Prince Mohammad Bin Fahd University
Department of Electrical Engineering

Polar Farming Robot

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Outline

- Project Definition
- Project Objectives
- Project Specifications
- Project Constraints and Engineering Standards
- Project Architecture
- Planning
- Background & Previous Projects
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- Impact of Project
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- Budget Estimate
- References

Project Definition

- Design low power consumption farming robot has the capability to make the agriculture automated as much as possible.

Project Objectives

- **Speed** up the farming process and reduce human interference in it.
- **Reduce** the power consumption used for farming process.
- **Lower** the price of manufacturing and maintaining the robot.
- **Reduce** the cost and the manpower required for planting.

Project Specifications

1) **Make** polar farming robot to have full three sixty-degree movement.

2) **Irrigate**, **Seed, Monitor, Weeding** and soil moisture Automatically.

3) **Move** robot from one known location to another known location at average velocity of 0.3 m/s.

4) **Function** precisely and accurately in a circular area of range of 2 to 3 m^2

5) **Perform** desire function with tolerance less than 20 mm between software configuration and actual position.

6) **Tolerate** change in weather condition.

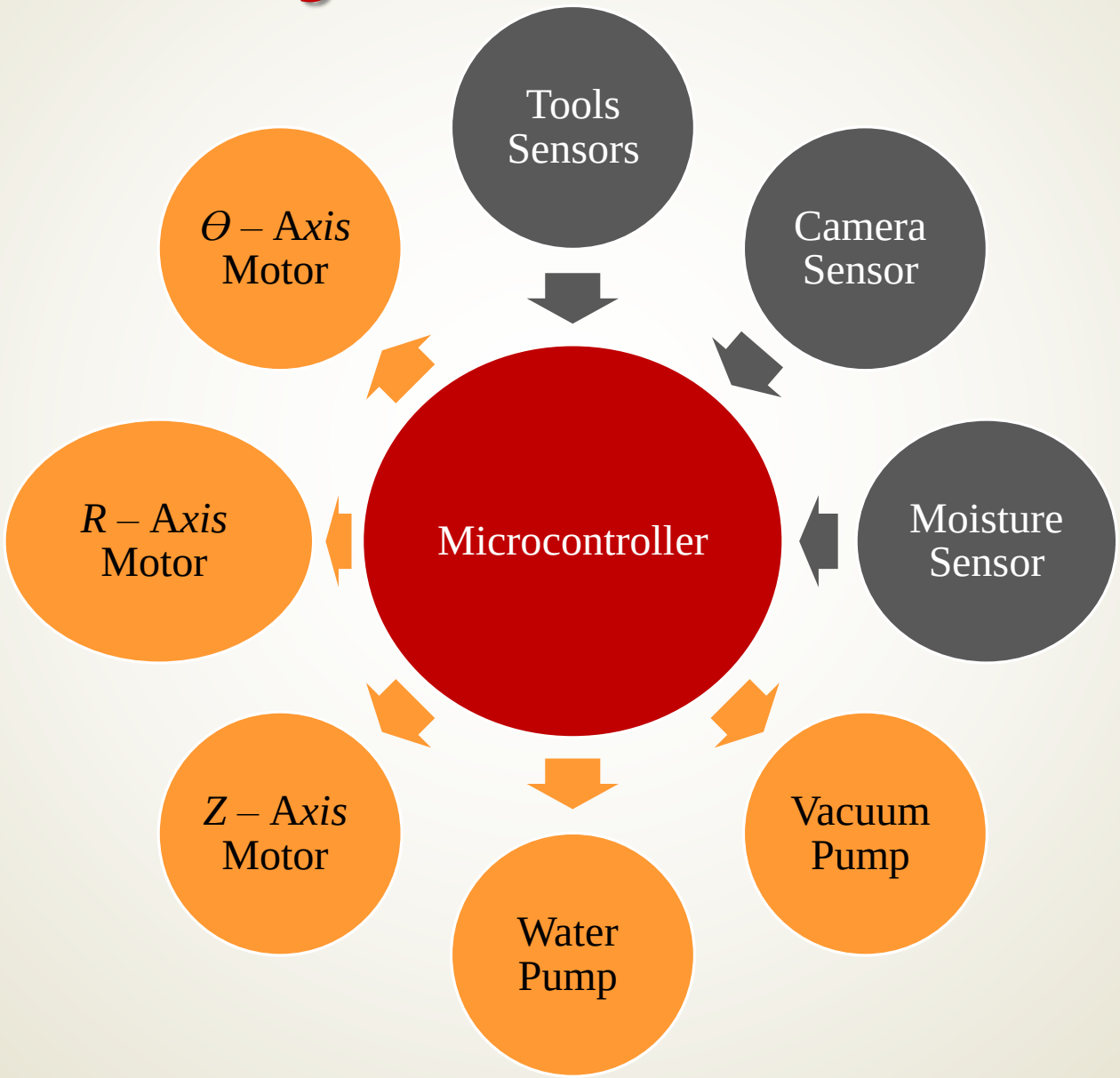
Design Constraints & Standards

Sustainable

Economy

Environmental

Project Architecture



Planning

- Did you verify project feasibility? √
- Did you verify that all components will be available locally or can be ordered within a reasonable time? √
- Did you verify that the required testing can be performed at PMU Labs (instruments and technical help availability)? √

Background: Problem

- Desertification.

