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SMART TECHNOLOGY APPLICATIONS IN AGRICULTURE

Supervised presentation

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Under supervision of:

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*Valley Higher Institute for Engineering & Technology
Ministry of Higher Education*



Topics

- [Introduction](#)
- [Problems Of Agriculture](#)
- [What's the importance of Agriculture?](#)
- [Smart Irrigation System Advantages](#)
- [Plant Disease Identification System](#)
- [Mobile Application Development](#)
- [Aim and Objective](#)
- [Challenges](#)
- [Diagram](#)
- [Internet of Things \(IOT\)](#)
- [Proposed System Hardware](#)
- [Flowchart](#)
- [Simulation](#)
- [Conclusion](#)



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

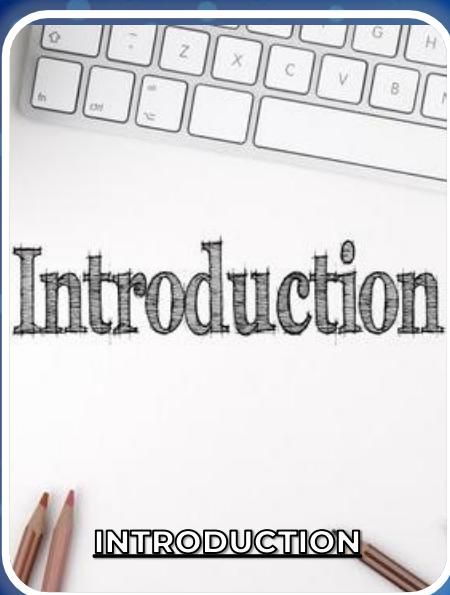
Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Introduction



- agr Agriculture plays a major role in the economy of any country.
- agr Employs roughly one-fourth of the labor force.
- agr Monsoon rains are insufficient
- agr Water saving compared to regular irrigation



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

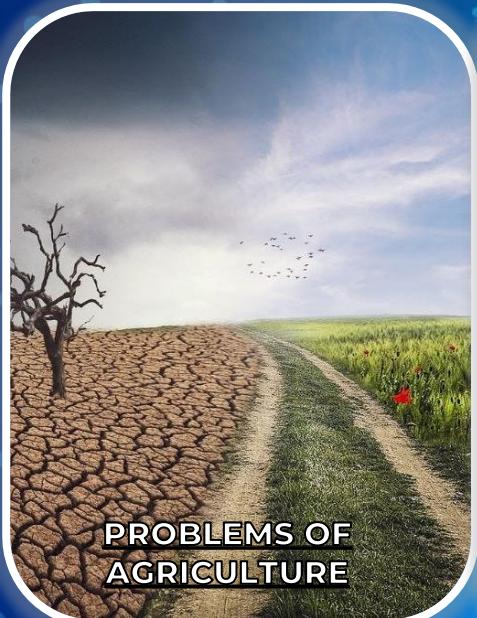
Flowchart

Simulation

Conclusion



Introduction



PROBLEMS OF AGRICULTURE



What's the importance of Agriculture?



Smart Irrigation System Advantages



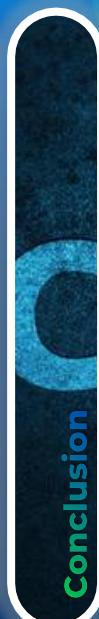
Plant Disease Identification System



Mobile Application Development



Aim and Objective



Conclusion



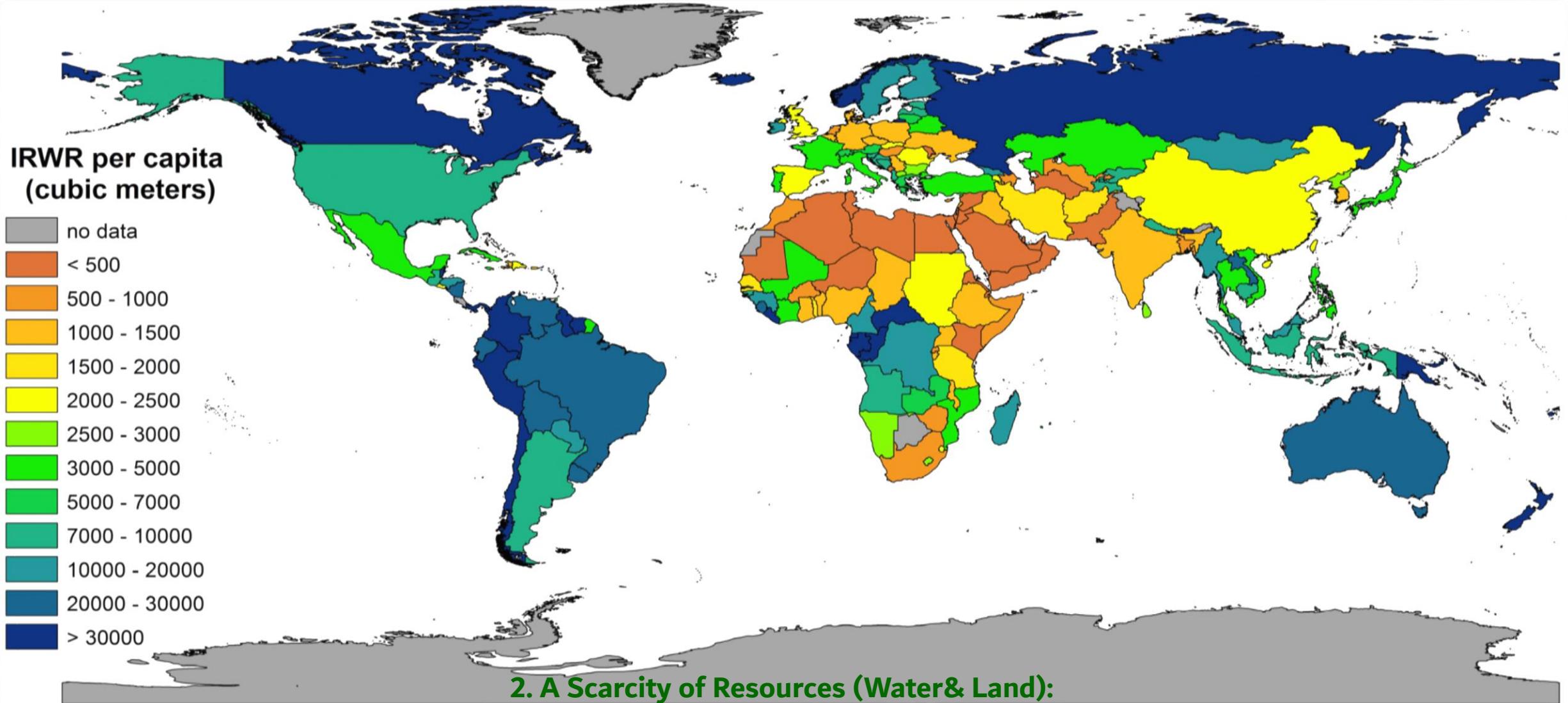
Problems Of Agriculture



1. Climate Change:



Problems Of Agriculture



Topics



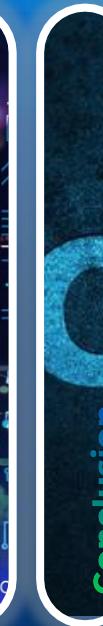
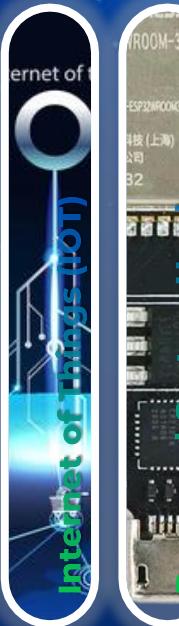
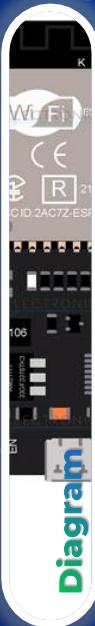
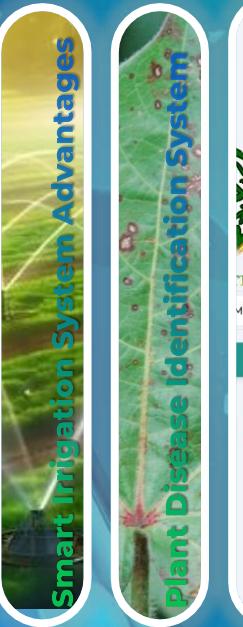
Introduction

Problems Of Agriculture



Intr

Introduction

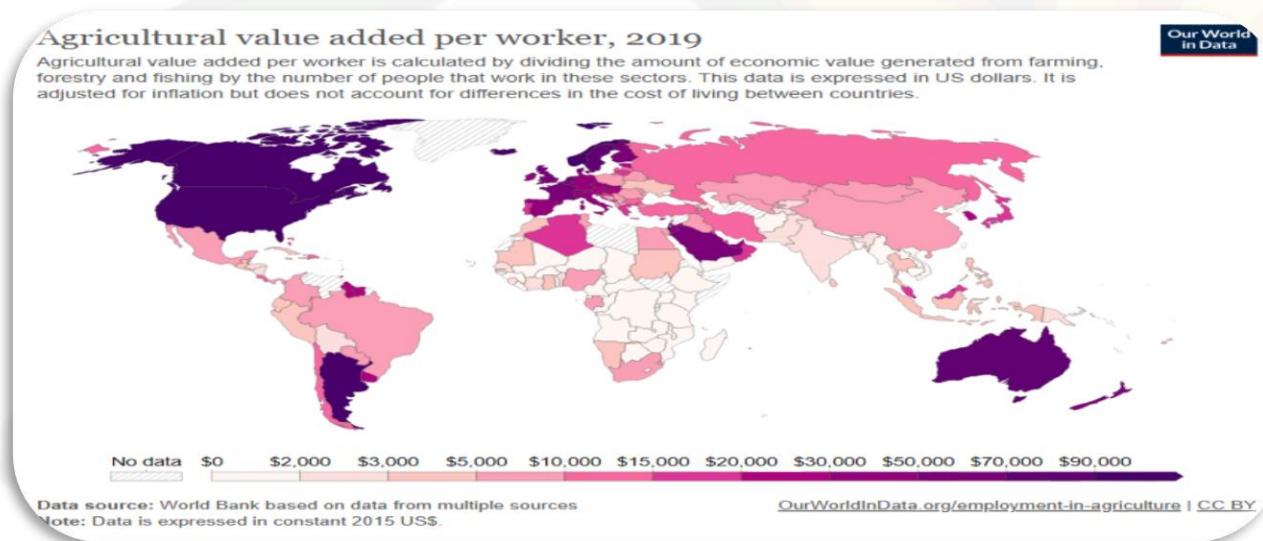


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What's the importance of Agriculture?



