Prince Mohammad Bin Fahd University
College of Engineering
Department of Electrical Engineering

Sustainable Greenhouse with Smart Energy Management System

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Advisor: Dr. Ala Raef Al-Haj Hussein

May 17st, 2022

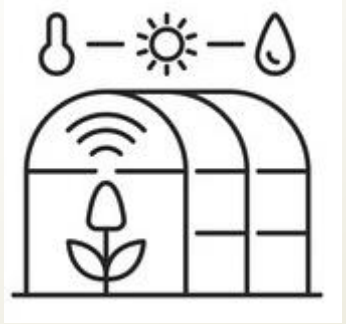
Outline

- Project Definition
- Project Objectives
- Project Specifications
- Project Constraints and Engineering Standards
- Project Architecture
- Planning
- Background
- Design: Subsystems and Component Selection
- Testing
- Project Management & Team Work
- Impact of Project
- New Skills Acquired and Applied
- Completed and Remaining Work
- Budget Estimate
- References

Project Definition

- A Sustainable Green House, is a controllable environment in term of humidity, temperature, pressure, water, and lighting

- It allows the user to set a steady environment with smart energy management system for the plants, and change it anytime



Project Objectives

- To be able to fully control the weather inside the greenhouse based on plants environment
- To control and adjust a fixed pressure inside a greenhouse, as it feels in a mountain
- To be able to control the water flow going through the plants
- To control the light shades instead of the sun

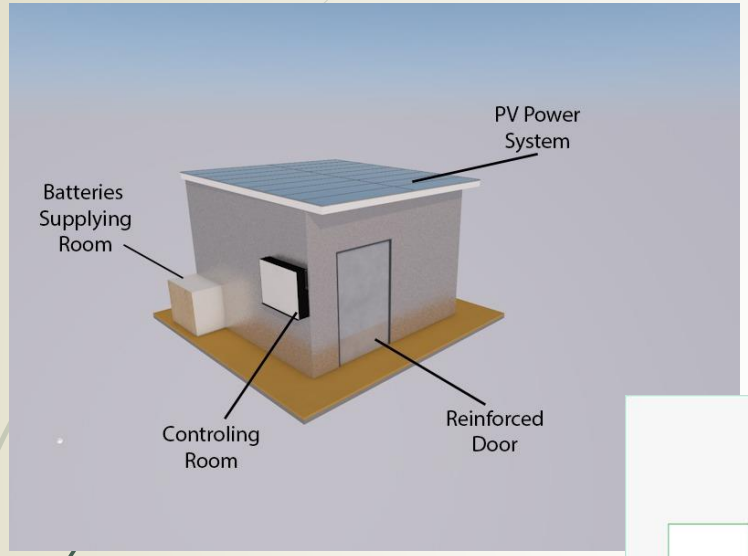
Project Specifications

- **Detect** the amount of water for each plant using Water Flow sensor
- **Control** the light timing for the whole room
- The **capability** of controlling the temperature and pressure inside the room
- **Display** the hours of light on/off
- The **capability** of changing the amount of water using keypad
- **Powering** the low voltage devices using PV

Design Constraints & Standards

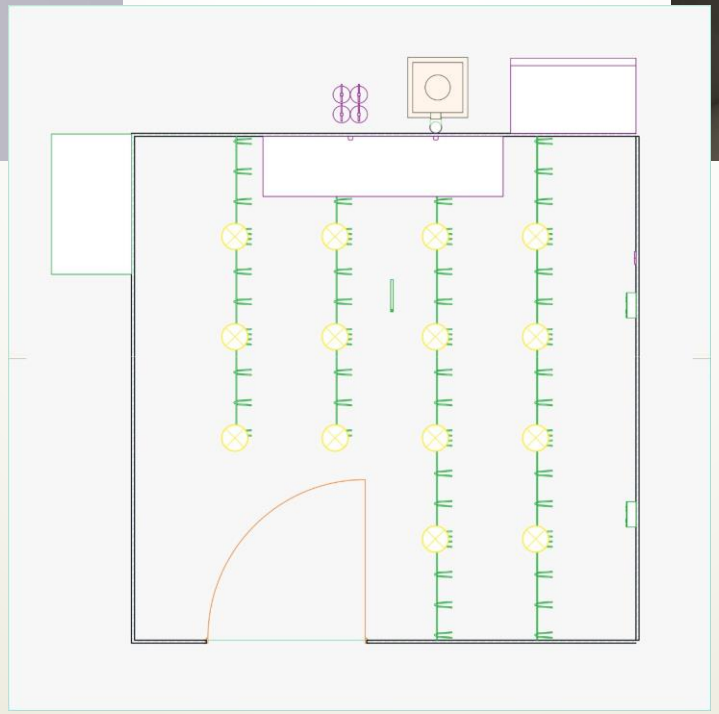
1. **Sustainability**
2. **Environmental**
3. **Economic**
4. **Safety**