- Lack of water resources.

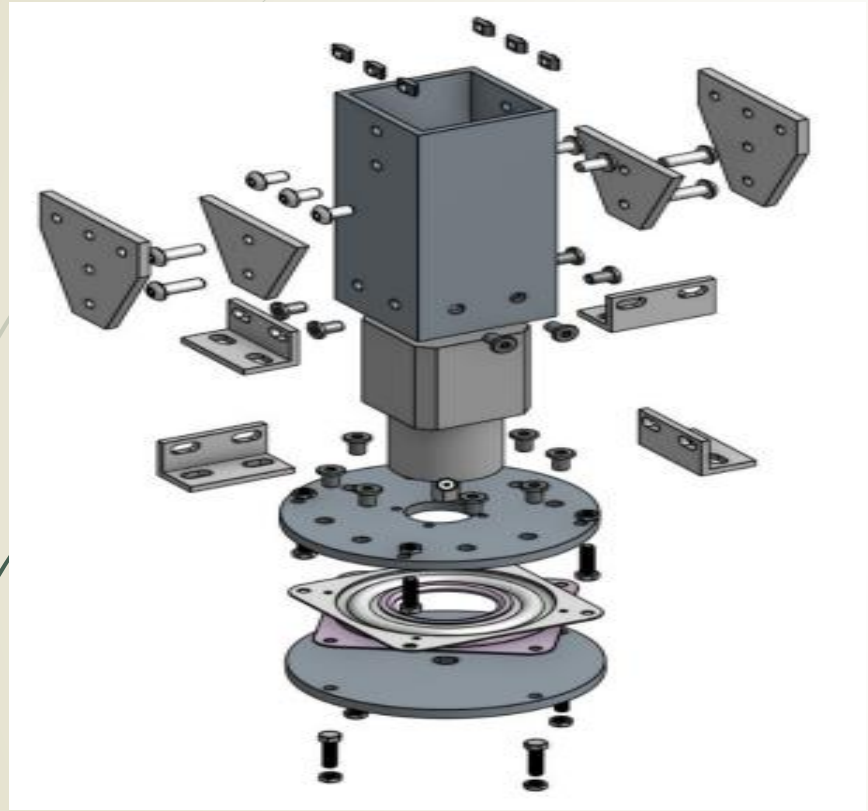
Background: Solutions

- Develop a new farming machine.

- Increase the use smart farming systems.

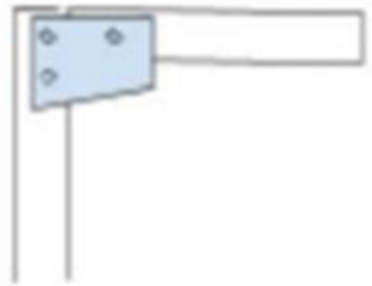
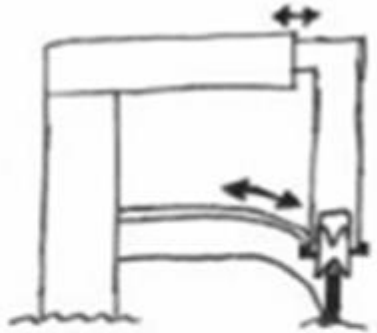
Polar Farming Robot Design

Design: Driven and base system.