- agr Agriculture plays a vital role in the growth of any state
- agr The primary sector of an economy comprises agricultural .
- agr Agriculture provides raw materials for many industries which form the backbone of the nation.
- agr Over one-fourth of the world's workers are employed in agriculture





Topics

Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

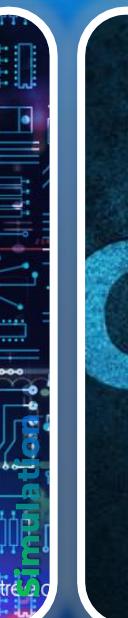
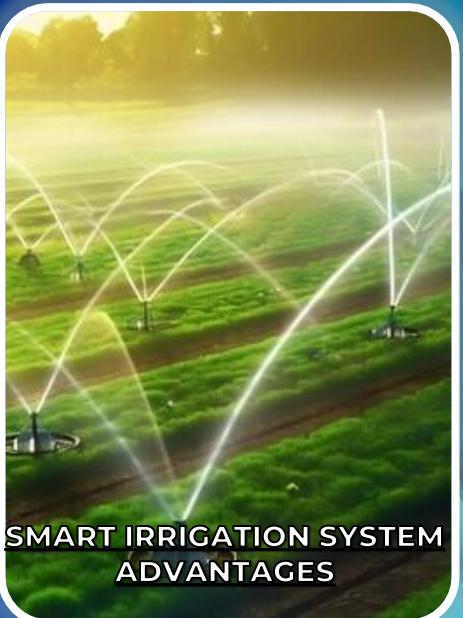
Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion





Smart Irrigation System Advantages

✳ **Save manpower**

✳ **Save water**

✳ **Remote management**

✳ **Fine irrigation & Intelligent control**





Topics

Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Introduction



Problems of Agriculture



What's the importance of Agriculture?



Smart Irrigation System Advantages



PLANT DISEASE
IDENTIFICATION SYSTEM



Mobile Application Development



Aim and Objective



Internet of Things (IOT)



Proposed System Hardware



Flowchart



Simulation



Conclusion

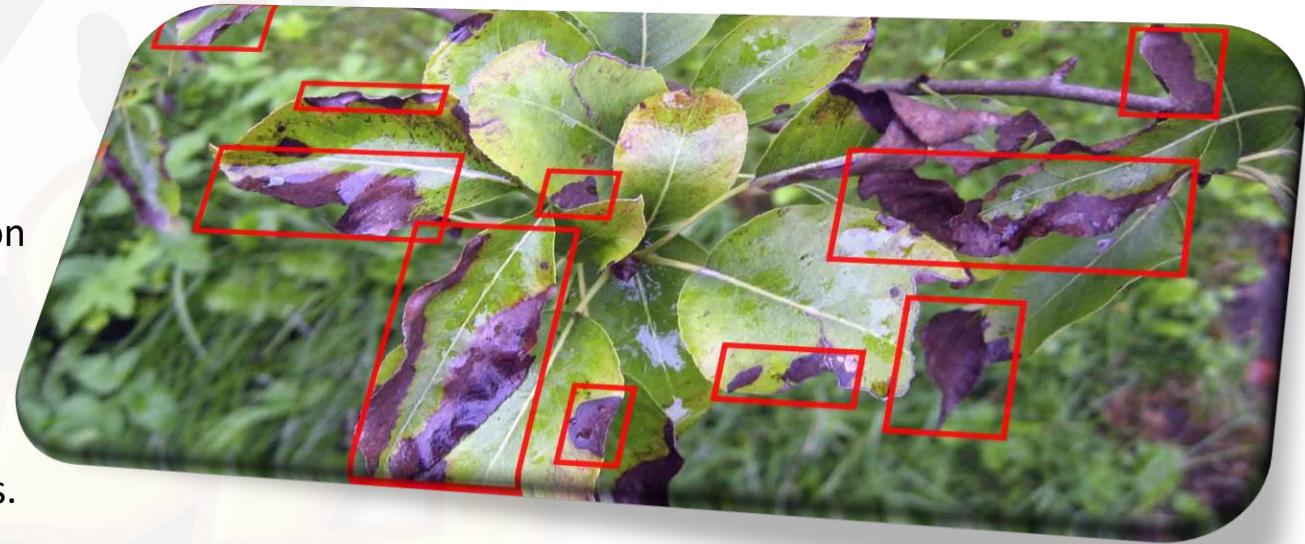


Plant Disease Identification System



1. Introducing a Revolutionary Plant Disease Identification System:

- **Innovation:** Utilizing AI for rapid and accurate disease detection.
- **Process:** data collection, model development, and training.
- **Integration:** Implementing the system into a mobile application for accessibility.
- **Advantages:** Empowering farmers with timely disease identification for better crop management and improved yields.
- **Impact:** Transforming agriculture for enhanced food security and sustainability globally.



Plant Disease Identification System



2. Plant Disease Identification Using Gemini AI:

- ▣ **Cutting-Edge Technology:** Introduction of Gemini AI for plant disease identification.
- ▣ **Accurate Detection:** How Gemini AI enhances accuracy in identifying plant diseases.
- ▣ **Revolutionizing Plant Disease Identification:** Exploring the transformative impact of Gemini AI on plant disease identification.
- ▣ **Harnessing the Power of AI:** Utilizing advanced AI technology to revolutionize the agricultural sector.
- ▣ **Potential Benefits:** the potential benefits of Gemini AI in improving crop management and yields.



Plant Disease Identification System



3. The Development and Training Process of an Advanced GEMINIAI Model :

- ▣ **Development and Training Process:** Stages from design to training, including data collection and optimization.

- ▣ **Data Collection:** Importance of comprehensive data collection.

- ▣ **Future Outlook:** Considering future advancements and improvements for GEMINIAI



Plant Disease Identification System



4. Integration with Mobile Application :

- ❖ **Seamless Integration:** AI model integrated into mobile app for on-the-go plant disease detection.
- ❖ **Convenience and Accessibility:** Users access disease identification anytime, anywhere.
- ❖ **User-Friendly Interface:** Easy interaction for effective management.
- ❖ **Instant Results:** Real-time recommendations for plant disease control.
- ❖ **Wide Adoption:** Accessible across devices for broad user reach.
- ❖ **Compatibility:** Works across different mobile platforms for universal use.
- ❖ **Enhanced Features:** Additional functionalities for improved user experience.

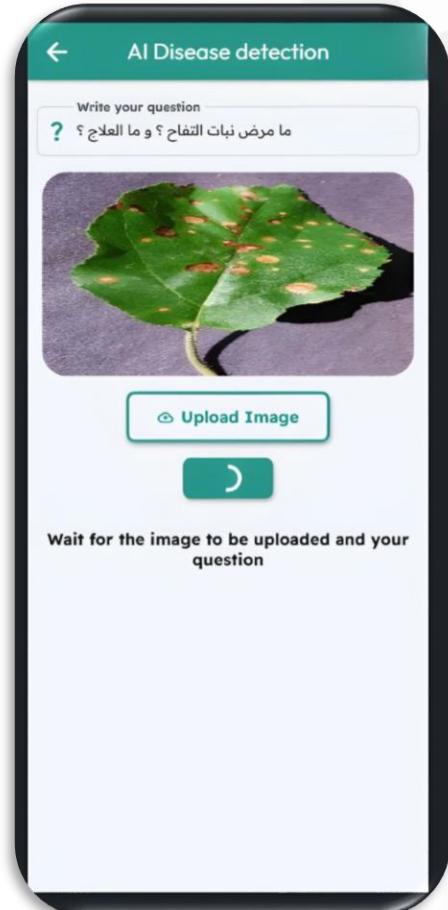


Plant Disease Identification System

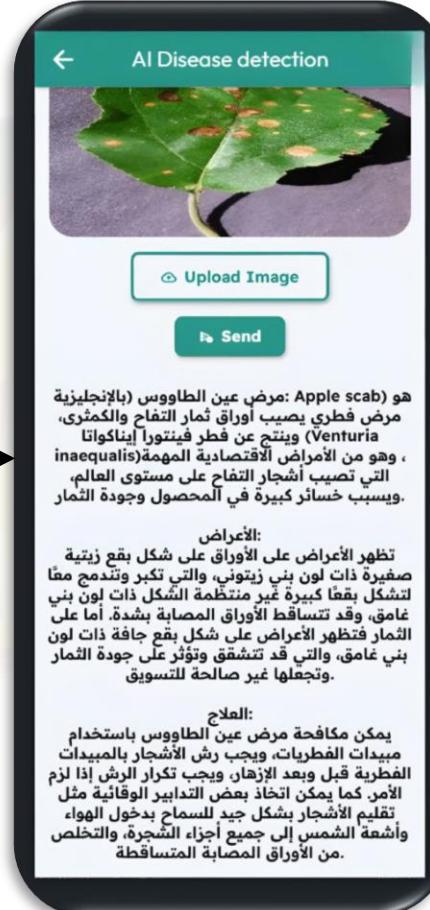


5. Application to Plant Disease Identification System :

1. Chat page with pictures with artificial intelligence



Identify the disease and answer the question



الأعراض:
تظهر الأعراض على الأوراق على شكل بقع زيتية صفيفة ذات لون بنى رمادي، والتي تكبر وتندمج معًا لتشكل بقعًا كبيرة غير منتظمة الشكل ذات لون بنى غامق، وقد تسقط الأوراق المصابة بشدة. أما على الشمار فتظهر الأعراض على شكل بقع جافة ذات لون بنى غامق، والتي قد تتشقق وتؤثر على جودة الثمار وتجعلها غير صالحة للتسويق.