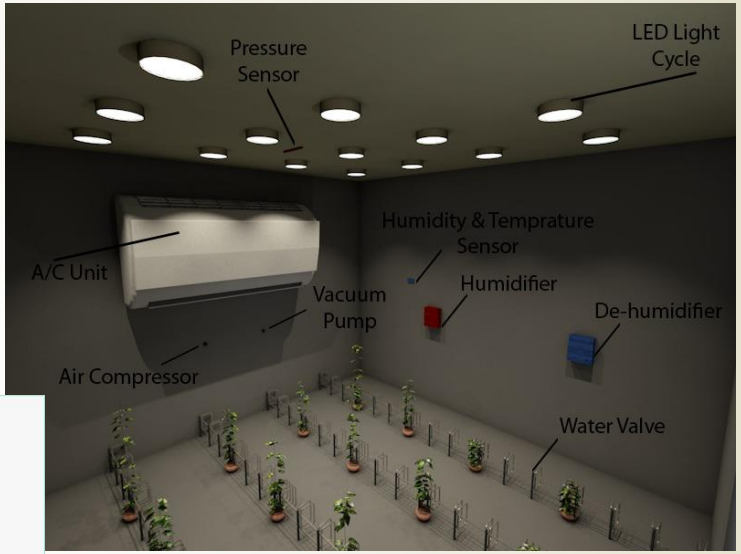
Project Architecture



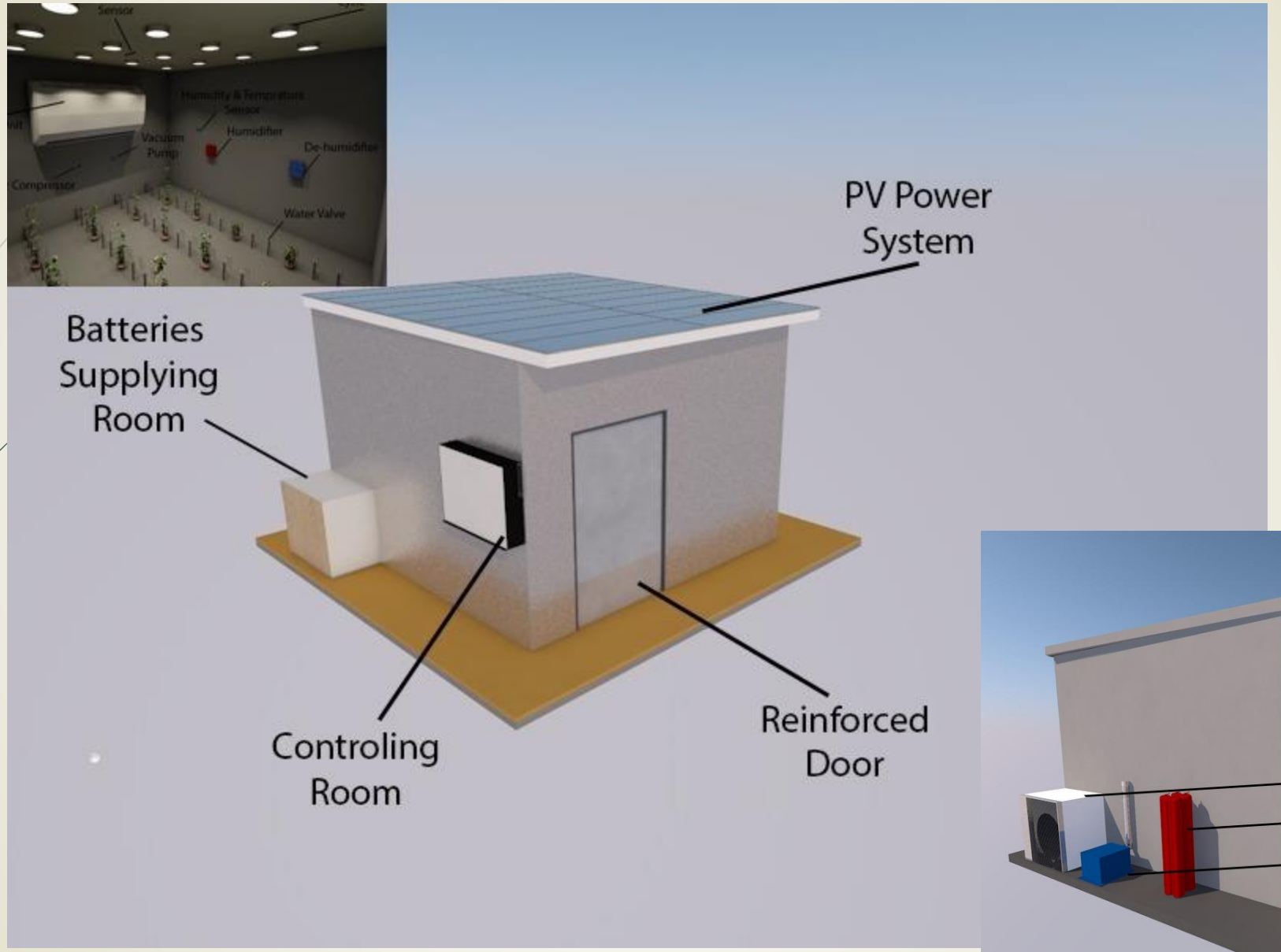
Isometric view (3D)