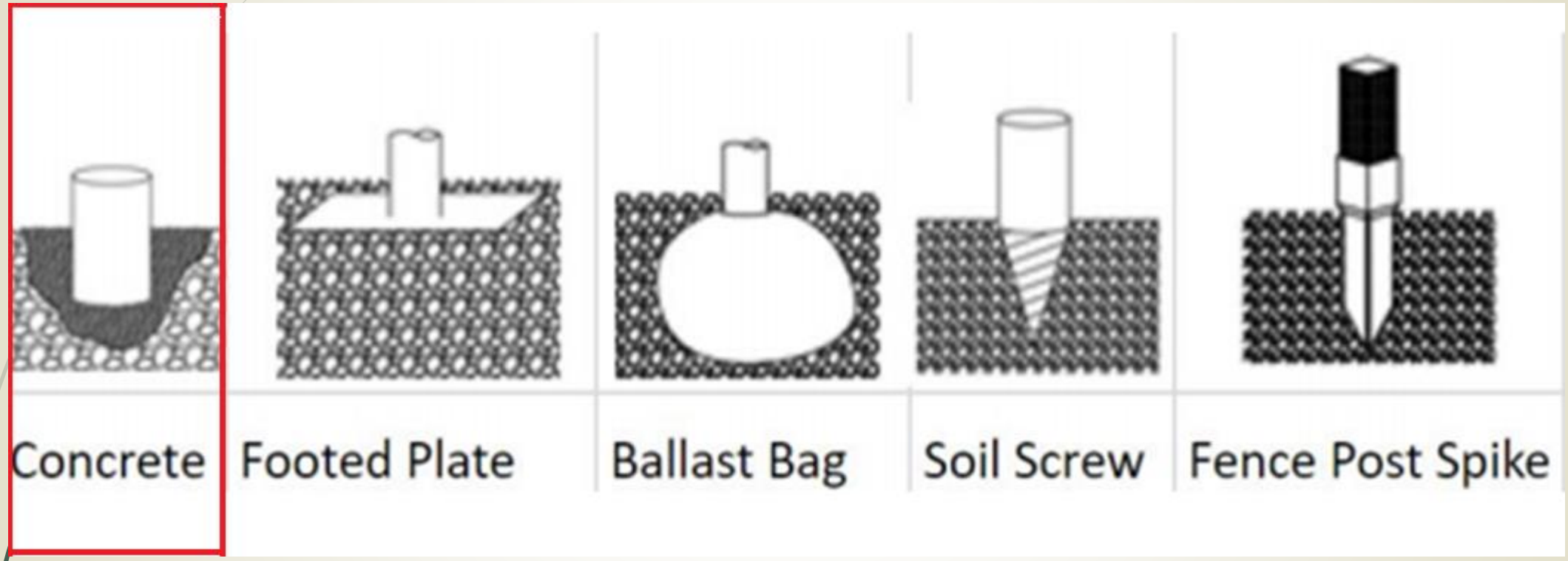
Driving system

Design: Structure Options

				
Simple Radial Arm with metal support bracket	Radial arm with wheel	Radial arm with groove and track	Radial arm with wheel and flexible track	Radial arm with cable support

