



KEMENTERIAN SAINS,
TEKNOLOGI DAN INOVASI
MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

MERAKYATKAN SAINS
MENGINSANKAN TEKNOLOGI



Dianjurkan Oleh

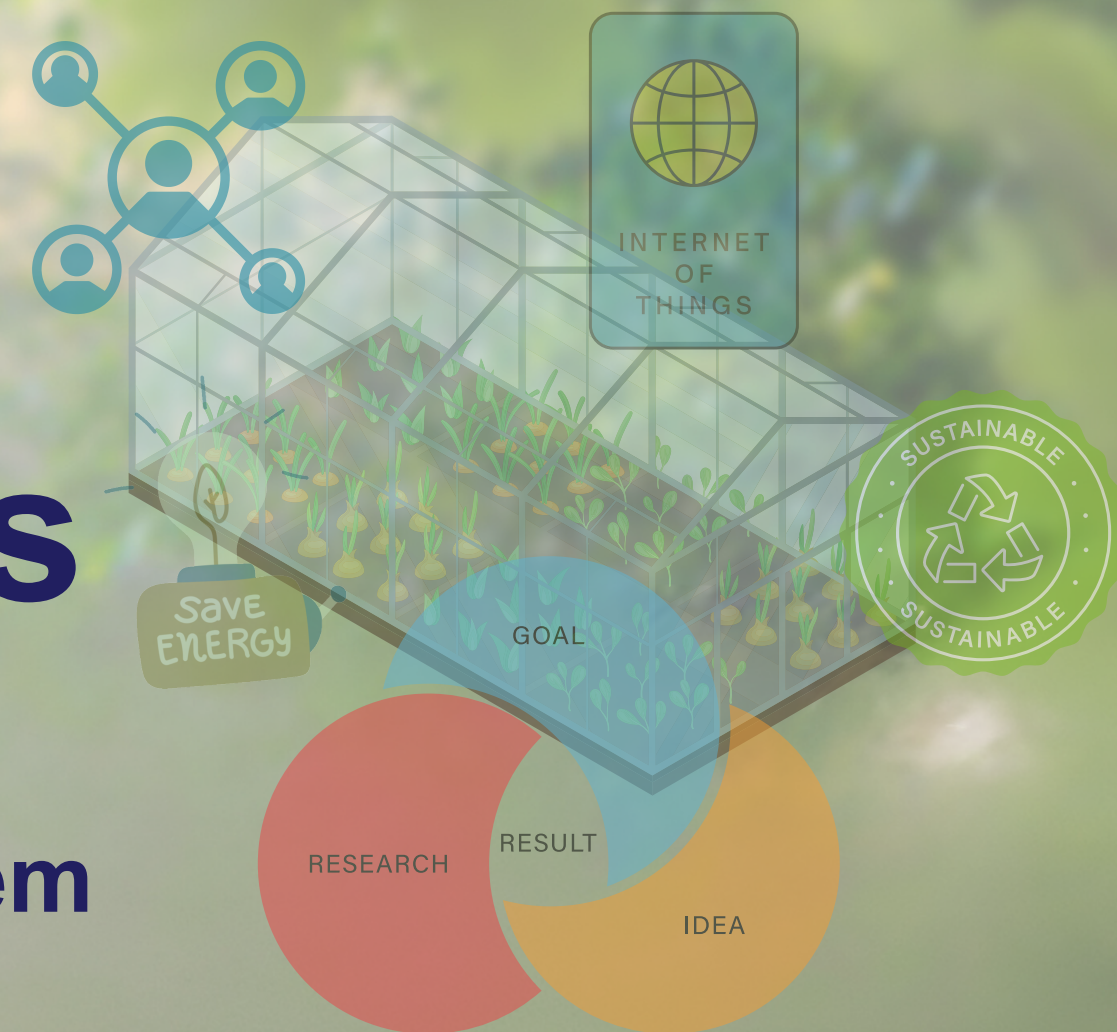


USM
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Mechatronon Masters

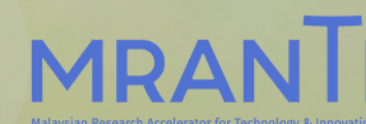
Universiti Sains Malaysia
IoT Integrated Smart Plantation System



Disokong Oleh



Digital
Village.



Problem Statement

- *Majority of plantation and crop owners do not use state of the art technology to integrate with daily monitoring routines.*
- *Longer time is used up for plant monitoring as physical method is much more time consuming and less effective.*
- *Unable to effectively hinder plantation from the harmful exposure to insects and pests.*
- *Over exposure to water by rain and death of crops in a short period of time.*
- *poor rain catchment system*
- *Ineffective fertiliser dispersion system.*



Solution/Idea

- *As a group, we have designed a prototype which resembles a multifunctional smart plant monitoring and management system with Integrated IoT system in the form of a contemporary green house for optimal plantation growth.*
- *Our prototype consists of 4 main parts which are the plant fertilisation system, smart plant monitoring system, pesticide system and a retractable roof and solar energy and water harvesting system.*
- *All these parts are IoT integrated and can be controlled by smartphone apps such as Arduino IoT Cloud and Blynk 2.0*