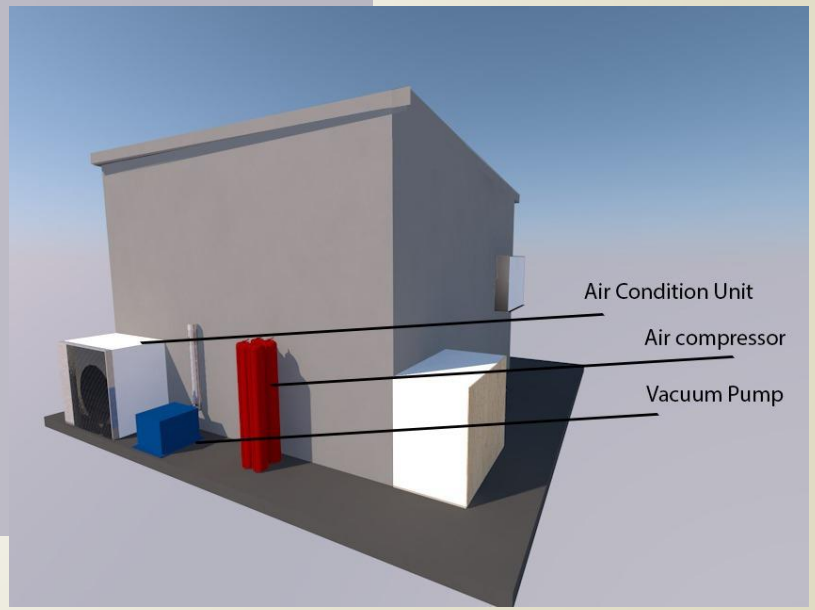
2D view

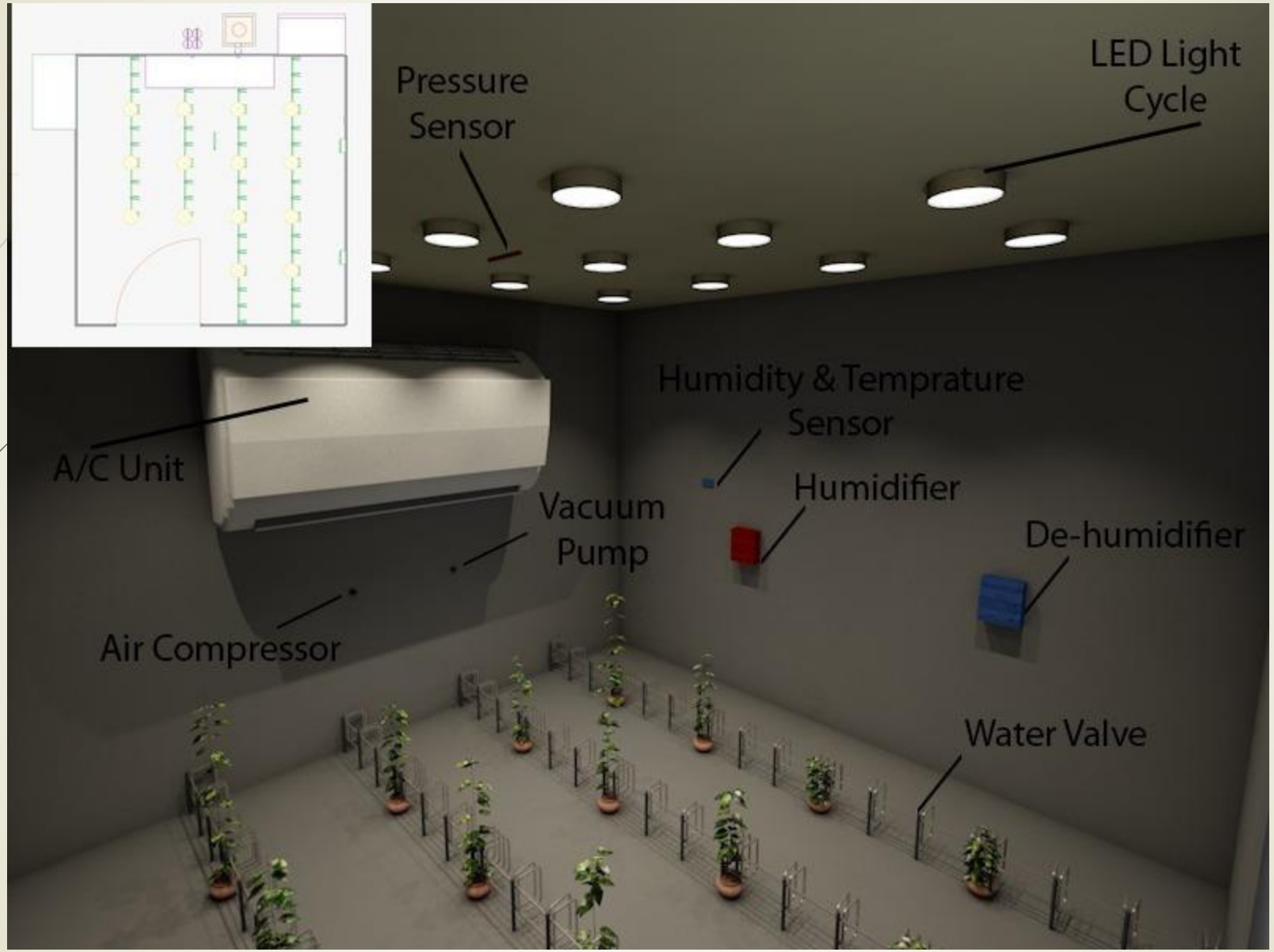




Inner view


Sensor
Humidity & Temperature Sensor
Humidifier
De-humidifier
Vacuum Pump
Compressor
Water Valve
PV Power System
Batteries Supplying Room
Controling Room
Reinforced Door


Air Condition Unit
Air compressor
Vacuum Pump


Pressure Sensor
LED Light Cycle
Humidity & Temprature Sensor
A/C Unit
Humidifier
Vacuum Pump
De-humidifier
Air Compressor
Water Valve

Background: Problem

- Plants do not grow in any surface level
- Some weather condition do kill plants
- Plants can’t harvest in all seasons
- Supply scarcity

Subsystems

- Sub I: Water Irrigation
- Sub II: Pressure Control
- Sub III: Light Cycle
- Sub IV&V: Temperature & Humidity Control
- Sub VI: Photovoltaic (PV) Power Supply
- Sub VII: Safety Camera