Arm design options

Design: Structure Options

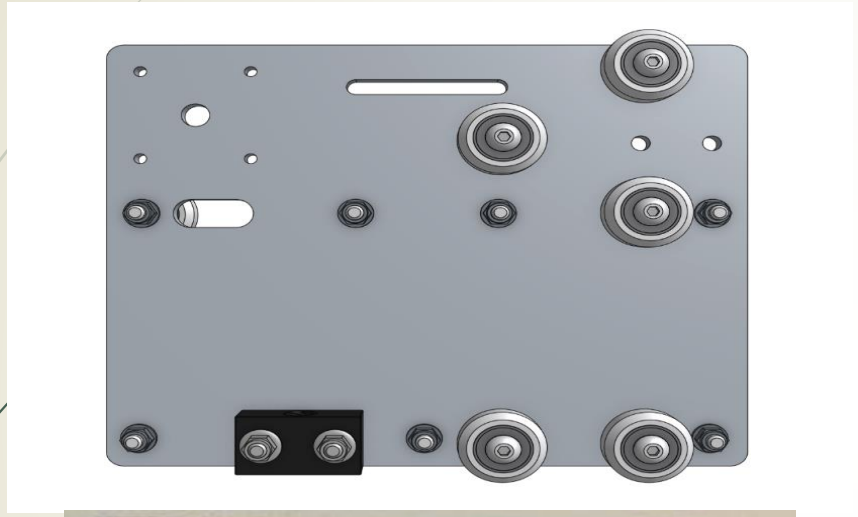


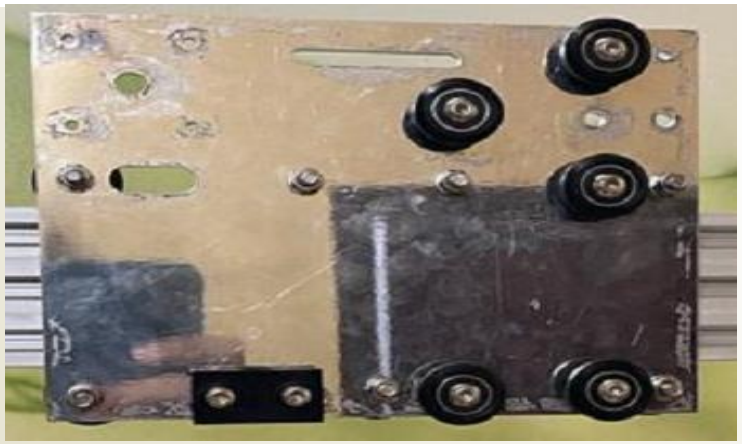
Base design options

Design: Motor Options

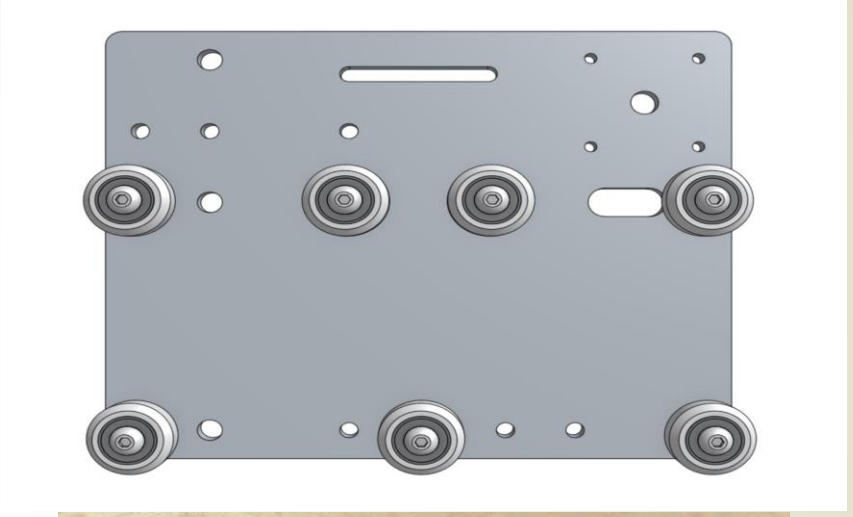
Stepper Motor	Servo Motor
Cheaper (cost??)	Expensive (Cost??)
Smaller	Larger
Used for high torque applications	Used for high speed applications