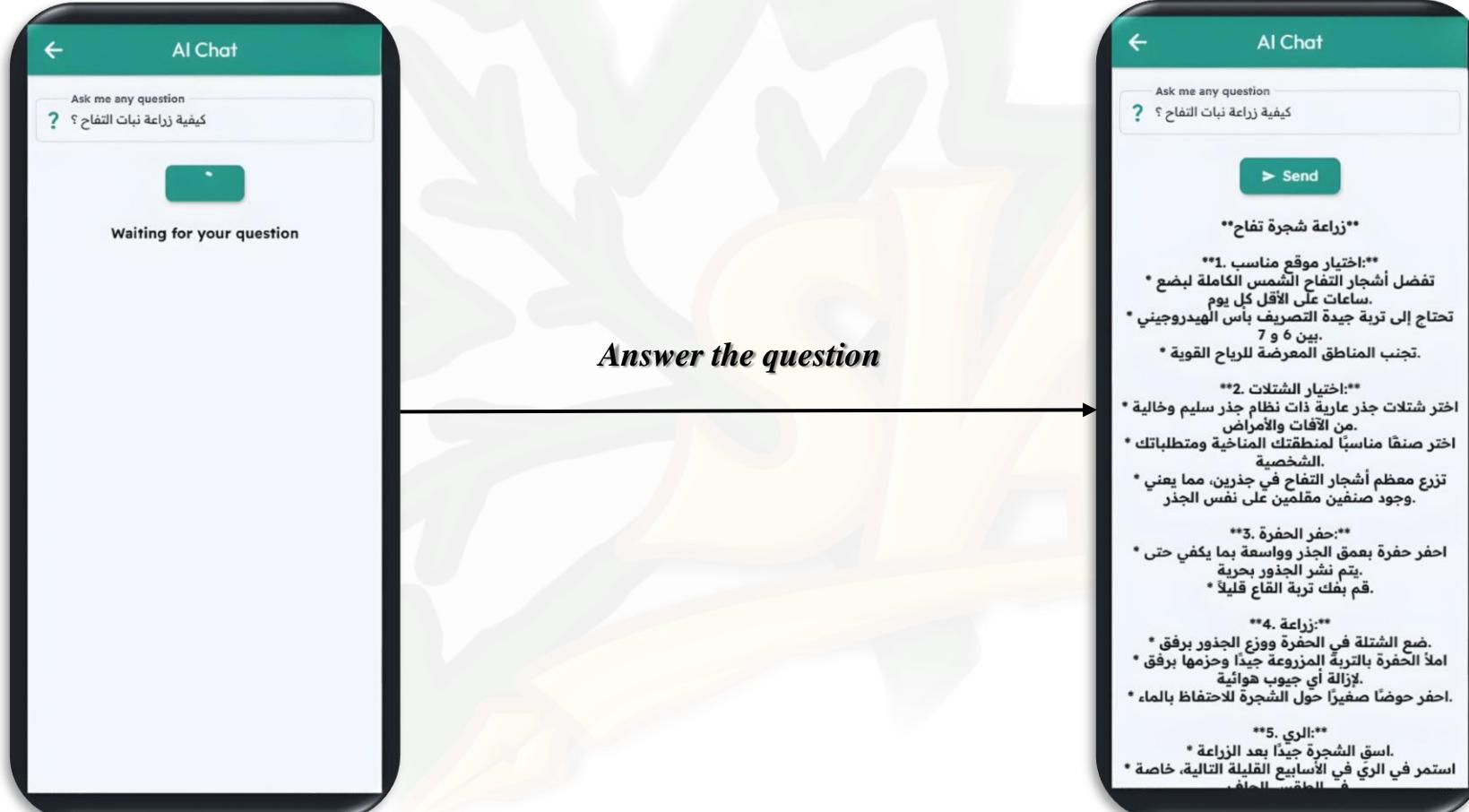
العلاج:
يمكن مكافحة مرض عين الطاووس باستخدام مبيدات الفطريات قبل وبعد الإزهار، ويجب تكرار الرش إذا لزم الأمر. كما يمكن اتخاذ بعض التدابير الوقائية مثل تقليل الأشجار بشكل جيد لسماح بدخول الهواء وأشعة الشمس إلى جميع أجزاء الشجرة، والتخلص من الأوراق المصابة المتتساقطة.

Plant Disease Identification System



5. Application to Plant Disease Identification System :

2. Chat page with artificial intelligence

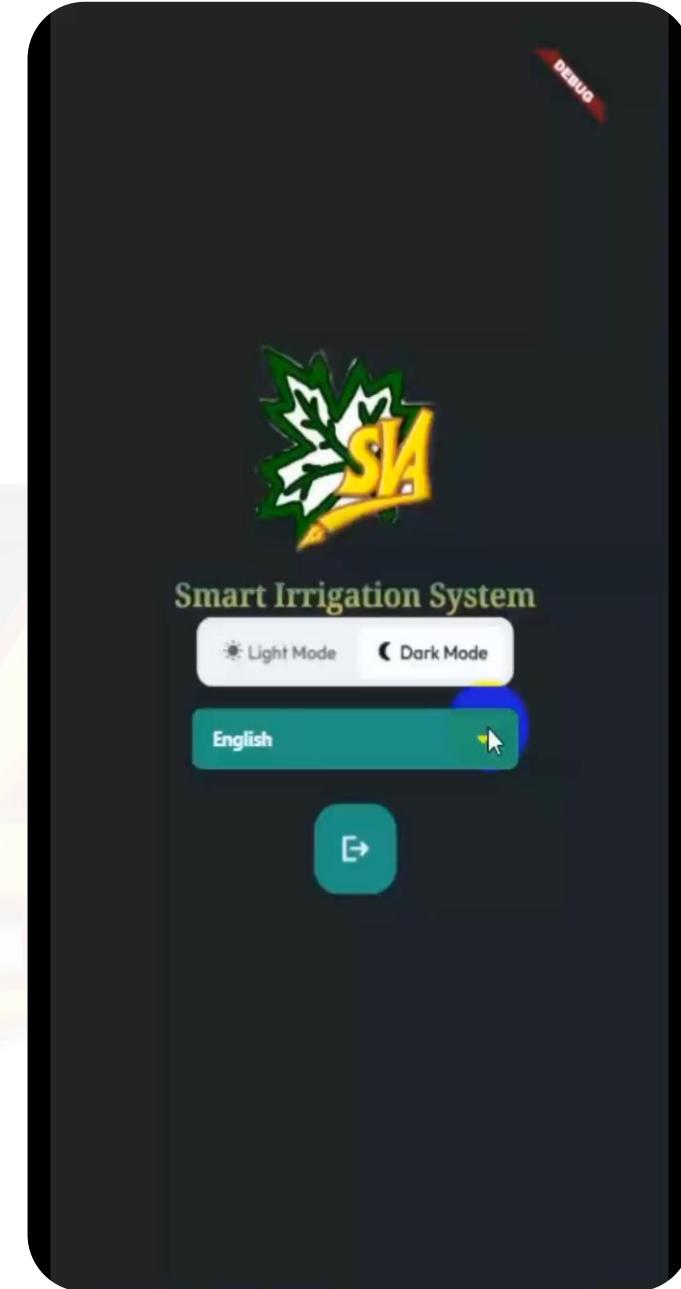


Plant Disease Identification System



5. Application to Plant Disease Identification System :

3. Practical application within the application





Topics

Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Mobile Application Development



1. Flutter & FlutterFlow for App Development:

- **Introduction to Flutter:** Flutter as a UI toolkit for cross-platform development.
- **FlutterFlow:** Visual design tool specifically for Flutter.
- **Benefits of Using Flutter & FlutterFlow Together:** Advantages of combining Flutter and FlutterFlow for efficient cross-platform app development.

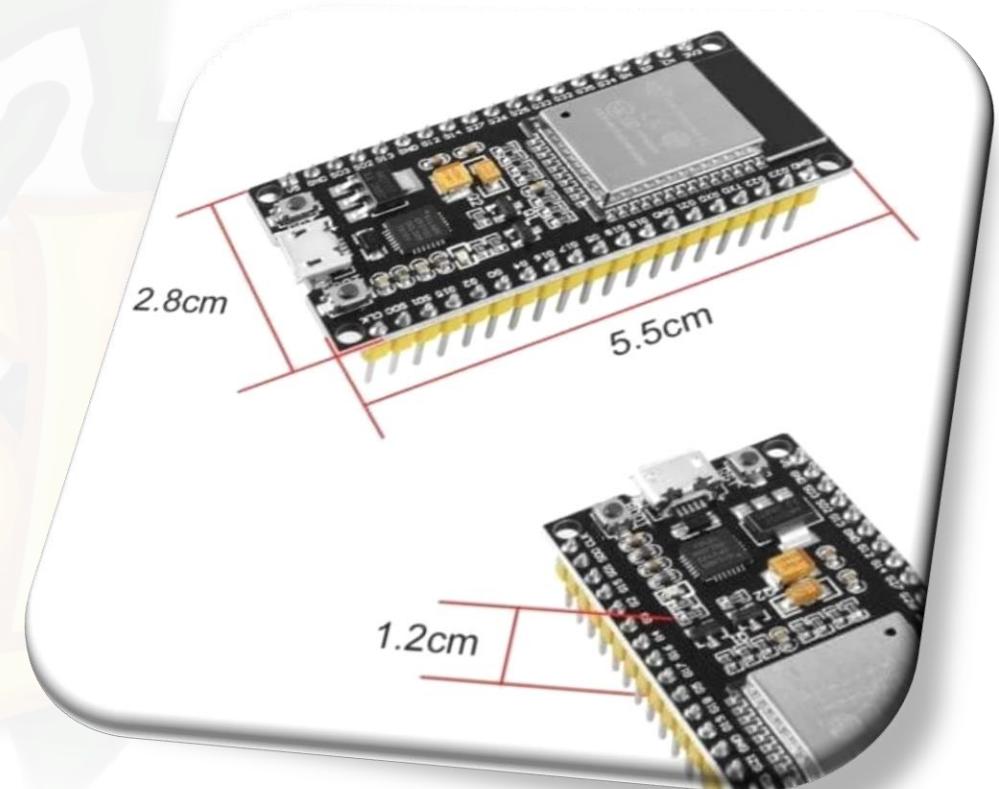


Mobile Application Development



2. User Interface Design with ESP32 WROOM 30-pin:

- **ESP32 WROOM 30-pin Capabilities:** The capabilities of ESP32 WROOM 30-pin microcontroller for user interface design.
- **Designing Intuitive User Interfaces:** Techniques for creating user-friendly and intuitive interfaces for ESP32-based applications.
- **Integration of ESP32 with Flutter:** Exploring how to integrate ESP32 with Flutter framework to enhance user interface and user experience (UI/UX).



Mobile Application Development



3. Functionality and Features of the Mobile Application:

Basic Features of the Application:

- IoT system integration for data collection and monitoring.
- Plant disease identification powered by Gemini AI for accurate diagnosis.

Unique Functionality Enabled by FlutterFlow:

- Visual design tool for rapid prototyping and UI development.
- Streamlined UI creation process, enhancing efficiency and flexibility.