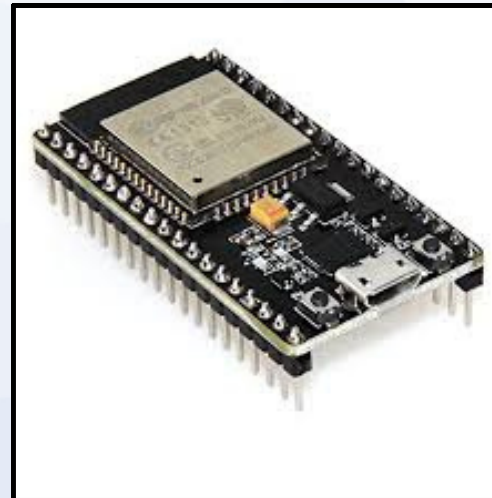


Design & Feature

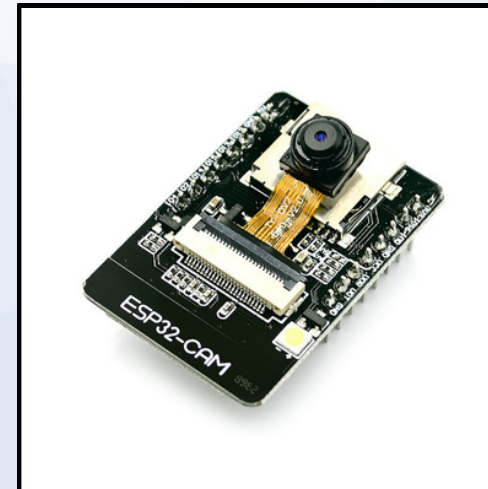
Since our project involves the combination of different systems, therefore we used many components since there were many I/O variables used.

List of materials and components used:

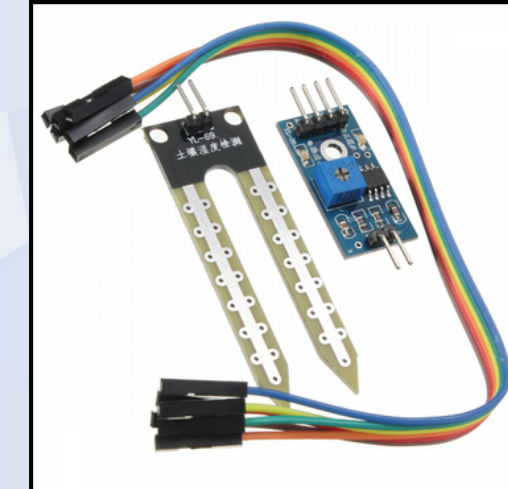
- BREADBOARDS
- JUMPER WIRE/CABLES
- ESP-32 CAM
- ESP-32 DEVKIT
- ARDUINO UNO
- ARDUINO NANO
- DC WATER PUMP MOTOR
- L293N MOTOR DRIVER
- 5V DUAL RELAY MODULE
- WATER LEVEL SENSOR
- PHOTORESISTOR SENSOR
- LED'S
- UNO EXPANSION SENSOR SHIELD
- SERVO MOTOR
- ESP-01 WIFI MODULE
- SOLAR PANEL
- RAINDROP SENSOR
- VOLTAGE SENSOR
- I2C BLUE 16x2 LCD's
- SOIL MOISTURE SENSOR
- HUMIDITY SENSOR MODULE