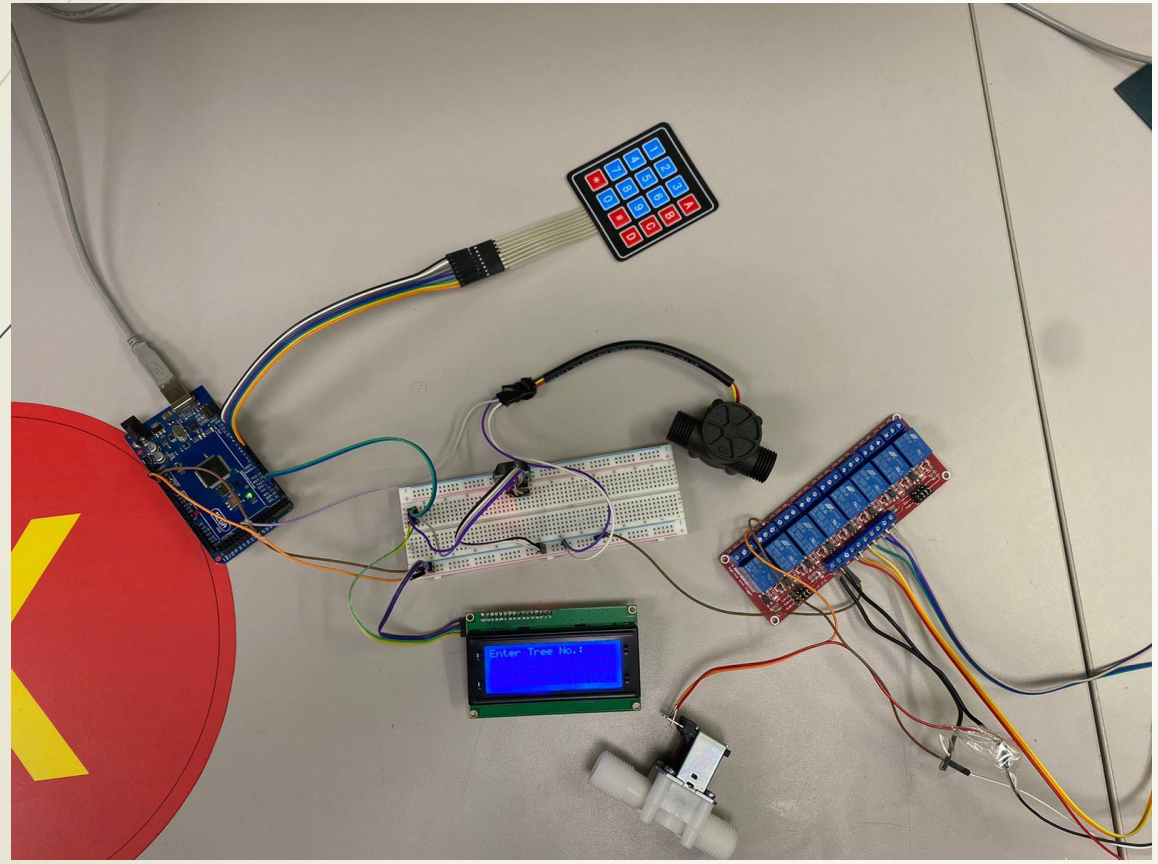
Background: controlling conditioning

- Pressure
- Temperature
- Humidity
- Water Irrigation

Background: controlling conditioning

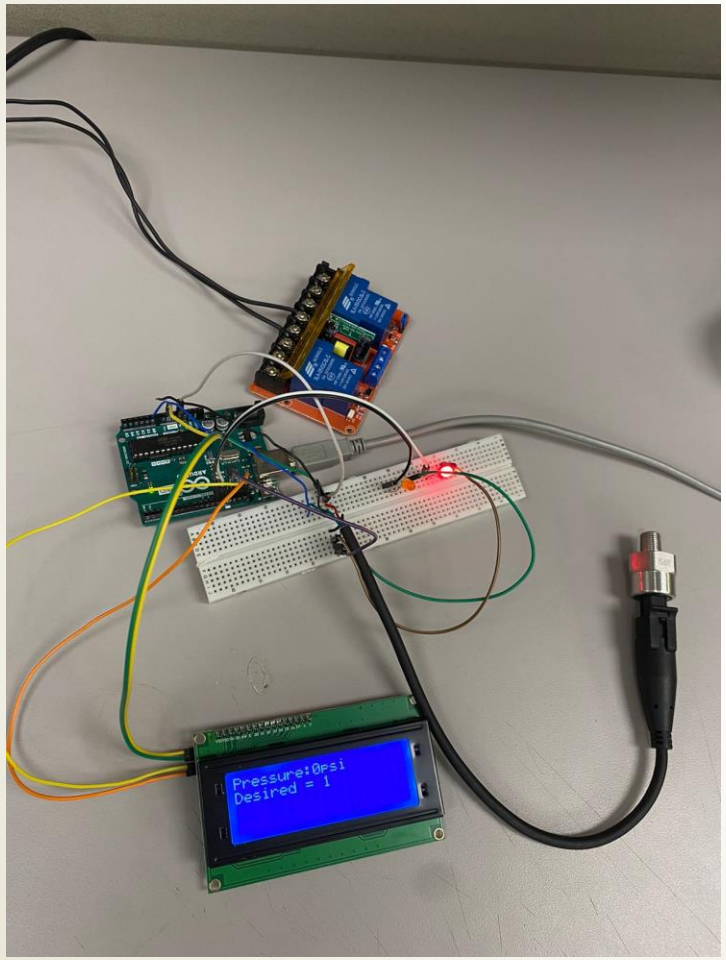