Mobile Application Development



4. Backend Integration with Cloud Services :

➤ Role of Firebase in Backend Services:

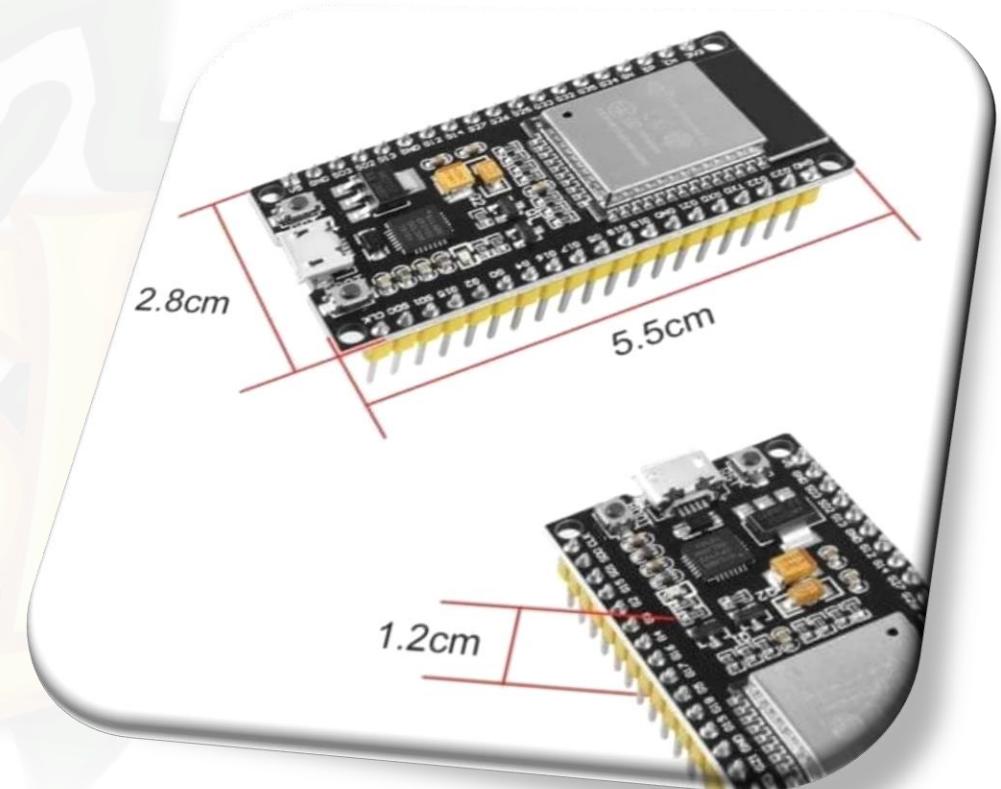
- Firebase serves as a comprehensive backend platform offering various services like database, authentication, and hosting.
- It facilitates real-time data synchronization and scalable cloud storage.

➤ ESP32 WROOM 30-pin as an IoT Device:

- ESP32 WROOM 30-pin is utilized as an IoT device for data sensing, collection, and transmission.
- It enables connectivity to the cloud for seamless data exchange and remote monitoring.

➤ Seamless Integration with Firebase:

- Integration with Firebase allows for effortless handling of real-time data streams.
- Firebase's APIs enable easy implementation of features like data synchronization and push notifications for enhanced user experience.

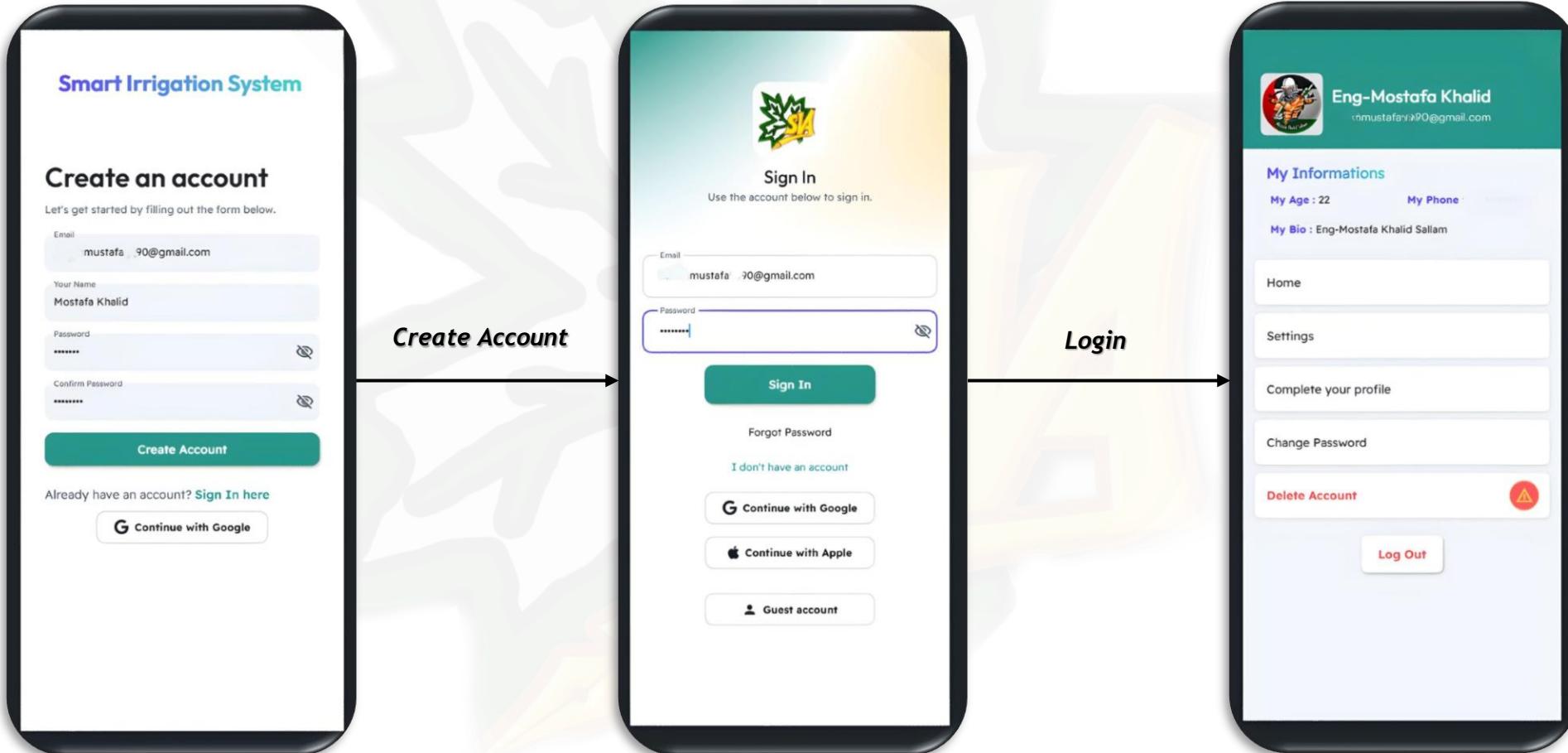


Mobile Application Development



5. Application to Mobile Application Development :

1. Account login and registration process

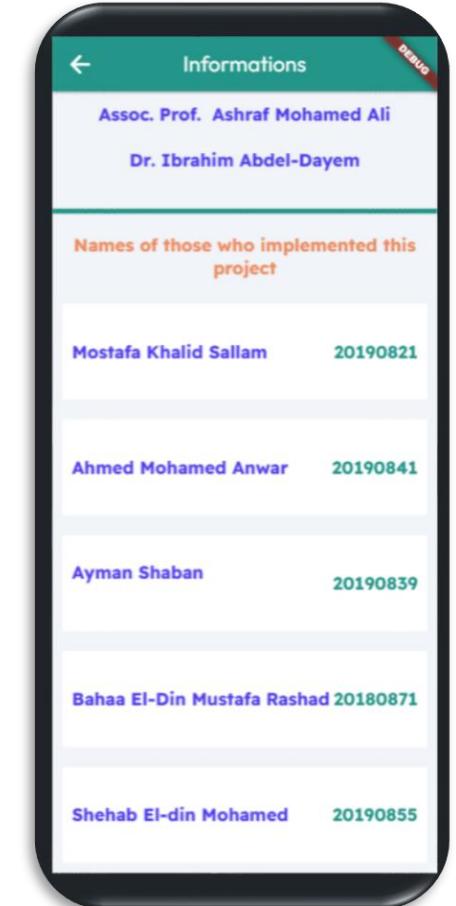
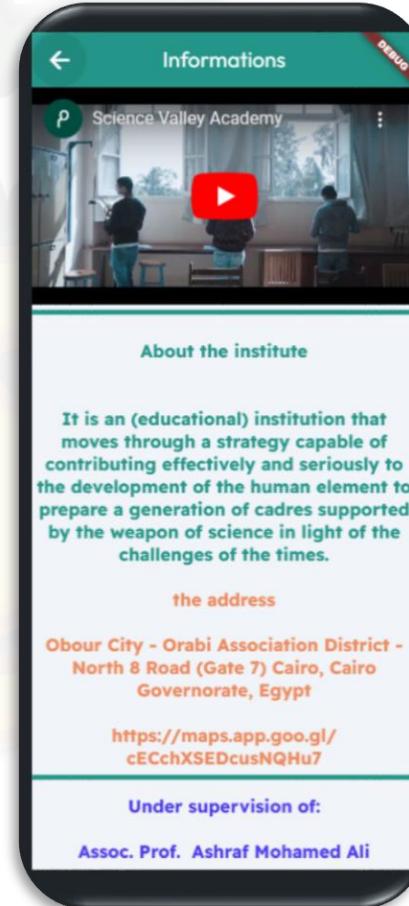
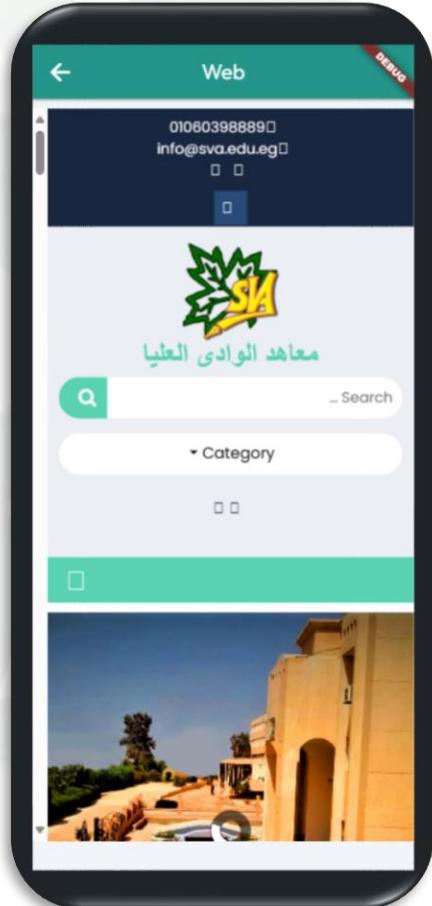
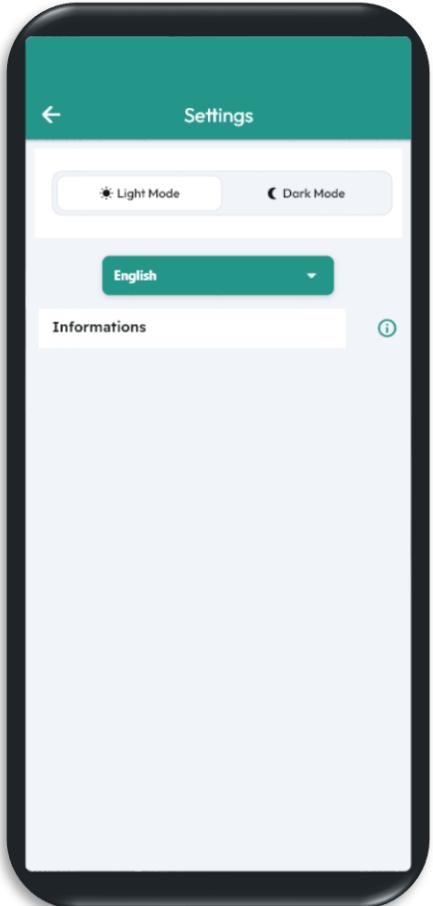


