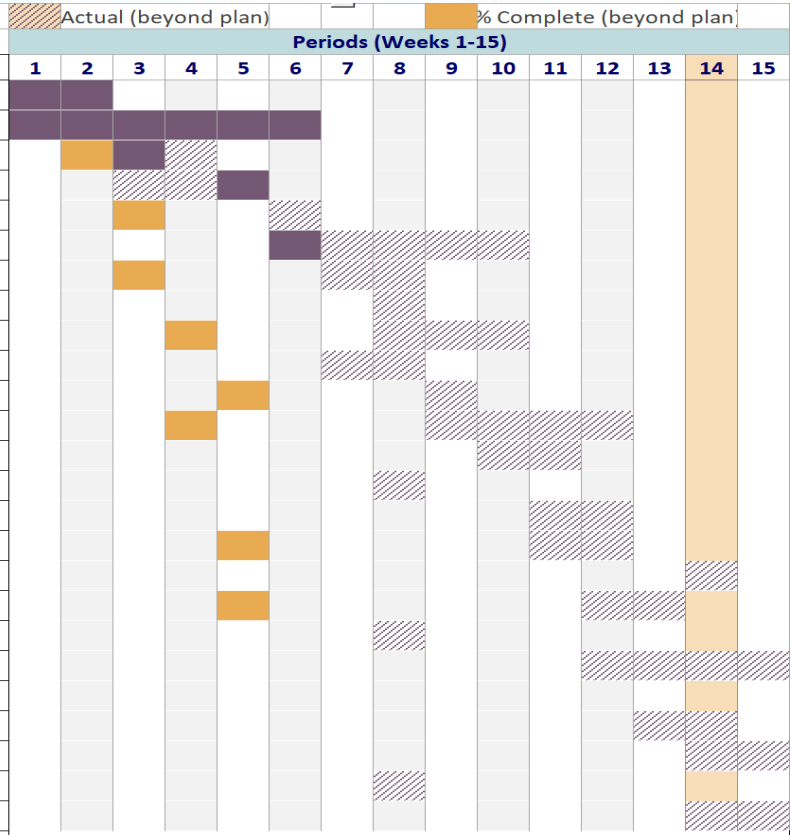


Project Management & Team Work



Project Management & Team Work

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Changing the advisor	1	2	ALL	1	2	100%
Ordering components	1	6	MA	1	6	100%
Fixing Chassis	3	2	MA	2	2	100%
Finalize Robotic Arms and Motor subsystems	3	3	ALL	5	1	100%
Progress Report 1	6	1	ALL	3	1	100%
Prepare Midterm Presentation	6	5	ALL	6	1	100%
Finalize Chassis Design	7	2	MA	3	1	100%
Progress Report 2	8	1	ALL	0	0	100%
Implement Motor subsystem	8	3	MA	4	1	100%
Finalize Sun Solar Panel	7	2	ALL	0	0	100%
Test Chassis' Validity	9	1	ALL	5	1	100%
Implement Robotic Arms	9	4	ALL	4	1	100%
Progress Report 3	10	2	ALL	0	0	100%
Implement Sun Solar Panel	8	1	KA	0	0	100%
Test Motor subsystem	11	2	MA	0	0	100%
Implement Automatic mode	11	2	MA	5	1	100%
Progress Report 4	14	1	ALL	0	0	100%
Test Robotic Arms	12	2	ALL	5	1	100%
Video live streaming	8	1	MA	0	0	100%
Prepare Project Demo	12	4	ALL	0	0	100%
Progress Report 5	0	1	ALL	0	0	100%
Draft Report	13	2	ALL	0	0	80%
Prepapre final presentation	14	2	ALL	0	0	100%
Finalize Video live streaming	8	1	MA	0	0	100%
Submit Rpt/PPT	14	2	ALL	0	0	50%



Project Management & Team Work

#	Risk Description	Risk Management	Impact
1	Disagreements between members	Members met several time	Problem resolved
2	Using Python/Lennix	Members keep exploring the Python and Lennix	Members were carful while using Python and Lennix

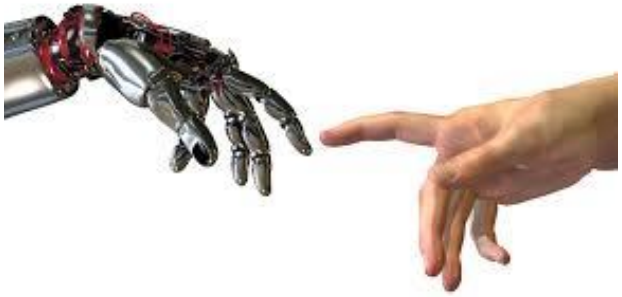
Impact of project

Economy:

- Job Creation
- Productive Growth
- Human replacement

Society:

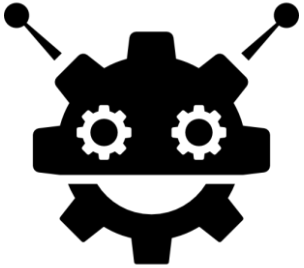
- Socially Acceptable
- Assist Devices
- Doing Dangerous Jobs