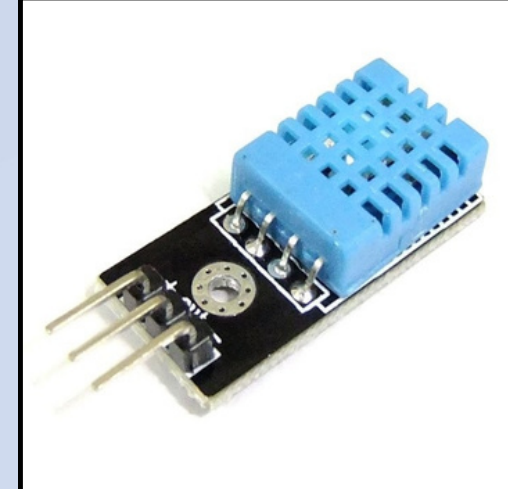
ESP-32 DEVKIT



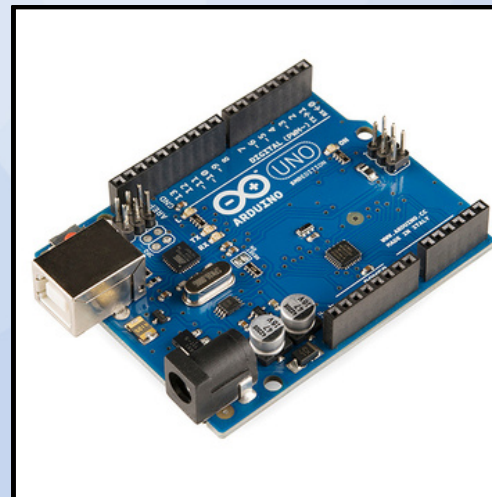
ESP-32 CAM



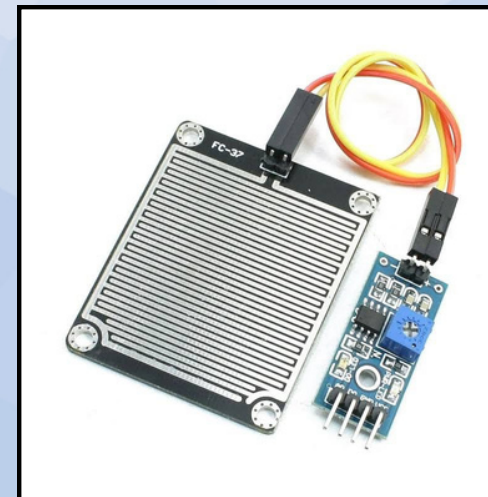
SOIL SENSOR



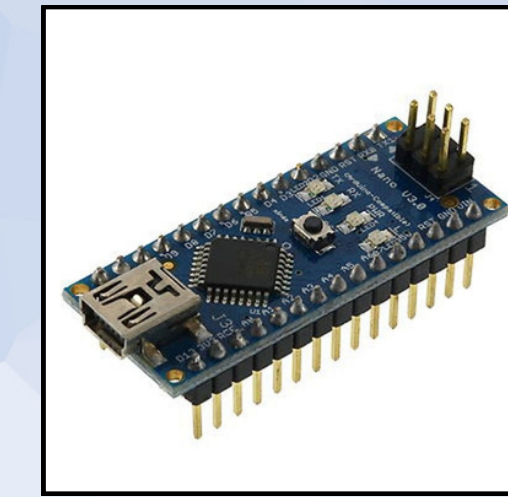
HUMIDITY SENSOR



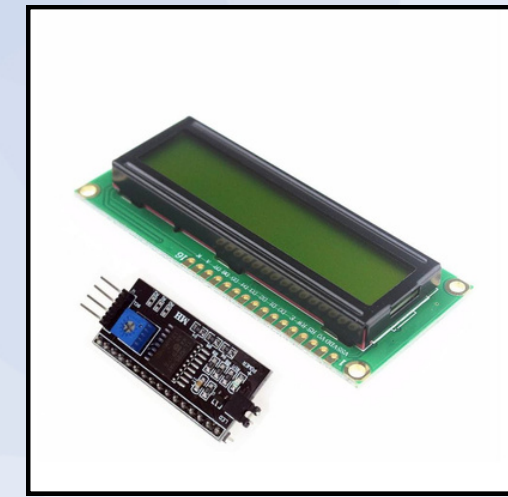
ARDUINO UNO



RAINDROP SENSOR



ARDUINO NANO

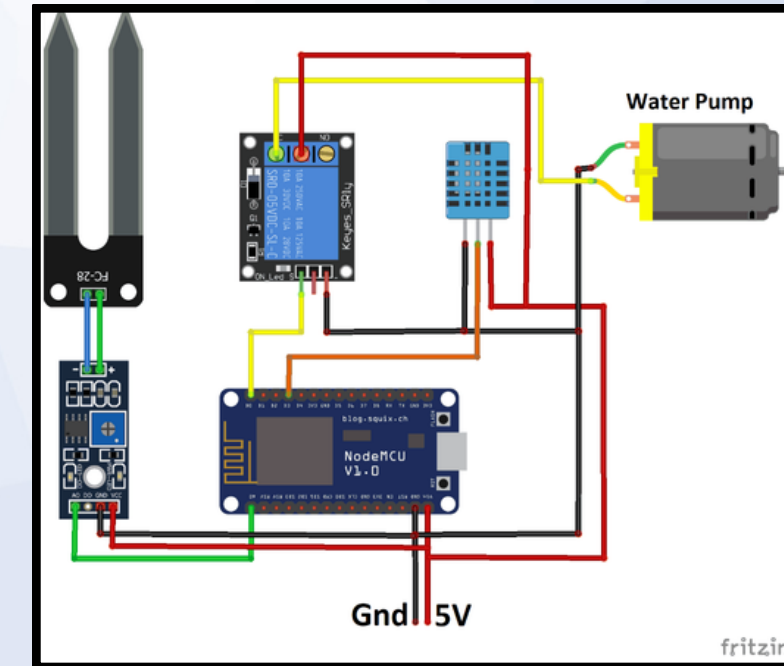


I2C 16x2 LCD

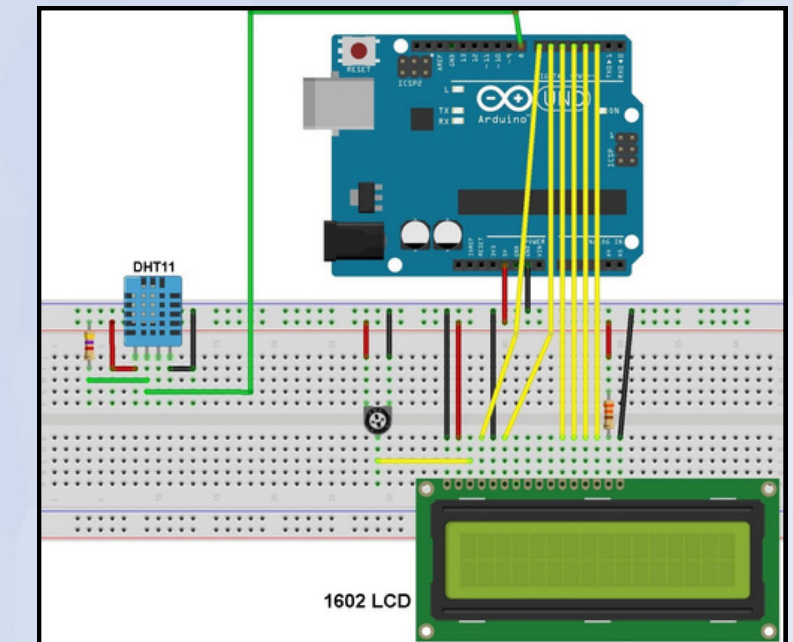
SUBSYSTEMS

SOIL MONITORING AND IRRIGATION SYSTEM

- This system consists of 2 different circuits merged into a system. One circuit represents the irrigation system where the esp32 is used as a serial connector which links the Arduino IoT cloud platform to the soil moisture sensors which return reading in the form of moisture, in turn governing the activation of the dc water pump.*
- The second circuit represents the soil monitoring system where humidity sensor is used to return data in the form of Temperature and Humidity which is displayed on the LCD.*