Mobile Application Development



5. Application to Mobile Application Development :

2. Additional pages in the project



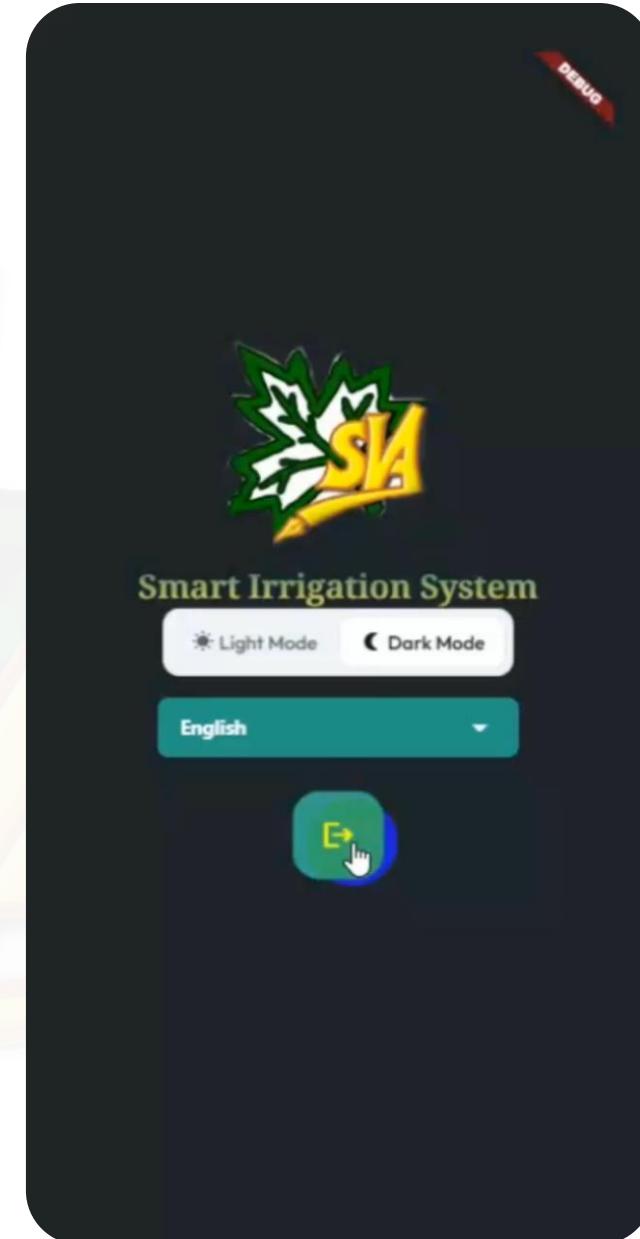
Mobile Application Development

DEBUG



5. Application to Mobile Application Development :

3. Practical application within the application





Topics

Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Aim and Objective



1. The main purpose:

- ✿ create a NodeMCU ESP32 based device that can also communicate with the Sensors.
- ✿ helps us monitor humidity, temperature, and irrigation conditions when the humidity is below the level.
- ✿ There is no unplanned water, so a lot of water can be saved.



Smart Irrigation System Advantages



2. Objective:

- ﴿ Saving farmers' time, money and strength through smart irrigation systems is the main goal of the project.
- ﴿ Water saving is also an important feature because it is necessary to reduce water loss and maximize the efficiency of use.
- ﴿ Power consumption must be monitored.



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Challenges



1. Life challenges:

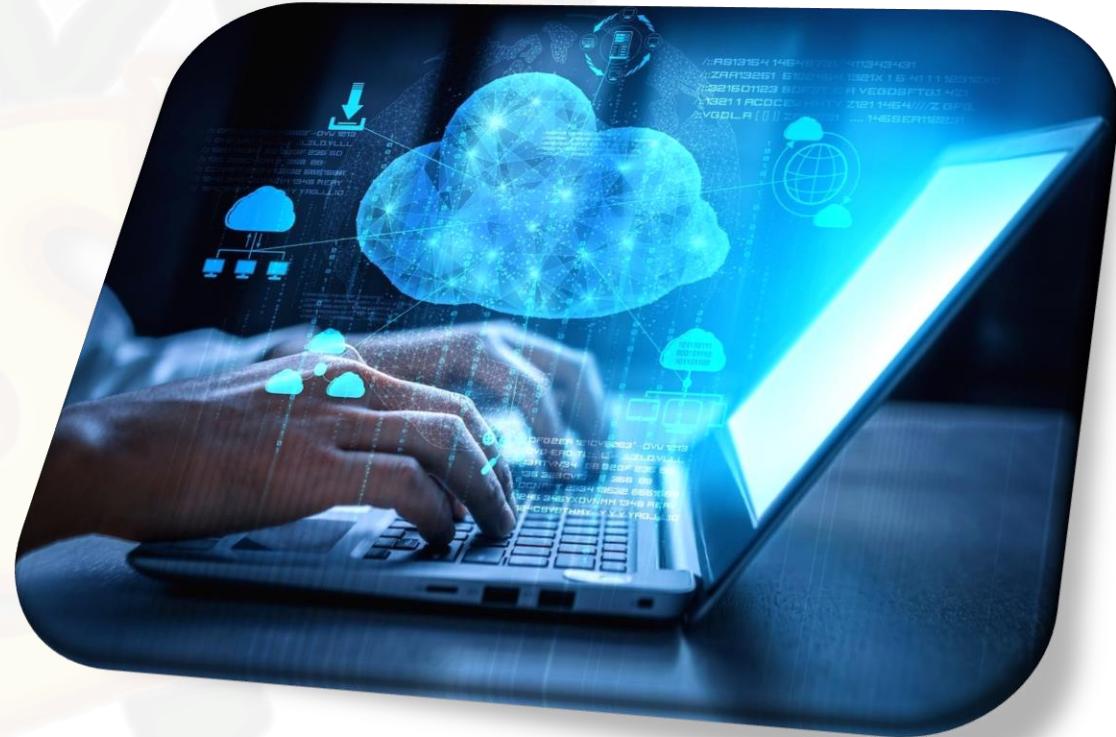
In our daily lives, water is very important to us. It is considered individuals, creatures, plants, etc. That's it, water shortage now has become one of the most serious problems in the world. There should be a solution to this kind of problem. It is water protection.



Challenges

1. Technical challenges:

- 1- Integration between sensors
- 2- Make the project (IOT) & Mobile Application
- 3- Upload the project to a suitable cloud platform
- 4- Protect the project (make the project protected against water)
- 5- Solar system
- 6- Cost



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Introduction



Problems Of Agriculture



What's the importance of Agriculture?



Smart Irrigation System Advantages



Plant Disease Identification System



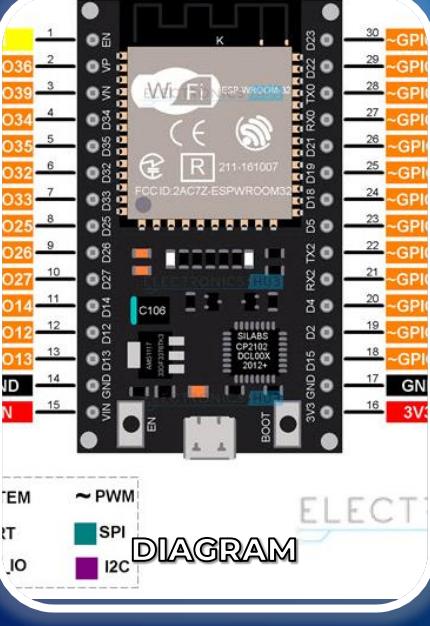
Mobile Application Development



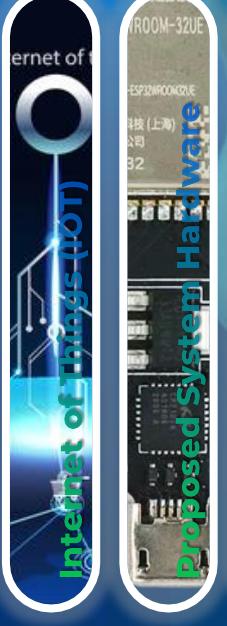
Aim and Objective



Challenges



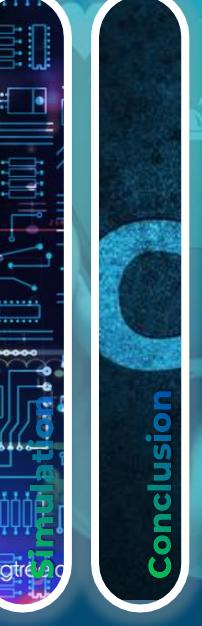
DIAGRAM



Internet of Things (IOT)