- Light Cycle

Water Irrigation Subsystem I



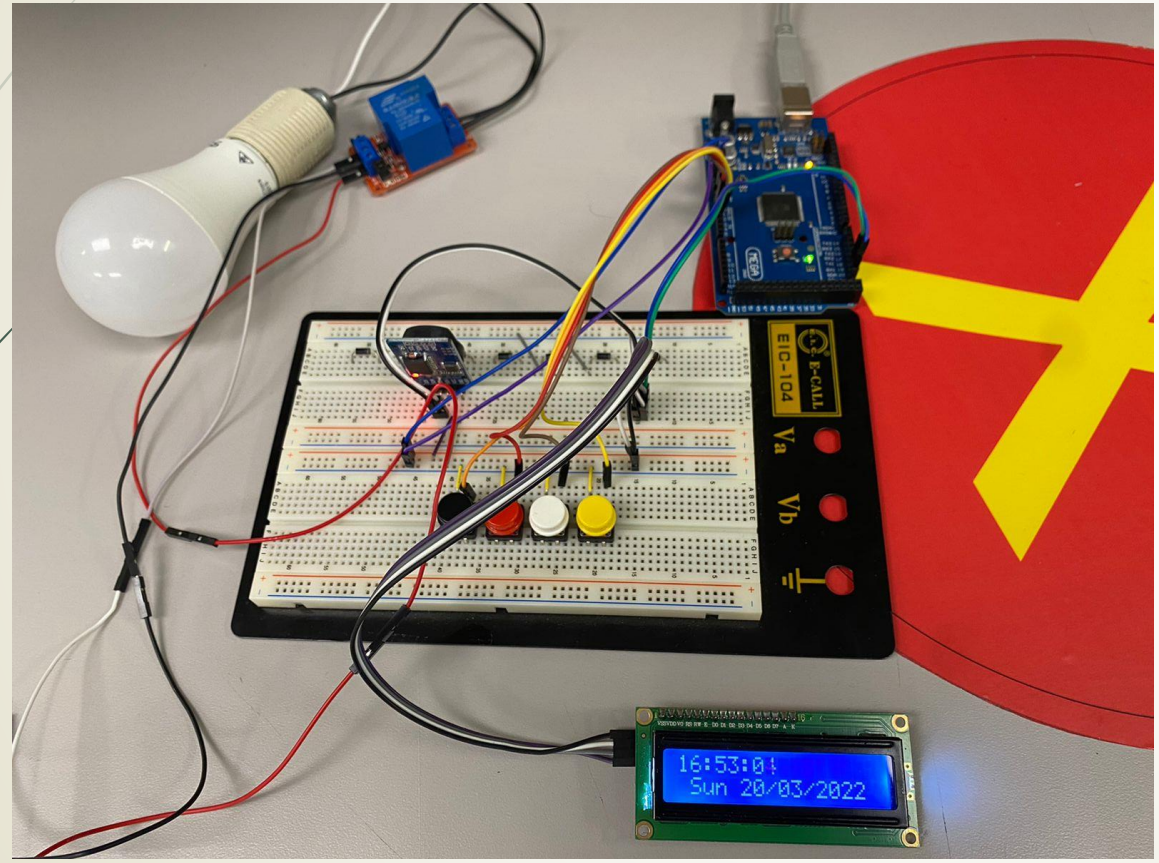
- Control water flow
- Control each plant
- EEPROM memory
- Easy to readjust the water flow
- Display the water flow