**Irrigation system
circuit schematic**

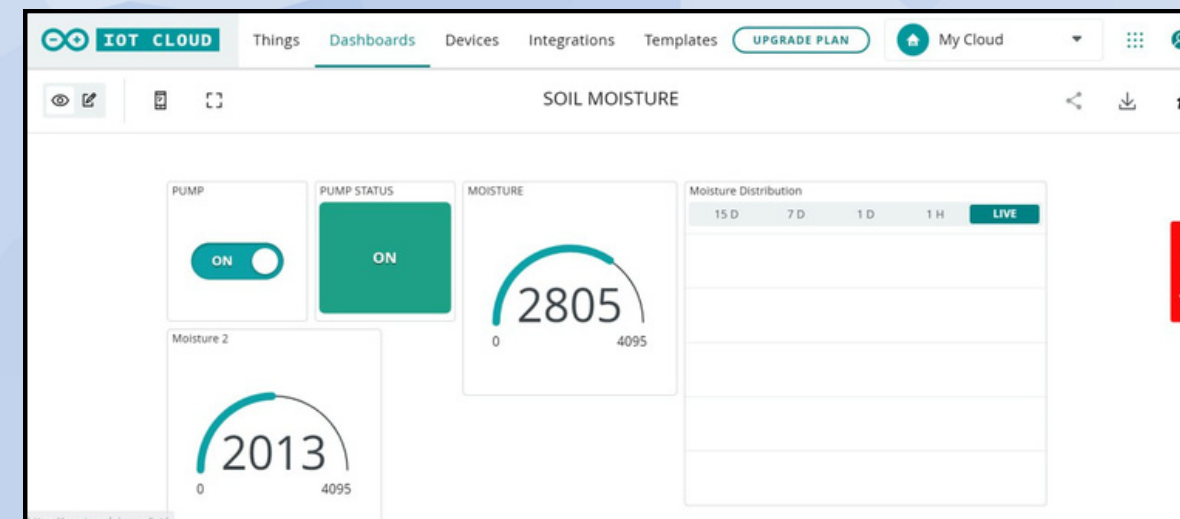


**soil monitoring
circuit schematic**



**Overview of
subsystem(red box)**

**Arduino IoT cloud
interface for soil
monitoring and
irrigation system**

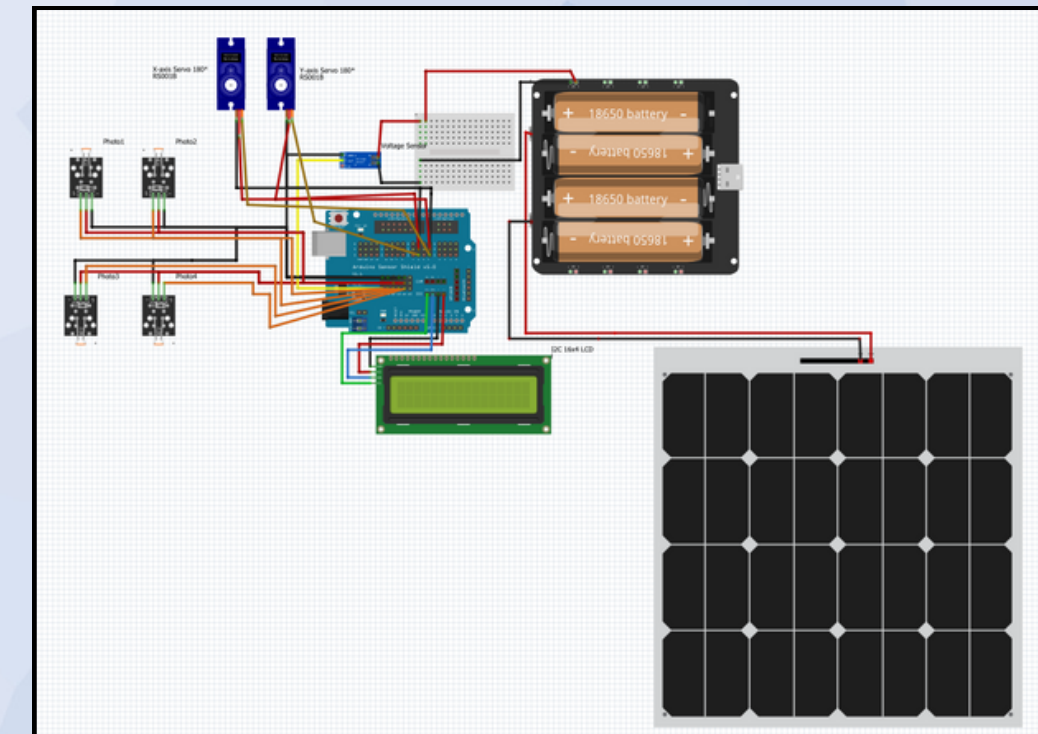


SUBSYSTEMS

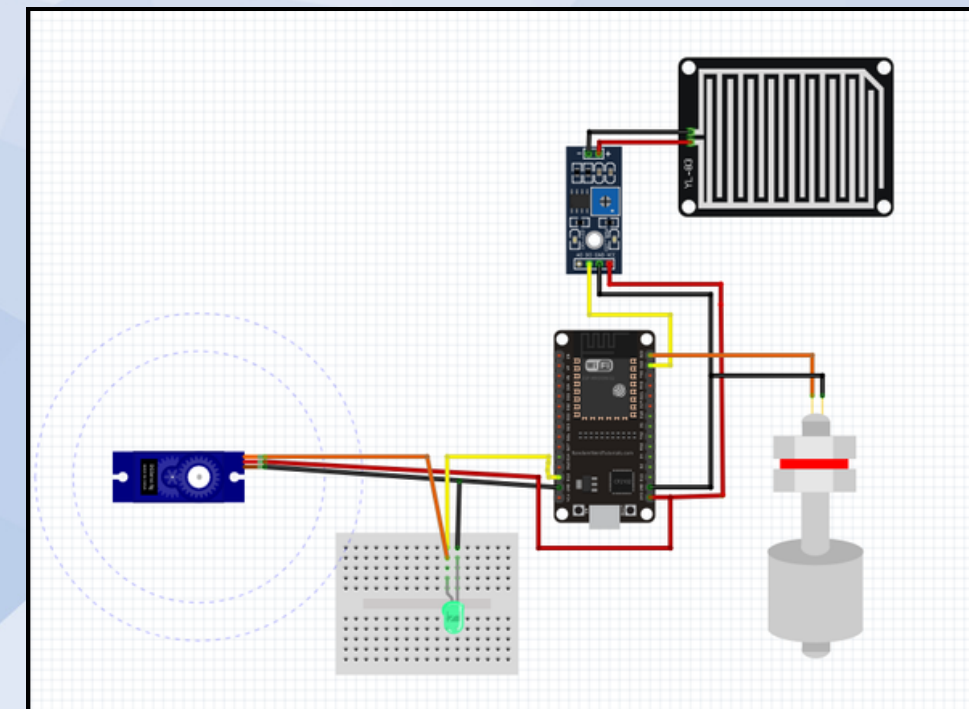
DUAL- AXIS SOLAR TRACKING SYSTEM AND IoT INTEGRATED RAIN ALERT AND MOTORIZED SUN ROOF SYSTEM WITH WATER HARVESTING SYSTEM