Proposed System Hardware



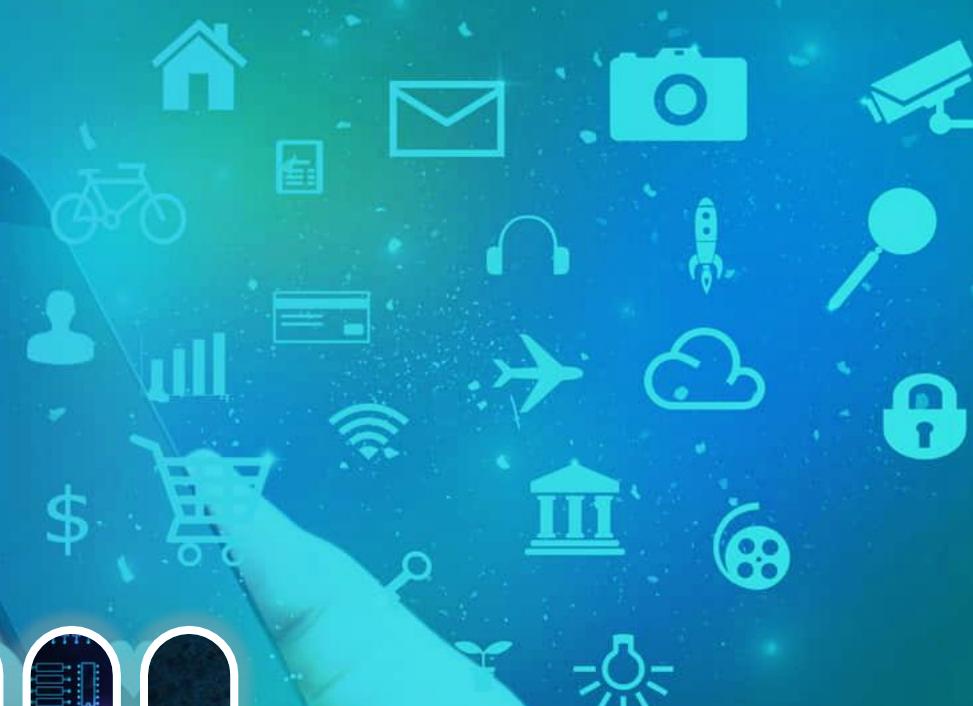
Flowchart



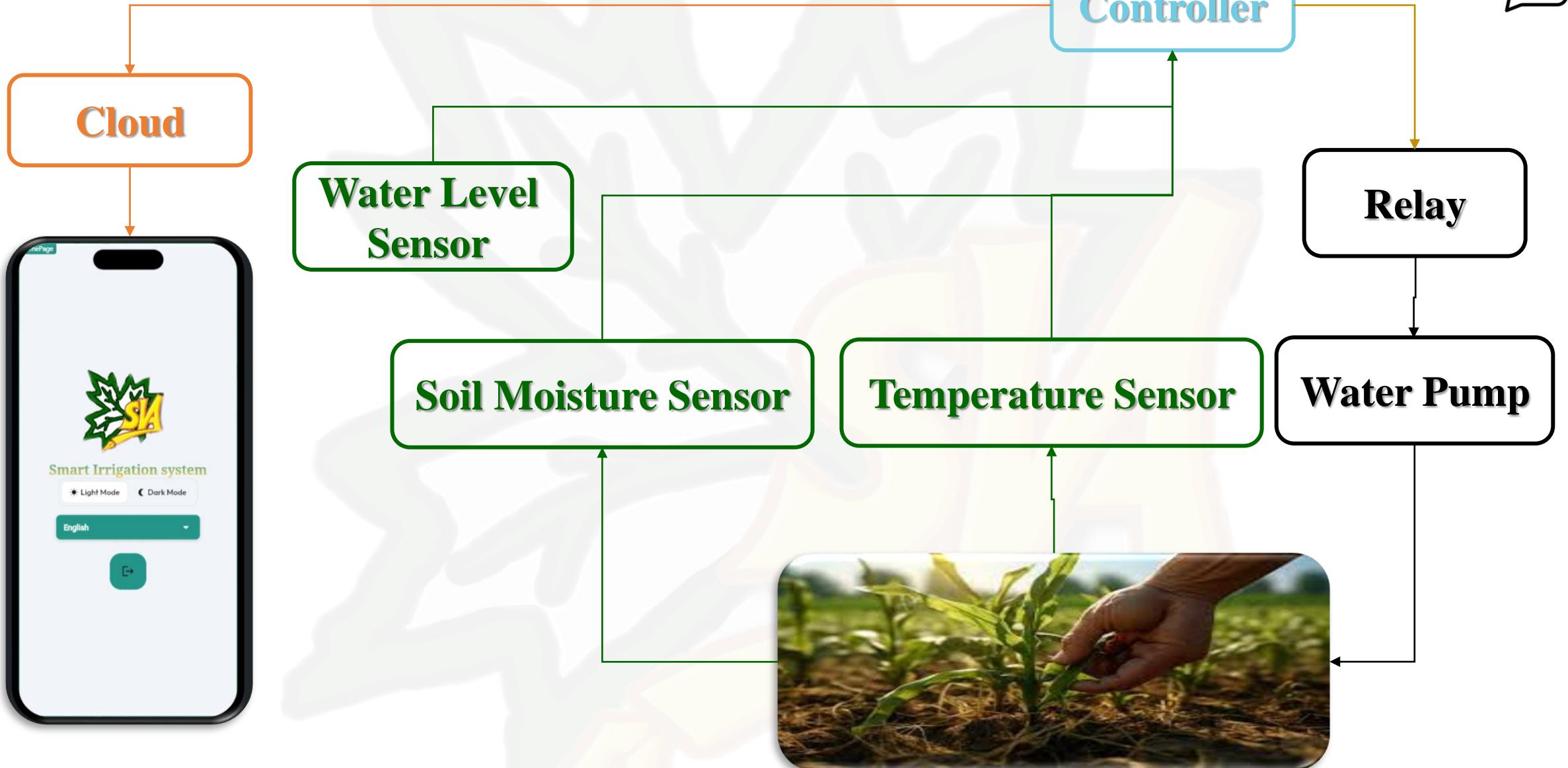
Simulation



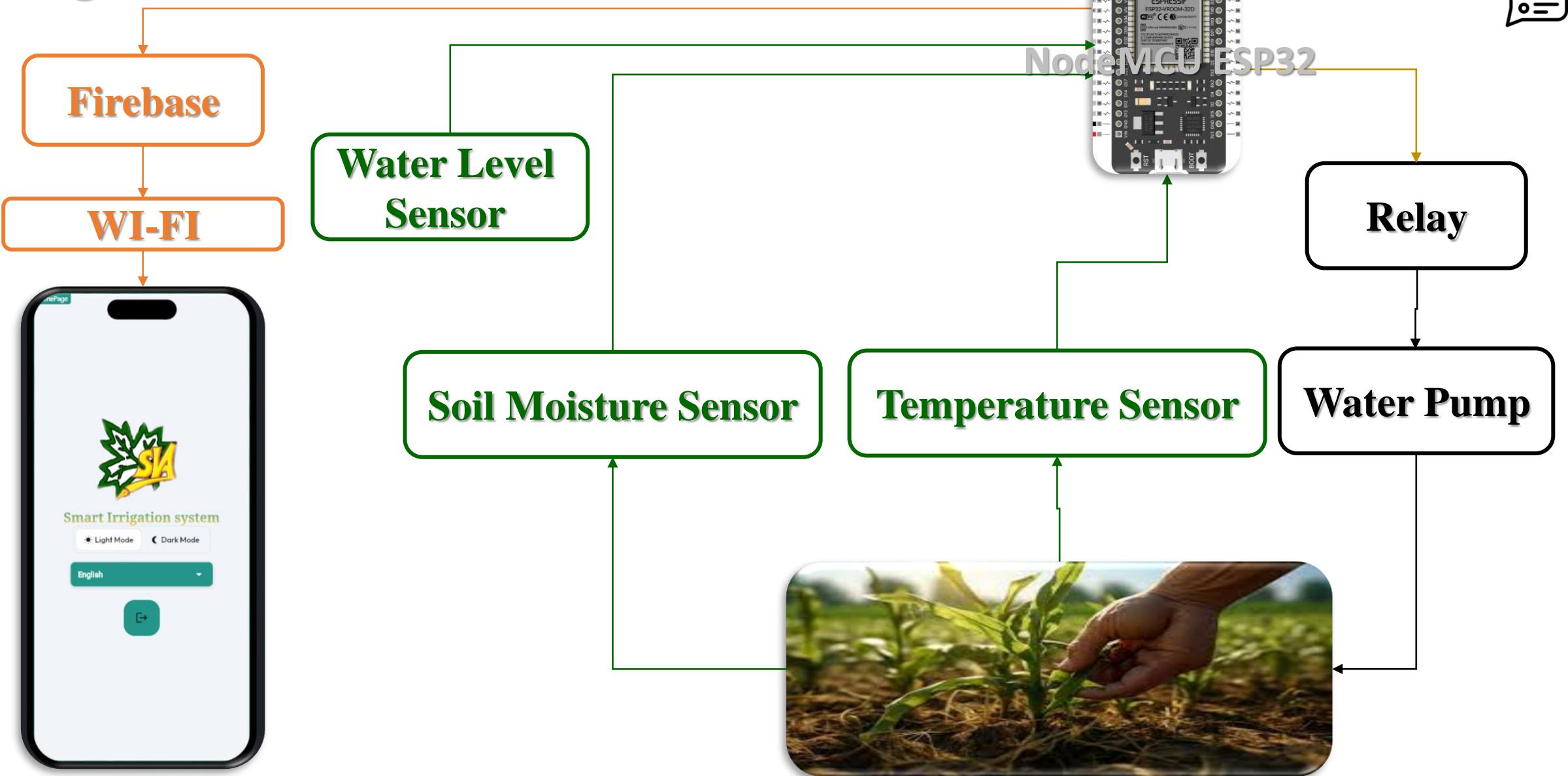
Conclusion



Diagram



Diagram



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Intr

Introduction



Problems of Agriculture



What's the importance of Agriculture?

Smart Irrigation System Advantages



Plant Disease Identification System



Mobile Application Development



Aim and Objective



Challenges



Diagram



INTERNET OF THINGS (IOT)



Proposed System Hardware



Flowchart



Simulation



Conclusion



Internet of Things (IOT)



1. What is IoT?

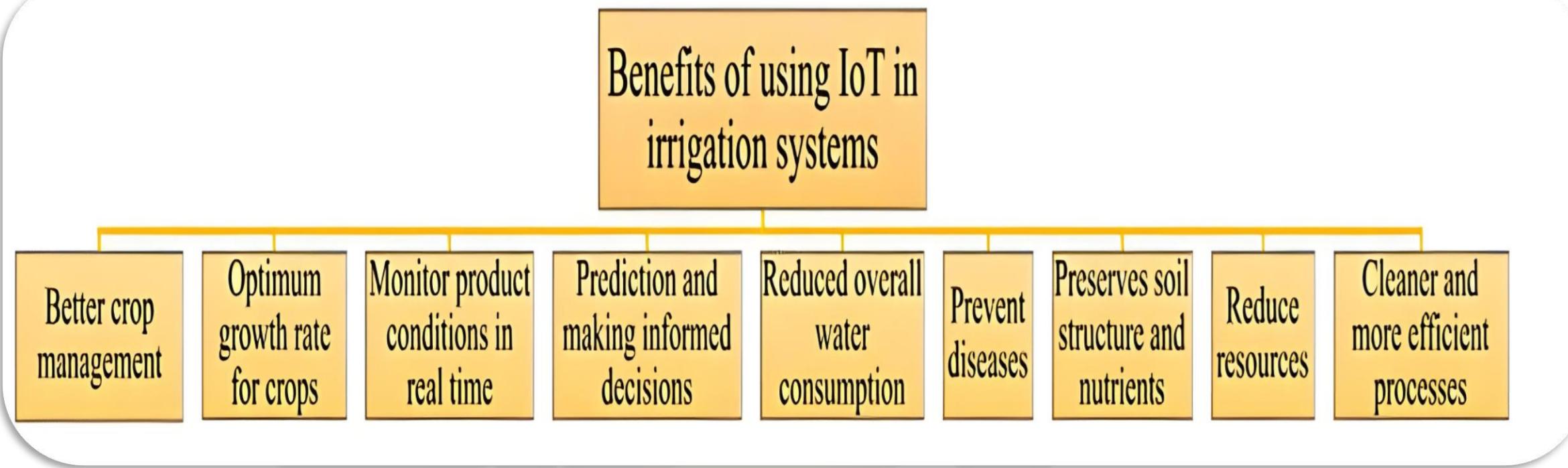
The Internet of Things (IoT) describes an emerging trend where many embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights.