Pressure Control Subsystem II



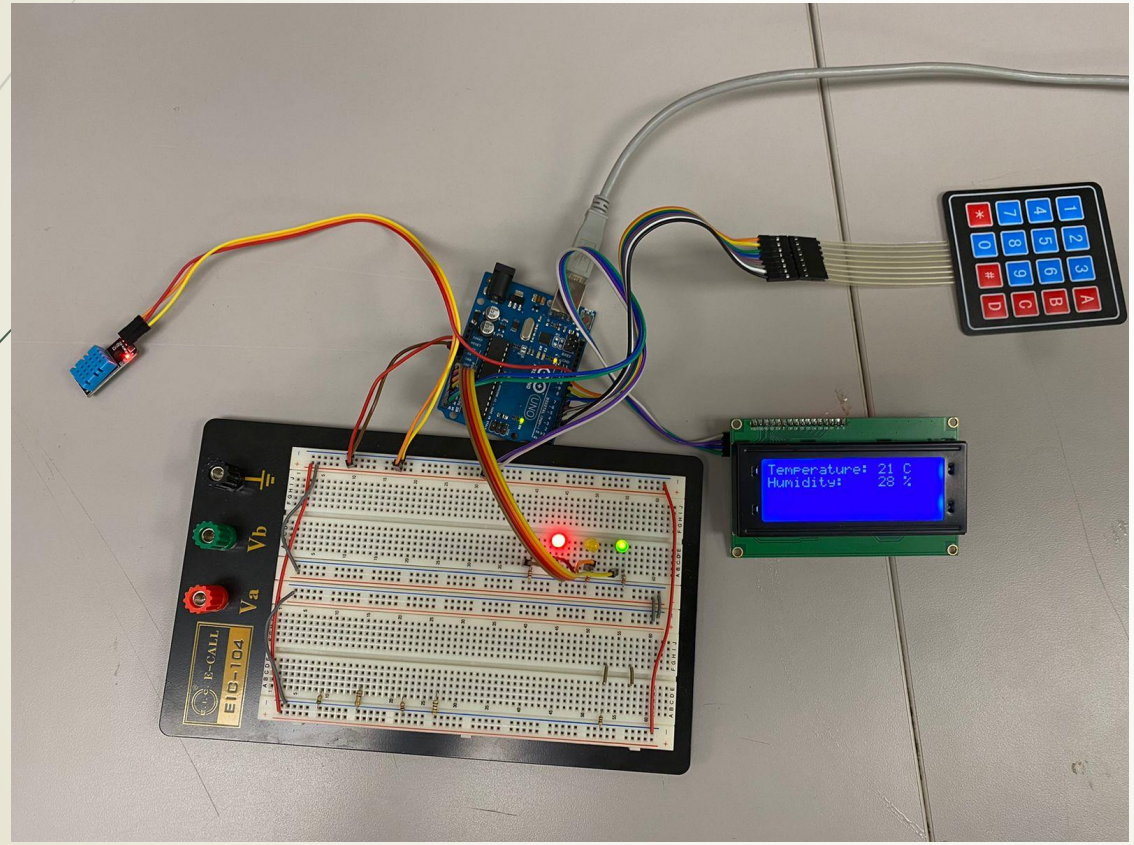
- Control the pressure
- EEPROM memory
- Easy to readjust the desired pressure value