Design: Cross slide



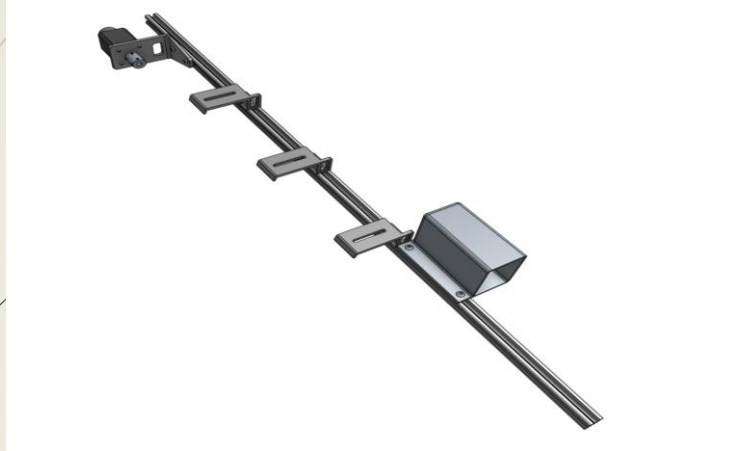


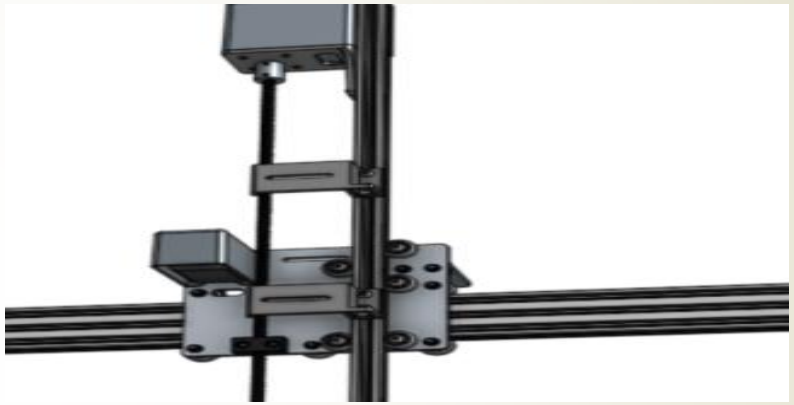
Back view of cross slide



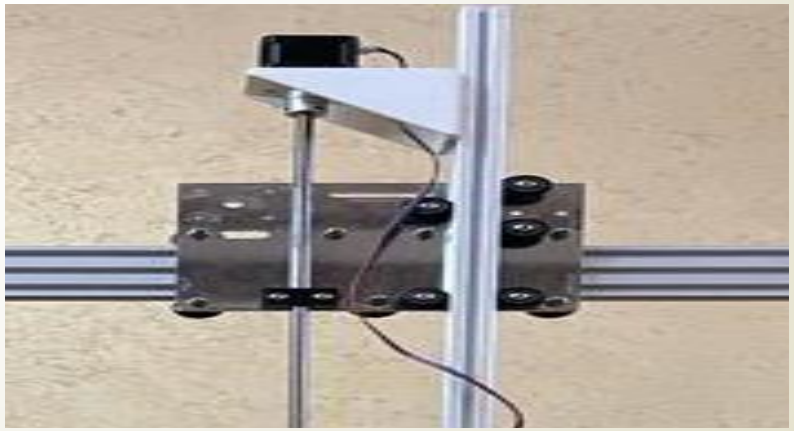
Front view of cross slide

Design: Z – Axis





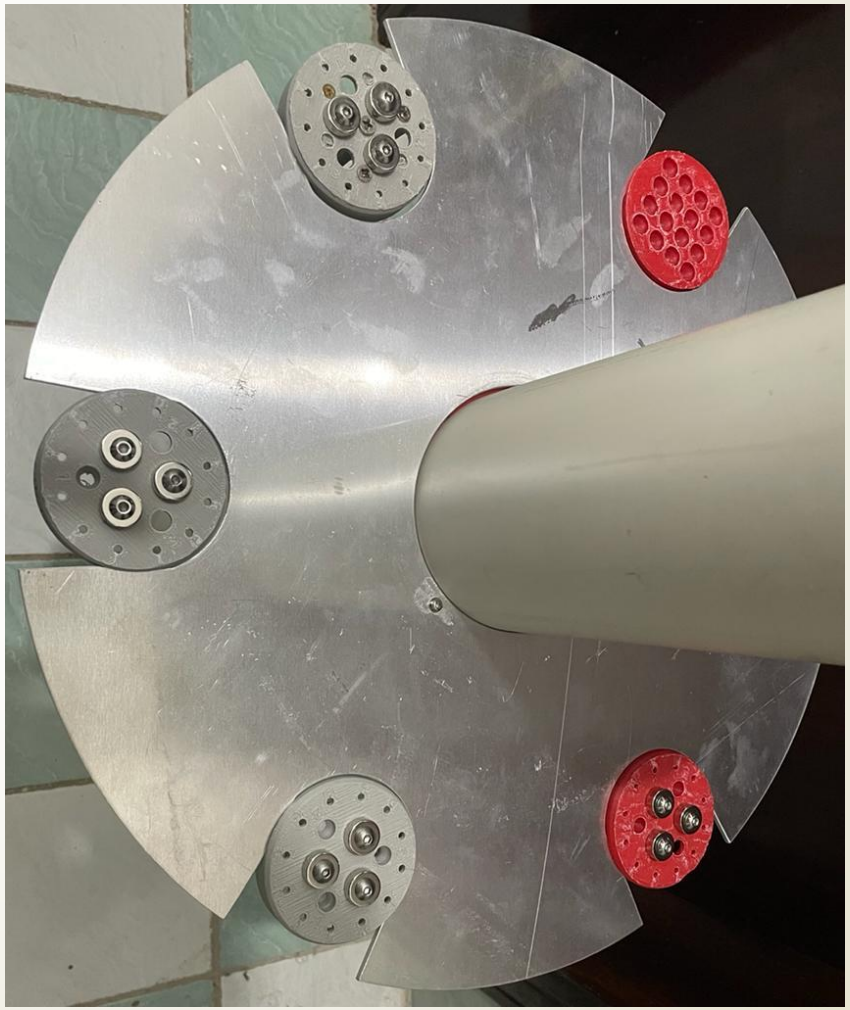
Z-Axis



Z-Axis attached to Cross slide

Design: Tool bay

- Tool Bay Design to stores tool and sensors heads

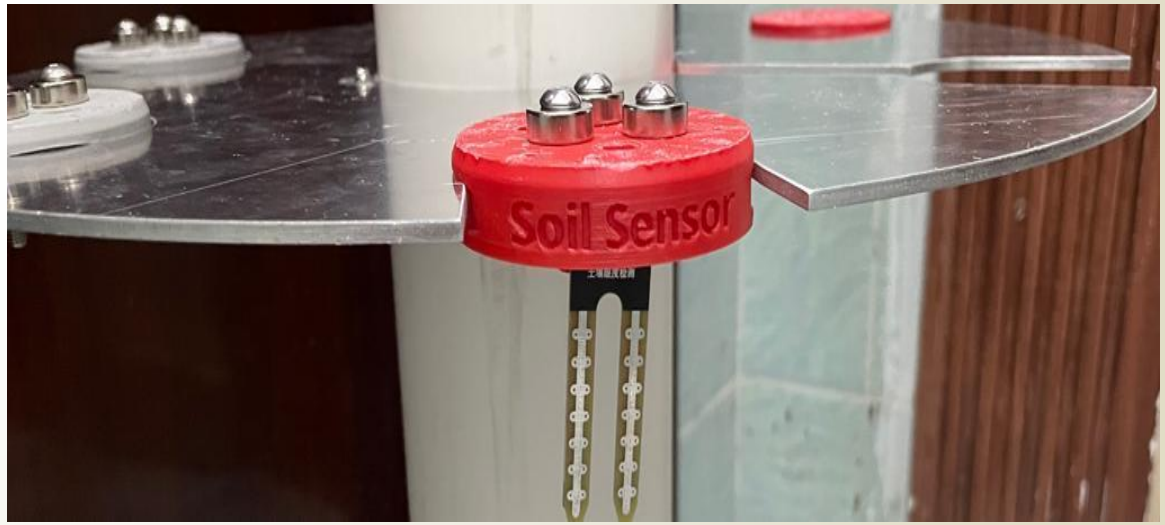


Design: Tool bay

- Weeder Tool and Seeder Tool

Design: Tool bay

- Watering Head tool and Soil sensor

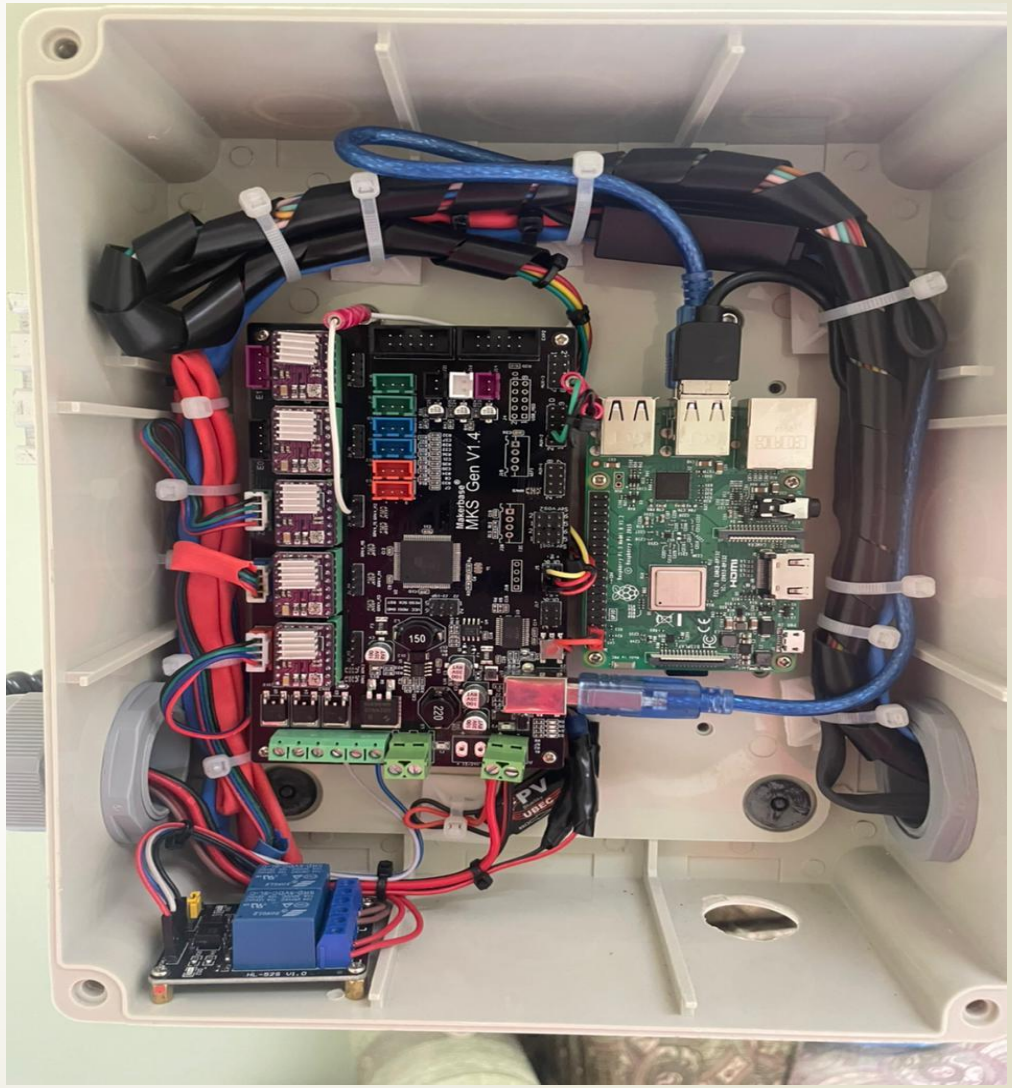


Design: Tool bay

- Seeder tool

Design: Electronic Box

- Raspberry pi
- RAMP Shield
- Control Relay
- Motor Drive



Design: Electronic Box

- 220 AC to 12 DC Power supply

Design: Completed Work

- Subsystem -1 which is driven and base system Completed
- List of Task for subsystem-1:

No	Task	Completion	Remark
1	Design and construct base	100%	Done
2	Fabricate aluminum rotate plate for driven motor	100%	Done
3	Connect driven motor to the base	100%	Done
4	Check mechanism and rotation of the driven system	100%	Done
5	Do a test for motor and run the system	100%	Done

Design: Completed Work

- Subsystem -2 which is Cross slide and Z – Axis Completed
- List of Task for subsystem-2

:

No	Task	Completion	Remark
1	Fabricate aluminum plate cross slide	100%	Done
2	Connect Z- Axis Colum to Cross slide plate	100%	Done
3	Check mechanism of the system	100%	Done
4	Do a test for motor and run the system	100%	Done

Design: Completed Work

- Subsystem -3 column shroud – Axis Completed
- List of Task for subsystem-3

:

No	Task	Completion	Remark
1	3D Printing	100%	Done
2	column shroud wiring	100%	Done
3	Check mechanism of the system	100%	Done
4	Do a test for shroud and run the system	100%	Done