- *This system is primarily located on the roof of our prototype as shown and acts as a harvester of sunlight to generate voltage, with the aid of voltage sensors, the accumulated voltage value is displayed.*
- *The raindrop sensor is used as a trigger during rainfall to notify user the current weather, and sunroof is used preventing the plants from overexposure to the sunlight.*
- *A gutter system is installed to channel the rainwater into a separate tank for irrigation usage.*

Schematic solar tracker circuit

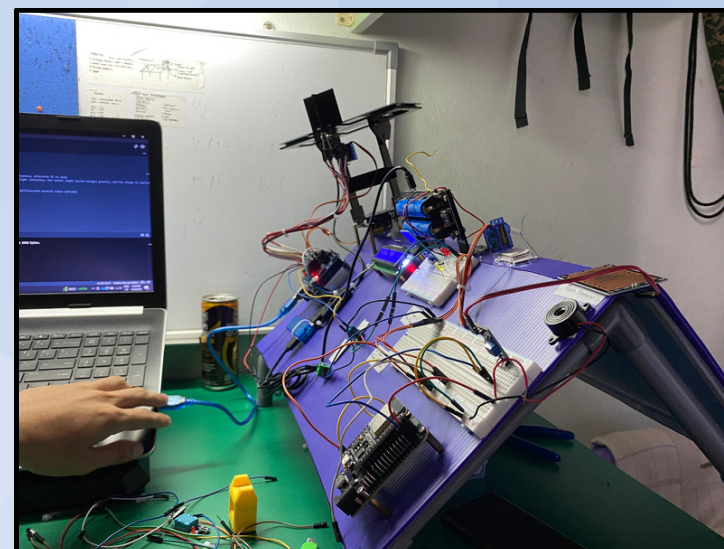
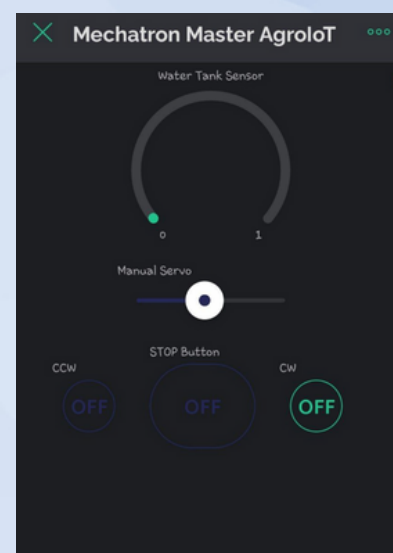