Light Cycle Subsystem III



- Control 4 strip lights
- Control each strip light
- Works with Real time
- EEPROM memory
- Easy to readjust each strip light timer

Temperature & Humidity Control Subsystem IV&V

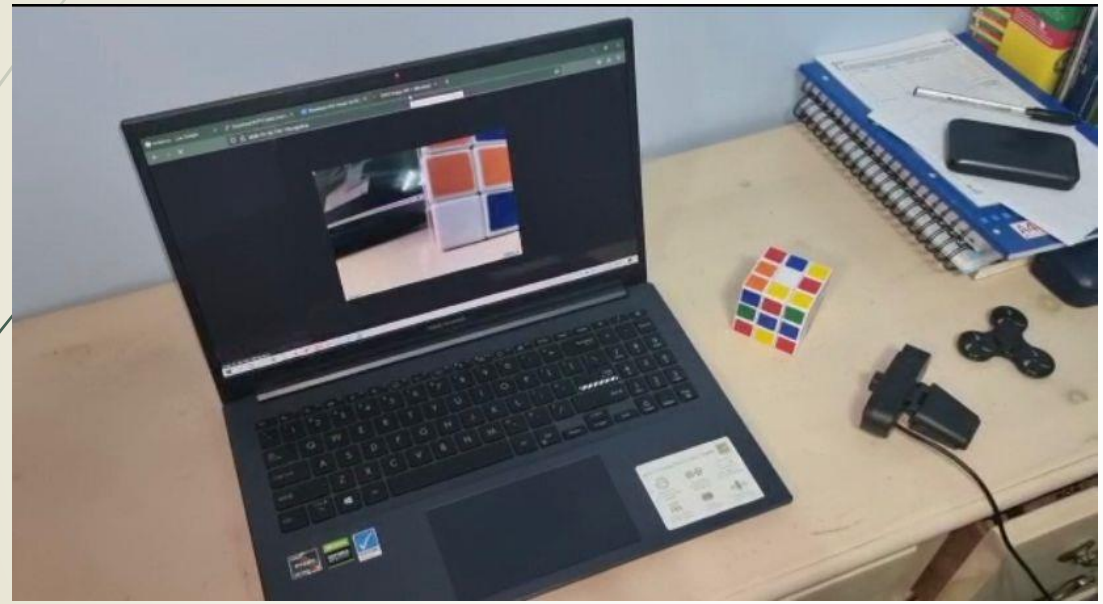


- Control the Temperature
- Control the Humidity
- EEPROM memory
- Easy to readjust both Temperature & Humidity

PV Subsystem VI

- Run 12V
- Arduino and Light Cycle (Sub III)

Safety Camera Subsystem VII



- PC Camera (DATAZONE DX-X2)
- Raspberry Pi 4 Computer Model B 4GB RAM
- 5V/3A Adapter

Project Management & Team Work

Team work task division

Task	Mohammed Sahwan	Hassan Alherz	Hassan Al Radwan	Khalid Ashi	Task Total
Search & acquire components	25%	30%	20%	25%	100%
Design Subsystems	25%	25%	30%	20%	100%
Test Subsystems	30%	20%	30%	20%	100%
Write Reports & Presentations	25%	25%	25%	25%	100%

Impact of project

- Impact on society
- Saving the environment
- Lower the price of goods
- Saving natural sources

New Skills Acquired and Applied

- Controlling functions by Arduino
- The use of transformers
- Ordering components based on specifications
- Solar panel with inverter