Design: Completed Work

- Subsystem - 4 Electronic Box and Software.
- List of Task for subsystem- 4

:

No	Task	Completion	Remark
1	Construct the box	100%	Done
2	Install the Electronic part	100%	Done
3	Connect the circuit	100%	Done
4	Do a test for the circuit	100%	Done
5	Software	95%	Done

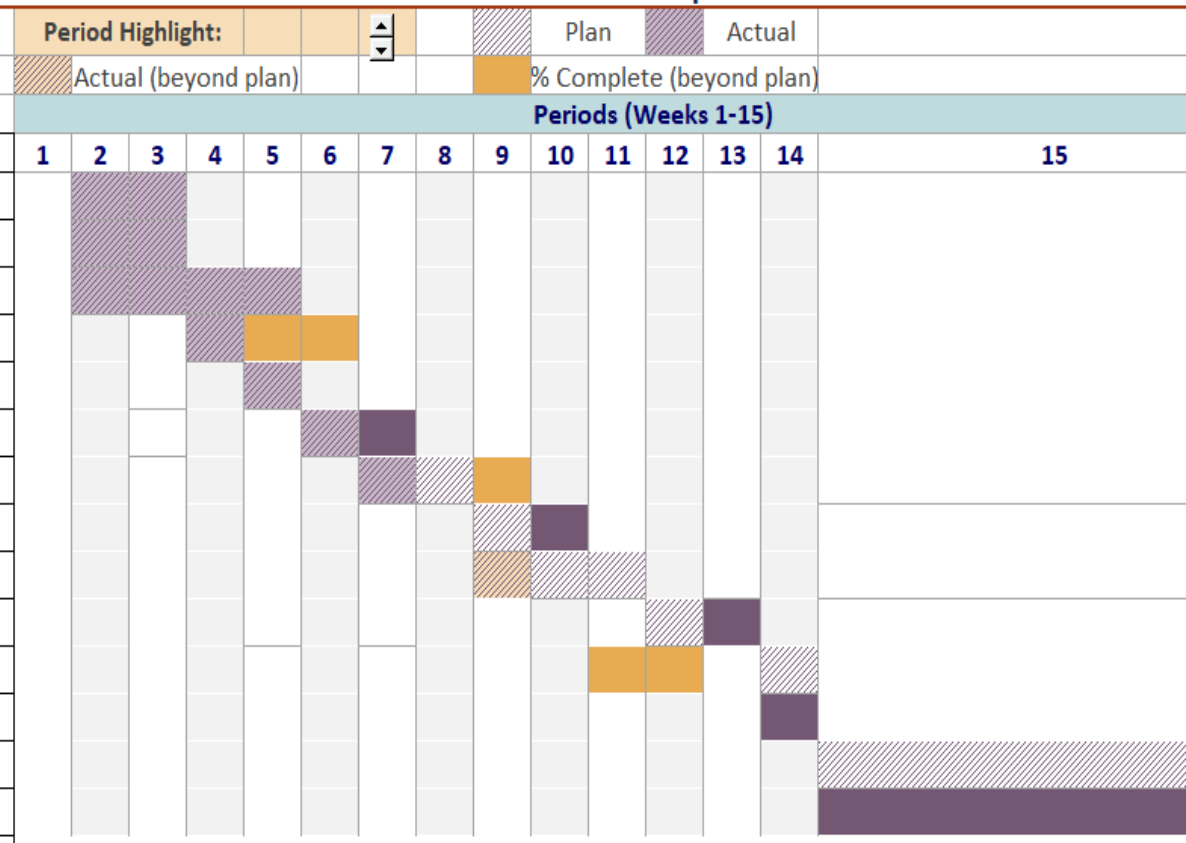
Design: Remaining Work

- The remaining subsystem is subsystem - 4 which is Electronic and Software.

Project Management & Team Work

Title: Polar Farming Robot	Advisor: Dr. Sadiq Alhuwaidi	Design II	Fall 2021
Majed Albouq 201600920 (MA)		Project PLAN & Progress	
Mohammed Alkhalaf 201600019 (MO)		ProgRpt No. 8	
Talal Alharbi 201400702 (T)		Plan updated (Date): December 21, 2021	
		Instructor: Dr. Sadiq Alhuwaidi	

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Write a plan	2	2	MA	2	2	100%
Ordered the material for subsystems 3 & 4	2	1	MA	2	1	100%
Make the material in 3D printer for subsystem 3 (farming tools)	2	2	MO	3	3	100%
Design & Implement subsystem 3	4	1	T	4	3	100%
Test subsystem 3	5	1	T	5	1	100%
Connect all subsystems	6	2	MO	6	2	100%
Prepare midterm Presentation	7	2	MA	7	3	100%
Midterm Presentation	9	2	ALL	9	2	100%
Design & Implement subsystem 4 (software)	10	2	MO	10	0	100%
Test subsystem 4	12	2	MO	13	0	100%
Prepapre final report	14	1	T	11	2	100%
Prepapre final presentation	14	1	T	14	1	100%
Prepare Project Demo	15	1	ALL	15	1	100%
Submit Rpt/PPT/Brochure	15	1	MA	15	1	80%