Schematic of rain alert and sun roof circuit



separated model view of whole subsystem

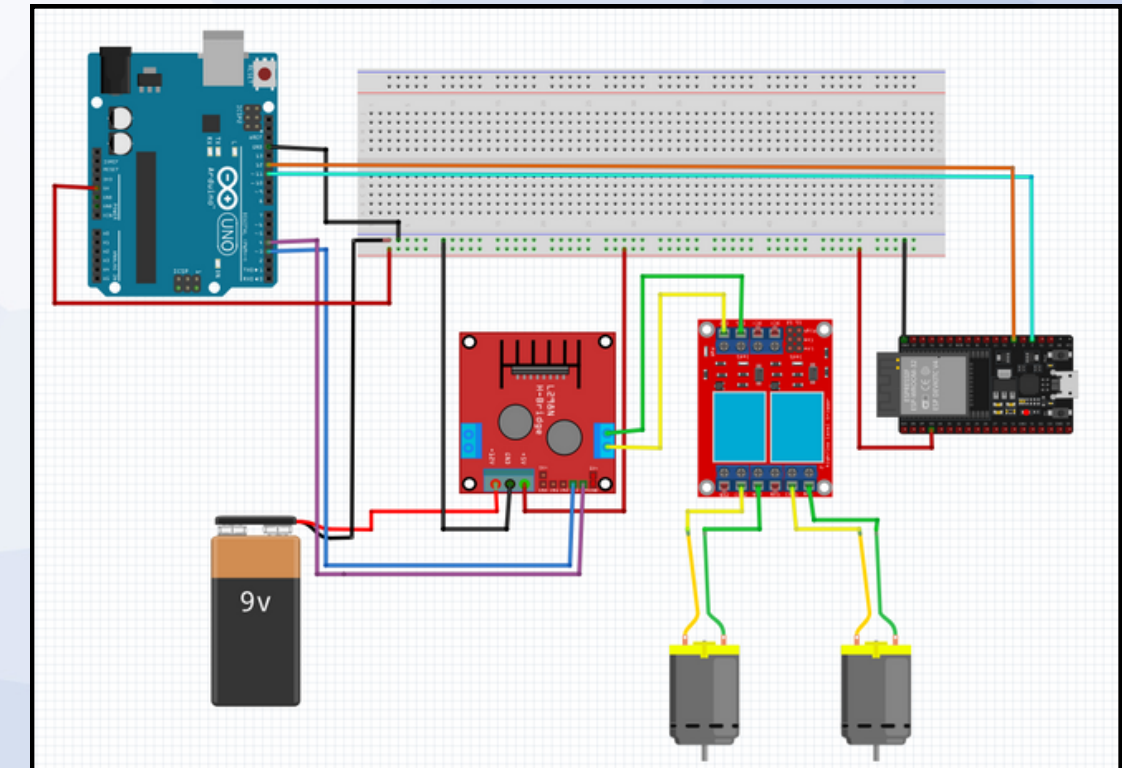
IoT Interface for sun roof control



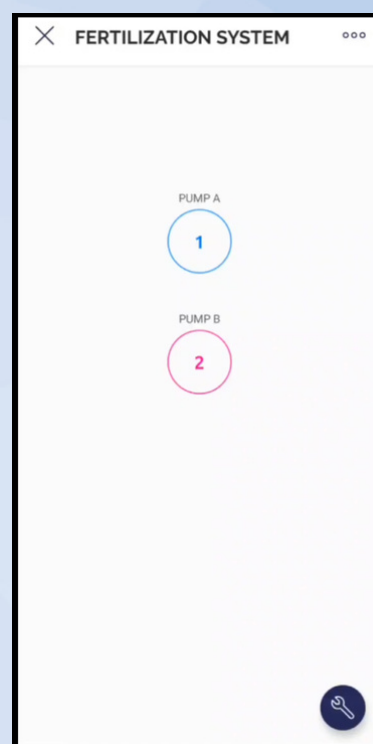
SUBSYSTEMS

IoT INTEGRATED FERTILIZER SYSTEM

- *Plants require fertilizer to maximize growth, therefore to show that we would be able to clarify plant diversity, two different liquid based fertilizers were used for the prototype.*
- *Blynk 2.0 was used as a serial connector and its corresponding mobile app was used to control the activation of the water pump in conjunction with the condition of the plants.*
- *L293 N motor driver was used to control the speed of the DC water pump.*