New Skills Acquired and Applied

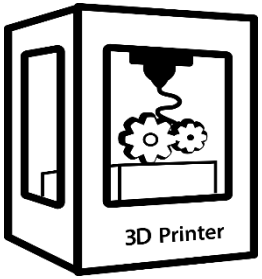
Programming

Teamwork

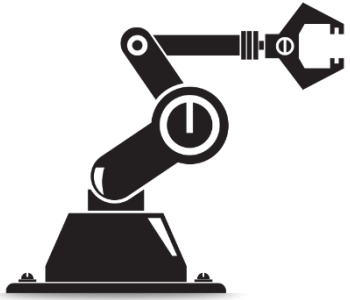


Robotics

Mechanical work



3D Printing

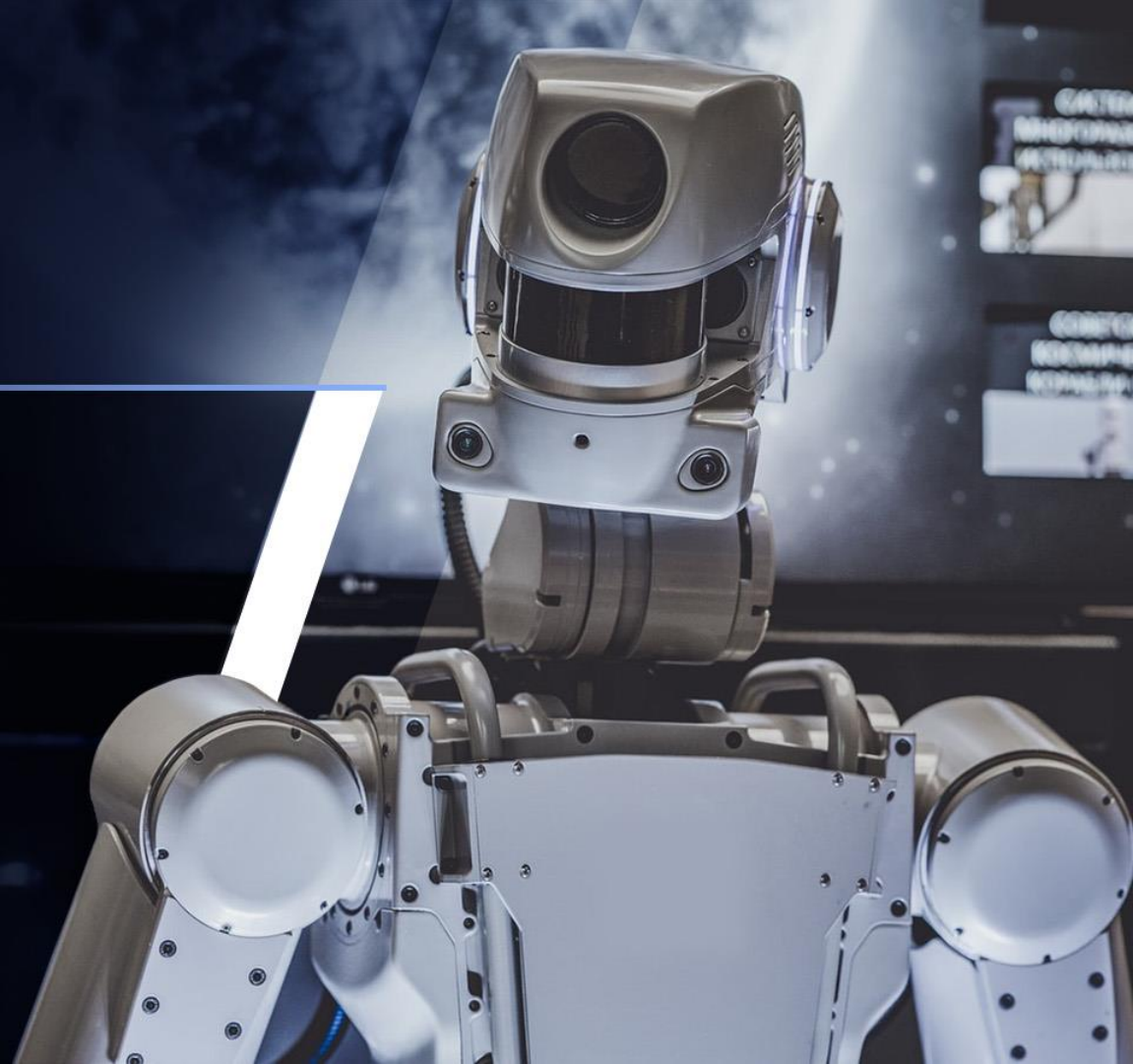


Robotic arms

Budget Estimation

No.	Description	Quantity	Unit Cost (SR)	Total Cost (SR)
1	Arduino uno	1	133	133
2	Relay Module 4-Channels	2	46	92
3	LM2596 DC to DC step down regulator module	2	18	36
4	12 volt 5A battery	1	68	68
5	Raspberry Pi 3 model B+ Plus	1	477	477
6	Raspberry Pi Camera Module	1	114	114
7	MG995 Servo motor	4	64	256
8	3D Printed Robotic Arm	1	450	450
9	Ultrasonic sensor	3	29	87
10	Sensor Shield V5.0 Expansion Board for Arduino	1	44	44
11	2-Wire Motor 393	4	63	254
12	5" Diameter Wheels (276-1498)	4	75	300
13	Chassis (Custom-build)	1	1500	1500
			Totals	3811

Video



Video

https://youtu.be/nsZGNeBfPeE

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Thank you

Any Question ?