Project Management & Team Work

Team work task division

Task	Talal	Majed	Mohamed
Search & acquire components	40%	30%	30%
Design & Implement Subsystem 1	25%	40%	35%
Design & Implement Subsystem 2	35%	35%	30%
Design & Implement Subsystem 3	30%	35%	35%
Design & Implement Subsystem 4	25%	35%	40%
Testing	20%	30%	50%
Write Reports &Presentations	30%	40%	30%

Risk management

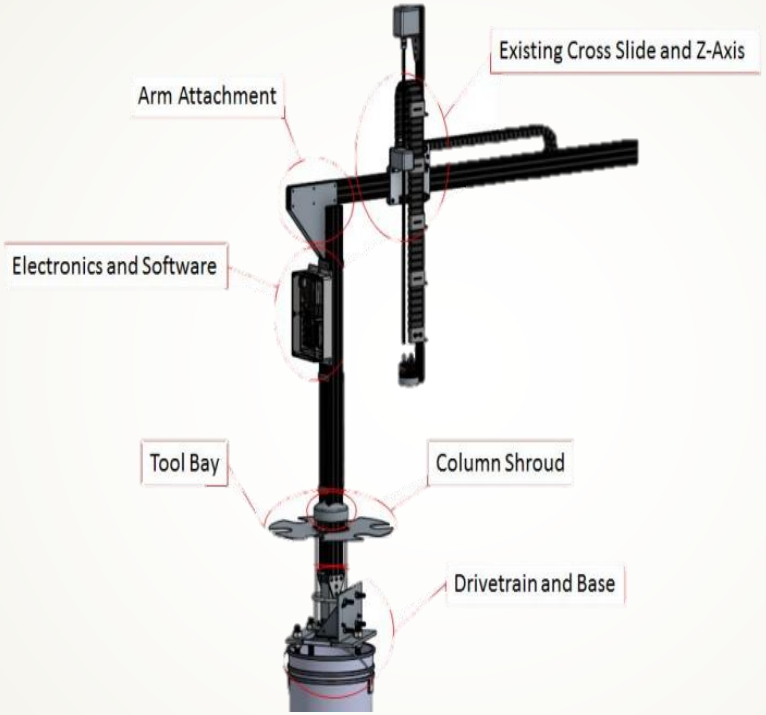
	Source	Events	Threats	Response	Status
1	**Materials**	Fail to delivered on time	Progressing	by ordering a head of time	All Materials have received and secured.
2	**Software**	Not ready yet	Fail to Control the Robot	Started working on the software	Progressing and it will be submitted with Sub system 4.
	Complexity	Integrating the 4 subsystems	Fail to perform the tasks accurately	Chose micro controller capable to done the functions.	We will test the results when software is ready.
3	**PC/microcontroller**	hard drive/memory failure	data and programs lost	back up data on external memory or on cloud	hard drive/memory shosed to be compatible with the Micro /Controller.
4	**Team members**	illness	Development/ test delay	sickness is unpredictable.	All of team Members have received the second Vaccine Does.

Challenges & Decision Making

- Delivery
- Online Classes
- Accuracy
- Functionality

New Skills Acquired and Applied

Technicality



Design

Teamwork

Creativity

Budget

Item	Quantity	Unit Cost (SR)	Subtotal(SR)
Microcontroller	1	95	95
Arm(Aluminum)	3	350	1050
Motor	4	150	600
Motor drivers	3	30	90
Planetary gearbox high torque	3	125	375
Wires	6	15	90
Sensor	6	35	210
Pump	2	70	140
Farming Box	1	600	600
Total Cost			3562

References

1. Statrep_1436_1437_water. (2017).StatRep_1436_1437_Water. Retrieved October 11, 2017from Ministry of Environment Water & Agriculture, Information And Statistics/ Statistical Reports Website:https://www.mewa.gov.sa/ar/InformationCenter/Researchs/Reports/GeneralReports/StatRep_1436_1437_Water.pdf

2. Nithin, V., & Shivaprakash, S. (2016). Multi purpose agricultural robot. International Journal of Engineering Research, volume No.5. Retrieved from http://www.ijer.in/ijer/publication/v5si6/12.pdf.

3. Lenz, J., & McMahon, J. (2015). Smart Irrigation Project. Retrieved from https://courses.engr.illinois.edu/ece445/getfile.asp?id=7091

4. alunkhe, P., Shaikh, S., Dhable, M., Sayyad, D., & Tamboli, A. (2016). Automatic Seed Plantation Robot. International Journal of Engineering Science and Computing, volume No.6. Retrieved from http://ijesc.org/upload/39c18a7339722c2c6bc06e96d835af77.Automatic%20Seed%20Plantation%20Robot.pdf


Questions