Design: Completed Work

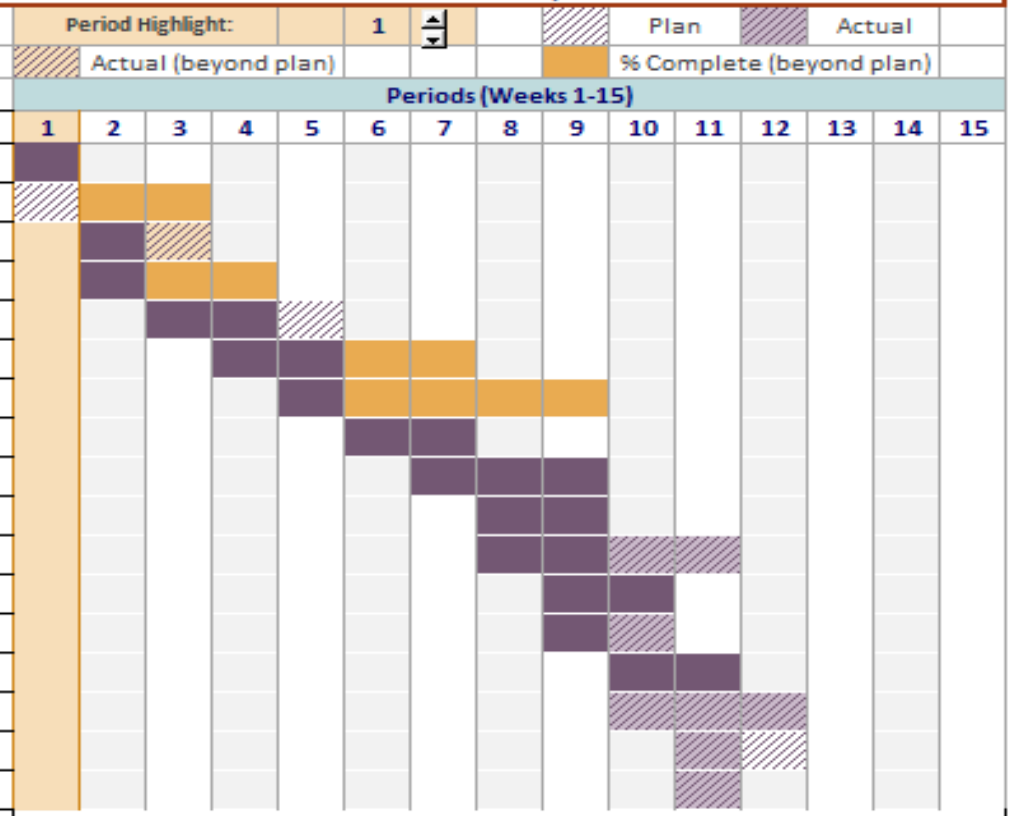
- Water Irrigation Subsystem I
- Pressure Control Subsystem II
- Lighting Cycle Subsystem III
- Temperature & Humidity Subsystems IV&V
- PV Subsystem VI
- Safety Camera VII

Title: Sustainable Greenhouse with Smart En	Advisor: Dr. Ala Hussein	Design II (ASSE 3)	Spring 2022

Mohammed Sahwan (MS) 201700325
Hassan Alherz (HH) 201501957
Hassan Alradwan (HR) 201501836
Khalid Ashi (KA) 201502249

Project PLAN & Progress
ProgRpt No. 6
Plan updated (Date): May. 17, 2022
Instructor: Dr. Sadiq Alhuwaidi

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Planning & Meetings	1	1	ALL	1	1	100%
Meeting Advisor & Schedule meetings	1	1	ALL	2	2	100%
Ordering components	2	1	HH	2	2	90%
Complete the Light Cycle (Sub 3)	2	1	HR	2	3	100%
Complete Water Irrigation Subsystem (Sub 1)	3	3	HH, HR	3	2	100%
Temperature & Humidity Subsystem (Sub 4&5)	4	2	MS	4	4	100%
Pressure Subsystem (Sub 2)	5	1	KA	5	5	100%
Buying Appliances	6	2	HH, HR	6	2	100%
Prepare midterm presentation and video	7	3	ALL	7	3	100%
Buying Iron	8	2	HR, HH	8	2	100%
Compiling the room	8	4	HR	8	4	70%
Testing components & Appliances	9	2	ALL	9	2	100%
Combining the system and PV (Sub 6)	9	2	ALL	9	2	20%
Planting the seeds	10	2	HR	10	2	100%
Monitor the system	10	3	MS, HR	10	3	0%
(IoT) communication feature	11	2	MS, HR	11	1	0%
Troubleshooting and Resultings	11	1	ALL	11	1	0%
Prepapre final report	12	5	ALL	9	5	70%
Prepapre final presentation	12	3	HH, MS, KA	12	3	90%
Prepare project demo	13	3	ALL	13	3	0%
Submit Rpt/PPT/Brochure/Video...etc.	14	2	MS	14	2	0%



Progress Details:

system compiled
Coffee Seeds planted
Subsystems have been in a troubleshooting
Rollup banner and Brochures are ready and printed

Issues (delay, etc.):

delay in receiving the room from the company

Budget Estimate

- List of key components and their approximate cost
- Add up total estimate

Item	Quantity	Unit Cost (SR)	Subtotal
Sensors	30	11 - 40	1000
Relay	4	143.35	573.5
Materials	20	2 – 15	338.16
Microcontroller	4	65	260
Iron Room 2m*2m*2m	1	21700	21700
Other components	7	-	1535.34
		Total	25407

References

1. National Energy Technology Laboratory (August 2007). "NETL Modern Grid Initiative — Powering Our 21st-Century Economy" (PDF). United States Department of
2. Sage, Emma, March 8th, 2014, Basic Plant Biology: Keeping the Coffee Plant “Happy” https://scanews.coffee/2014/03/08/science-basic-plant-biology-keeping-the-coffee-plant-happy/
3. Cruithne, October 19th, 2016, "Atmospheric Pressure vs. Altitude.png“https://en.m.wikipedia.org/wiki/File:Altitude_and_air_pressure_%26_Everest.jpg
4. https://www.nationalgeographic.org/encyclopedia/altitude/

Thank you