Schematic of fertilizer circuit



**IoT interface
for controlling
fertilizer pump**

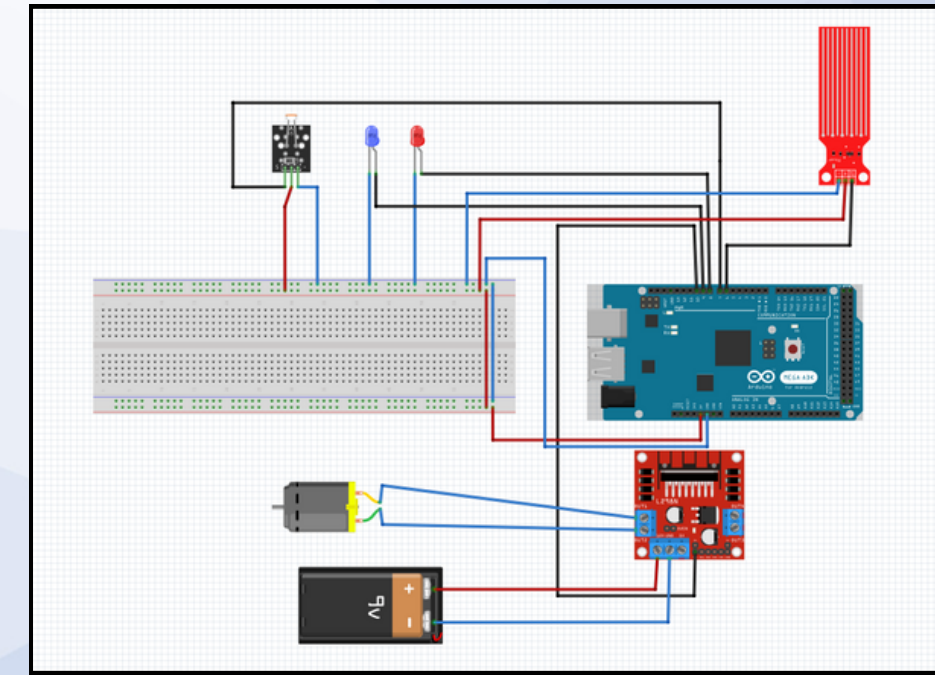


overview of system

SUBSYSTEMS

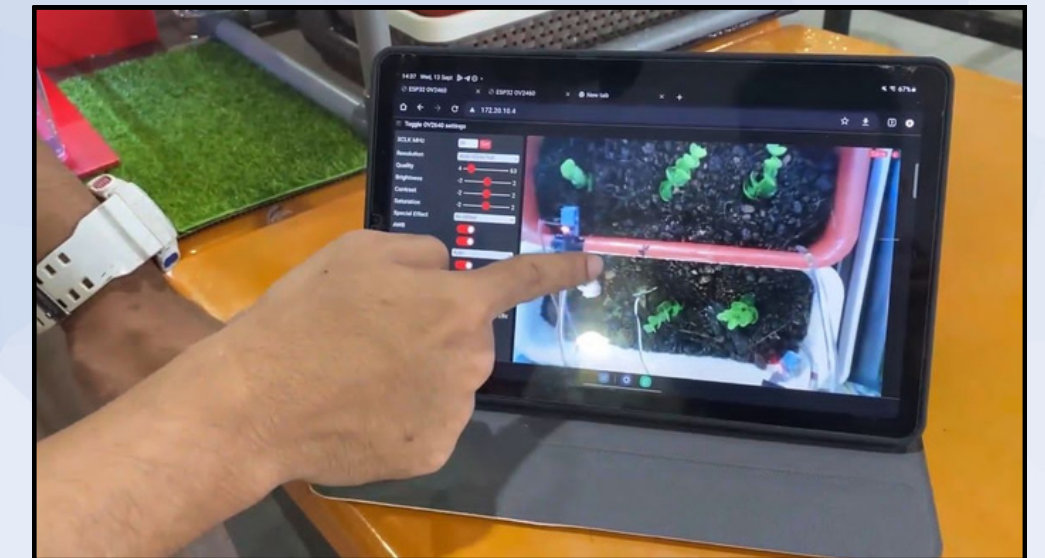
IoT INTEGRATED INSECT TRAP AND MONITORING CAMERA

- *Pests are harmful towards growth of crops. Hence, we added a trap system which detects the movement of pests surrounding the plants.*
- *Apart from that, we utilize the water level sensor in detecting the level of pesticide in the container. The water pump is activated to channel water into the container when the water level sensor is high as it is negatived edged.*
- *The photoresistor sensor is used to activate the corresponding LED to signal for night or day.*
- *The monitoring camera is represented by the esp32-cam to show a live video feed of the area surrounding the plants, hindering it from pests.*



Schematic of subsystem circuit

Monitoring camera



Overview of subsystem



Costing

MOTIVE:

- We decided to pursue this topic for our project as we believe that more advancement in technology could be done and used in the smart agriculture sector and we would like to be the catalyst of that change.*

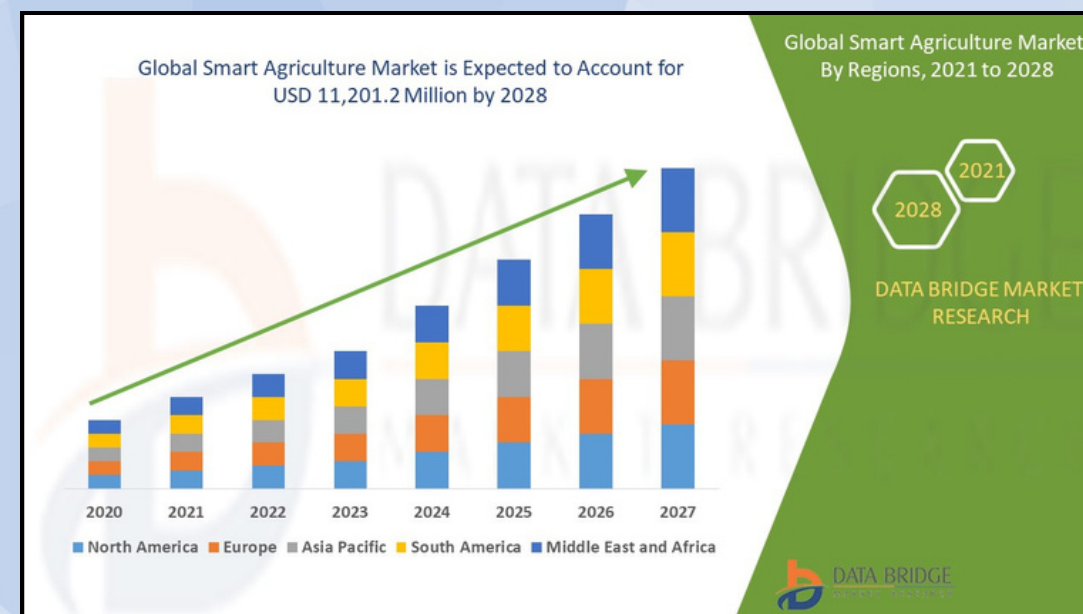
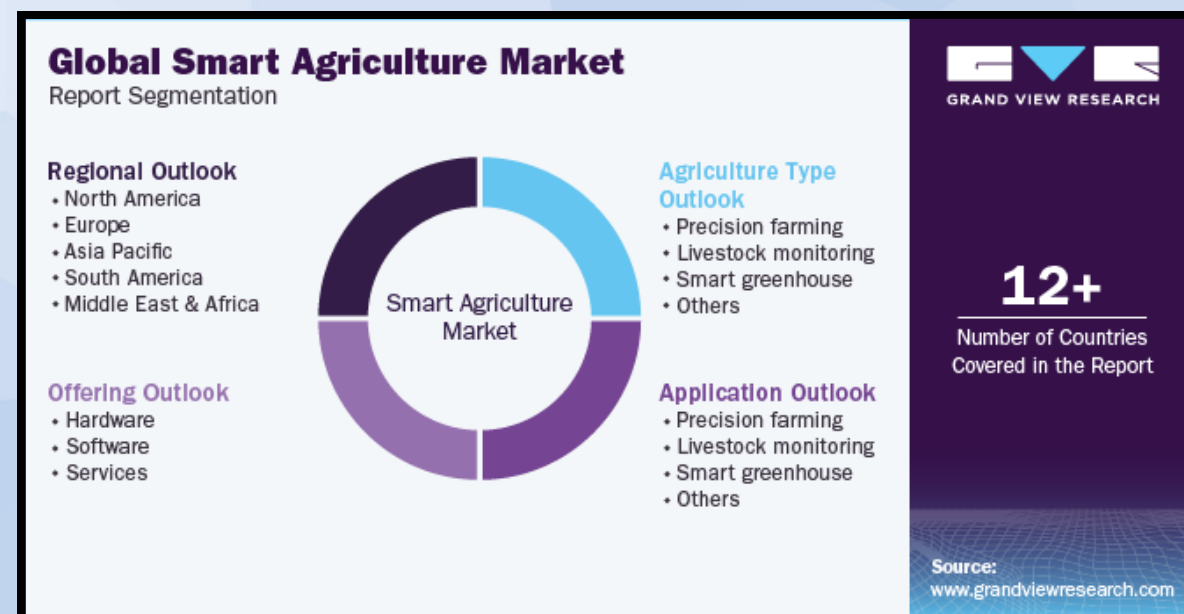
COSTING:

PROTOTYPE COSTING			
COMPONENT	PRICING(RM) PER PCS	QUANTITY	TOTAL PRICE(RM)
ARDUINO NANO(OWN)	15	1	15
ARDUINO UNO	22	3	66
ESP 32 CAM	30	2	60
ESP 32 DEVKIT(OWN)	22	3	66
ESP-01 WIFI MODULE	8	1	8
DC WATER PUMP(OWN)	6	5	30
SERVO MOTOR(OWN)	3	3	9
UNO EXPANSION SHIELD	5	1	5
I2C BLUE 16x2 LED(OWN)	10	2	20
LED'S(OWN)	0.5	3	1.5
PHOTORESISTOR SENSOR	2	5	10
WATER LEVEL SENSOR	2	1	2
SOIL MOISTURE SENSOR	4	2	8
HUMIDITY SENSOR DHT11	3	2	6
RAINDROP SENSOR	3	1	3
VOLTAGE SENSOR	3	1	3
SOLAR SET	150	1	150
5V DUAL RELAY MODULE	10	2	20
L293N MOTOR DRIVER	5	1	5
BREADBOARDS(OWN)	5	6	30
JUMPER WIRES/CABLES	7 per 40 pcs	100	17.5
ARDUINO MEGA	50	1	50
ELECTRIC FLOAT M10	12	1	12
CURRENT SENSOR	7	1	7
18650 3800mAH BATTERY	8	2	16
18650 3800mAH BATTERY GRADE A	13.5	2	27
MATERIALS			53
			700

Total Project Costing

Market Research

- *Based on the latest trends in smart agriculture, livestock and crop owners are in greater need of automation in irrigation systems and monitoring systems and require more accurate technology in dealing with the demand in produce.*
- *The market has grown by 10.30% in the last 5 years and this is promising for upcoming developers of smart agriculture technology as the return is much more promising and worthwhile.*
- *Cultivators realize the potential benefits of growing plants inside a greenhouse, which has led to the development of commercial greenhouses.*
- *Cultivators have shifted from the conventional lighting systems to LED grow lights as the latter can easily be integrated into a CEA setup*



Conclusion

- *As a whole, we have managed to capture the many demands in the current smart agriculture sector by the various subsystems within our prototype. After testing we have managed to tick all the boxes in our problem statement.*
- *If given more time we could enhance the features of our project and raise it to a greater height, making it suitable for any type of smart agriculture, make it be plantation or even livestock rearing.*
- *Even though the prototype may have cost us a large sum, we feel that given the nature of our project and the vision for our project the sum is understandable given the various functions and features that our project provides in countering our problem statements.*

RECAP

- *Our project consists of 4 subsystems*
- *IoT Integrated soil monitoring and irrigation system*
- *IoT Integrated fertilization system*
- *IoT Integrated insect trap and video monitoring*
- *IoT Integrated rain alert and motorized sun roof tracking with dual solar axis harvester system with water harvesting system*

Demo



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Thank you

By:

**MOHAMMAD QAYYUM BIN VARISAI MOHAMMED
AKMAL MIRZA BIN ZAZALI
MUKHLISH BIN MAHMAD
MUHAMMAD AFFAN NUR IMAN BIN AZMAN**

Disokong Oleh