Cheap cloud computing power and increased device connectivity are enabling this trend.





2. Benefits of IoT System in Irrigation:



Internet of Things (IOT)



3. IOT using FireStore (FireBase) :

The screenshot shows the Google Cloud Firestore interface for a database named "smart irrigation". The left sidebar has a dark theme with icons for Data, Rules, Indexes, Usage, and Extensions. The main area shows a collection named "users" with a sub-collection "grSqJGik3qg7Nzah01vflU2vMeCf2". This document contains the following fields:

- Age: "22"
- Bio: "Eng - Mostafa Khalid Sallam"
- created_time: "June 14, 2024 at 5:05:04 PM UTC+3"
- display_name: "Mostafa Khalid Sallam"
- email: "mostafakhalidsallam@gmail.com"
- photo_url: "https://firebasestorage.googleapis.com/v0/b/sm... v77nzz.appspot.com/o/users%2FgrSqJGik3qg7Nzah01vflU2vMeCf2%2falt=media&token=97ecf8fb-142e-4706-9075-0a71c7808033"
- uid: "grSqJGik3qg7Nzah01vflU2vMeCf2"

Internet of Things (IOT)



3. IOT using FireStore (FireBase) :

The screenshot shows the Google Cloud Firestore interface for a project named "Smart irrigation". The left sidebar contains navigation icons and a list of databases. The main area displays a hierarchical database structure under the "Cloud Firestore" tab:

- (default)
- sensors
 - + Start collection
 - sensors
 - + Add document
 - users
- sensors
 - + Add document
- esp32
 - + Start collection
 - + Add field

The "esp32" collection contains the following fields and values:

- humidity: 45
- ledPin: true
- ledStripState: false
- pumpState: true
- soil_moisture: 0
- temperature: 33.56
- water_level: 0



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Intr

Introduction



Problems of Agriculture



What's the importance of Agriculture?



Smart Irrigation System Advantages



Plant Disease Identification System



Mobile Application Development



Aim and Objective



Challenges



Internet of Things (IOT)



Flowchart



Simulation



Conclusion

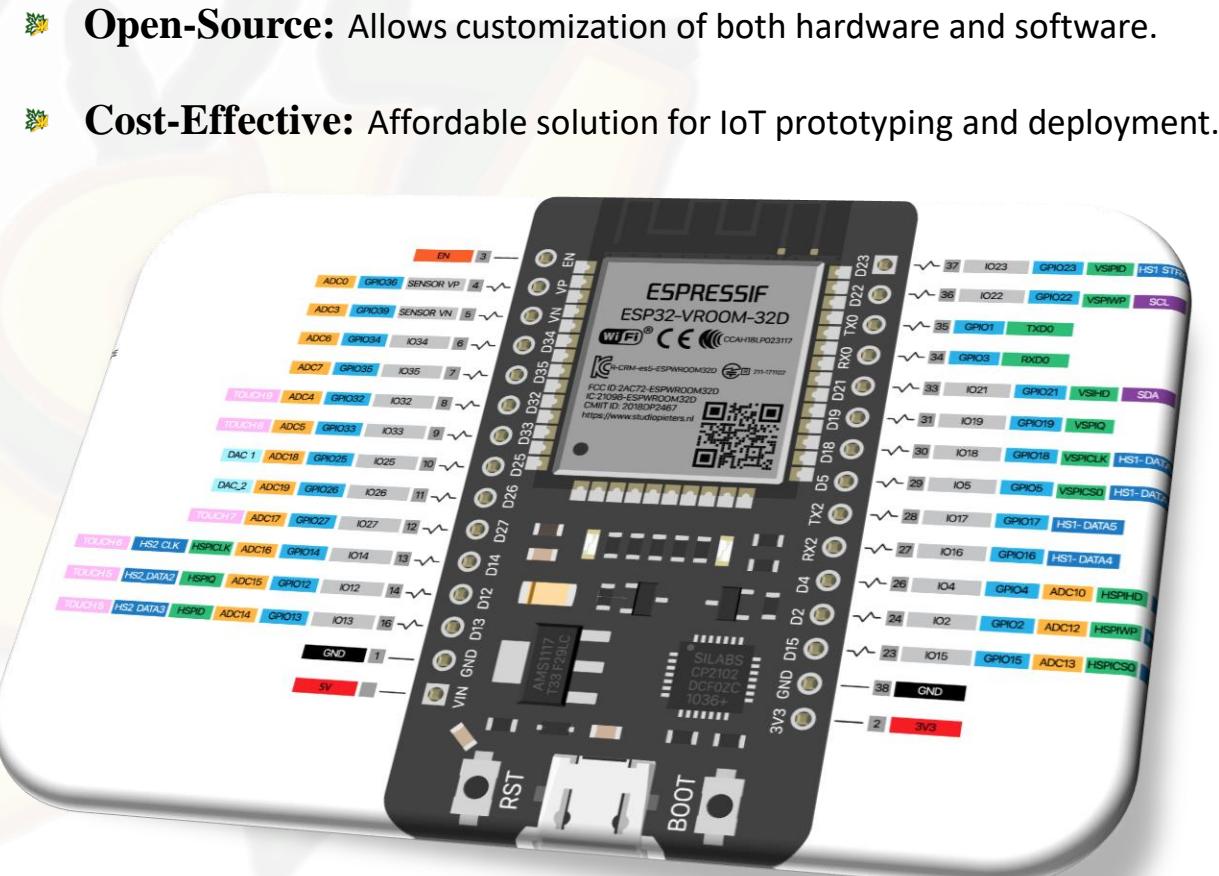


Proposed System Hardware



1. NodeMCU ESP32 WROOM 30-pin :

- **Overview:** NodeMCU ESP32 WROOM is a powerful IoT microcontroller board.
- **Processor:** Dual-core Tensilica LX6 processor for high efficiency.
- **Connectivity:** Built-in Wi-Fi and Bluetooth for seamless communication.
- **GPIO Pins:** 30 pins for versatile interfacing with peripherals.
- **Features:** Includes ADCs, DACs, PWM, SPI, I2C, UART interfaces.
- **Programming:** Supports Arduino IDE, MicroPython, Lua scripting.
- **Power Efficiency:** Low power consumption for battery-operated devices.
- **Community:** Active community support for resources and troubleshooting.



Proposed System Hardware



1. NodeMCU ESP32 WROOM 30-pin :

Feature	NodeMCU ESP 32 WROOM 30 Pin	Arduino
Microcontroller	Dual-core Tensilica Xtensa	ATmega328P
Operating Voltage	2.2V to 6V	5V
Output Current	500 mA	45 to 80mA
Flash Memory	4MB	32KB
SRAM	520KB	2KB
GPIO Pins	34	14
Wi-Fi	Built-in	Not built-in
Bluetooth	Built-in	Not built-in
Operating Temperature	-40°C to 125°C	Not specified
Programming Languages	Arduino IDE, MicroPython, LuaESP-IDF, JavaScript	Arduino IDE
Frequency	160 MHz	16 MHz

Proposed System Hardware

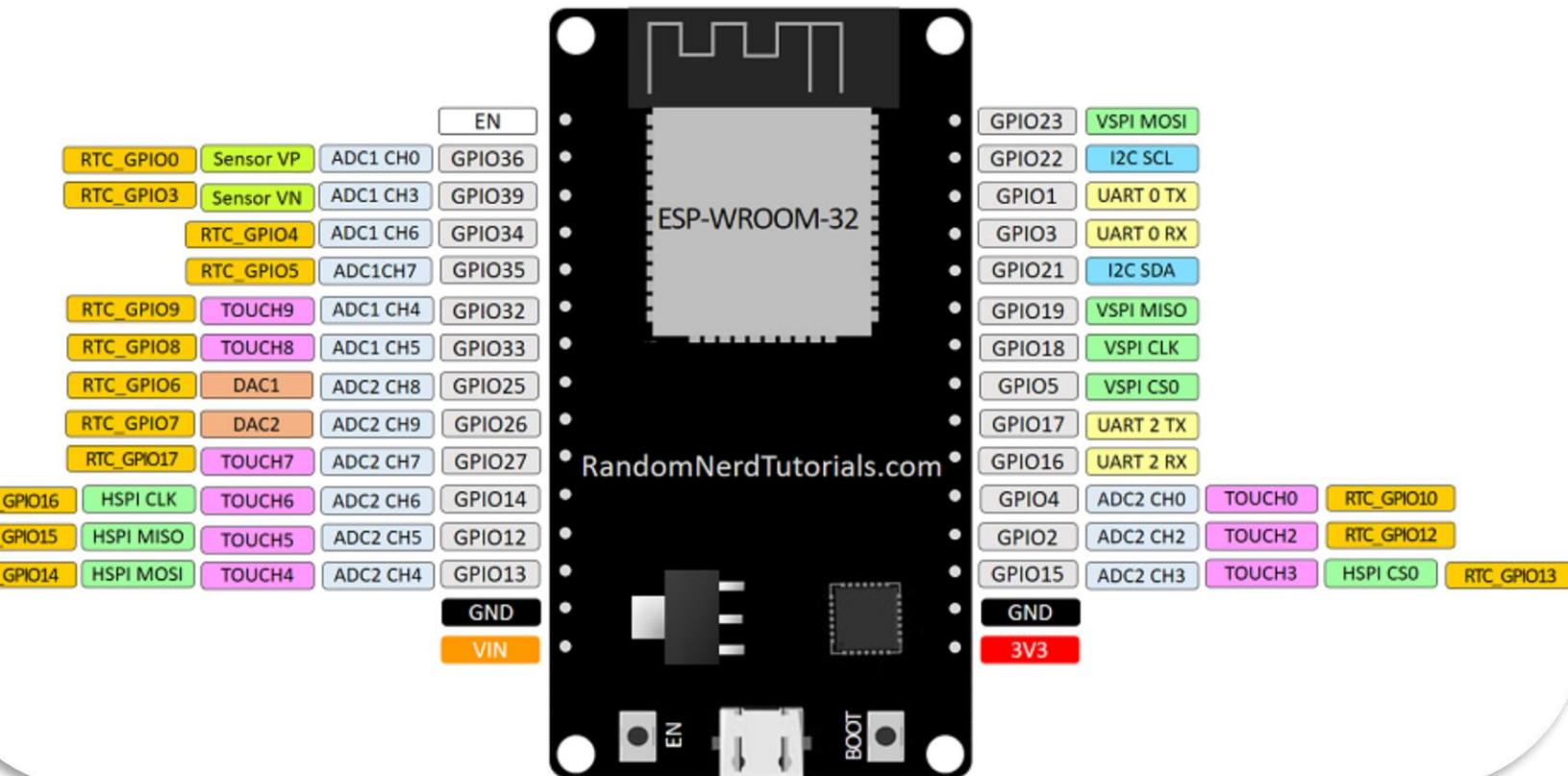


1. NodeMCU ESP32 WROOM

Pin diagram:

30-pin :

ESP32 DEVKIT V1 – DOIT
version with 30 GPIOs

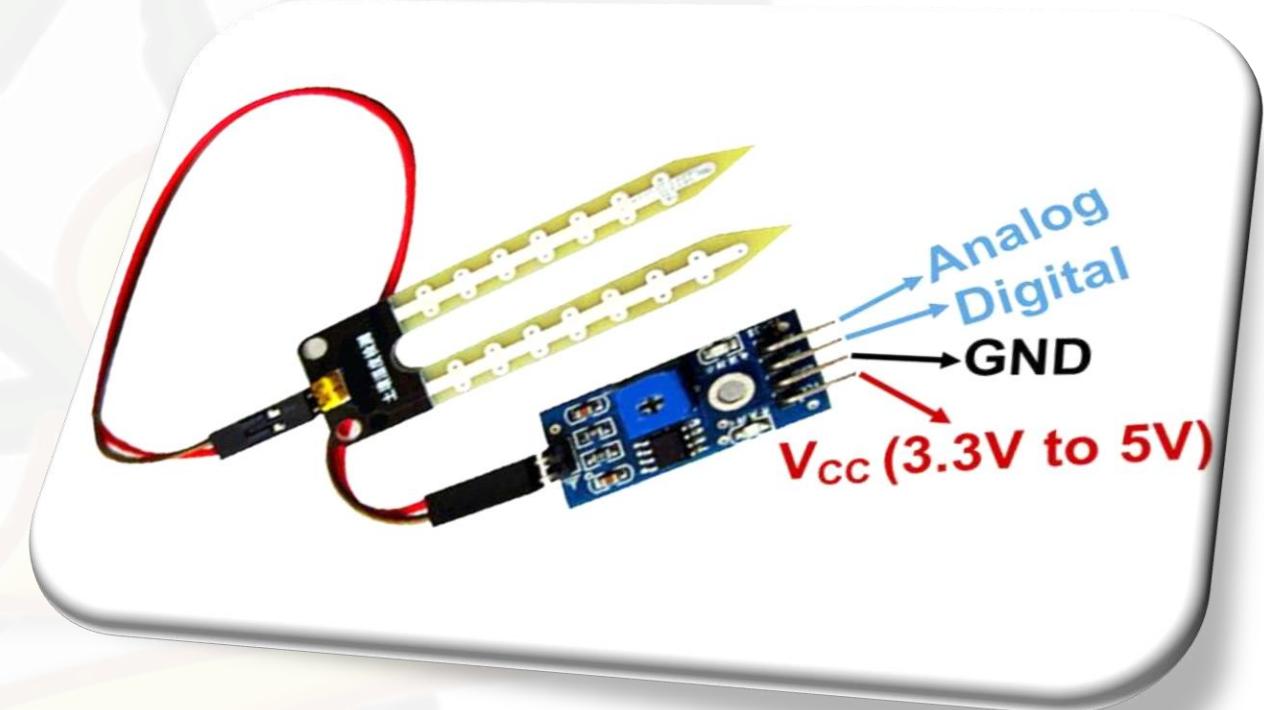


Proposed System Hardware



2. Soil Moisture Sensor:

- ✿ The soil moisture sensor is shown in the Figure and the hygrometer is usually used to detect the humidity of the soil.
- ✿ So, it is perfect to build an automatic watering system or to monitor the soil moisture of the plants.
- ✿ The sensor is set up by two pieces



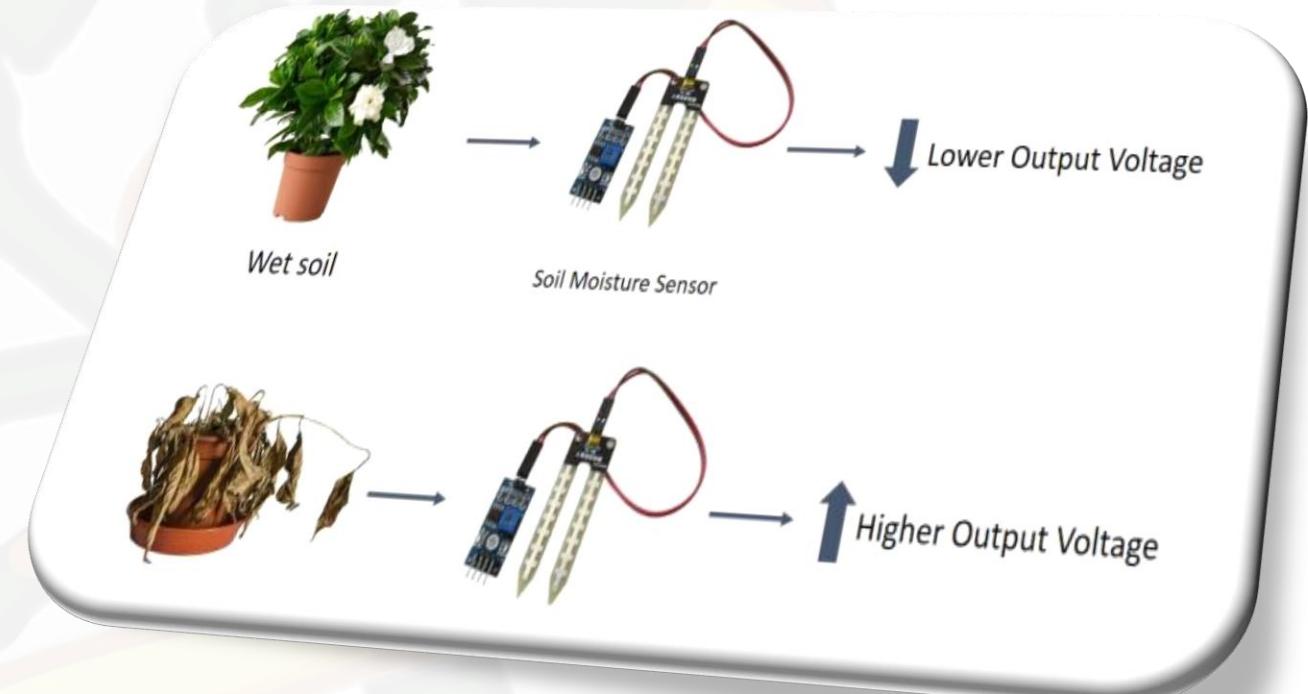
Proposed System Hardware



2. Soil Moisture Sensor:

How Does Soil Moisture Sensor Work?

- When the soil is Wet: the output voltage decreases.



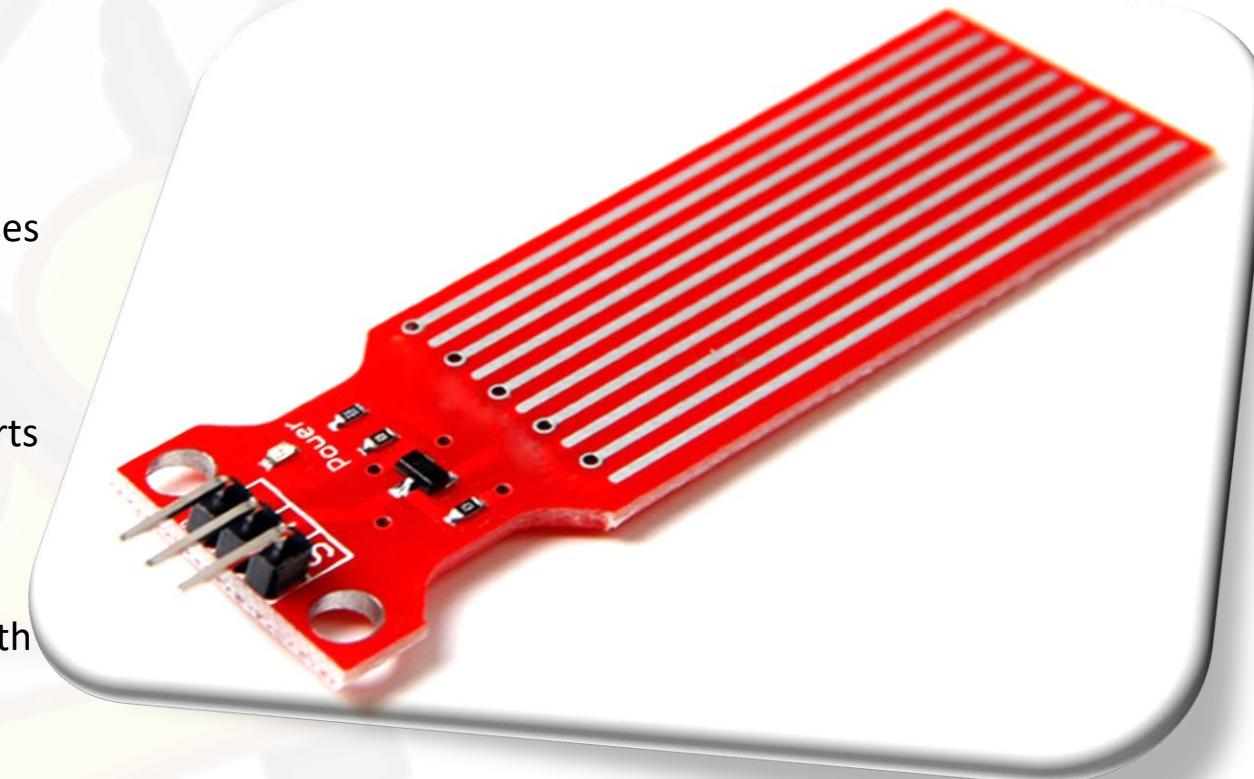
- When the soil is dry: the output voltage increases.

Proposed System Hardware



3. Water Level Sensor:

- **Function & Integration:** Measures water levels using ESP32 for processing and connectivity.
- **Accuracy & Applications:** Provides precise readings for various uses like tanks and irrigation.
- **Wireless Control & Alerts:** Enables remote monitoring, sends alerts for critical levels.
- **Efficiency & Customization:** Operates efficiently, customizable with additional features.
- **Cost-Effectiveness:** Offers an affordable solution for water management.

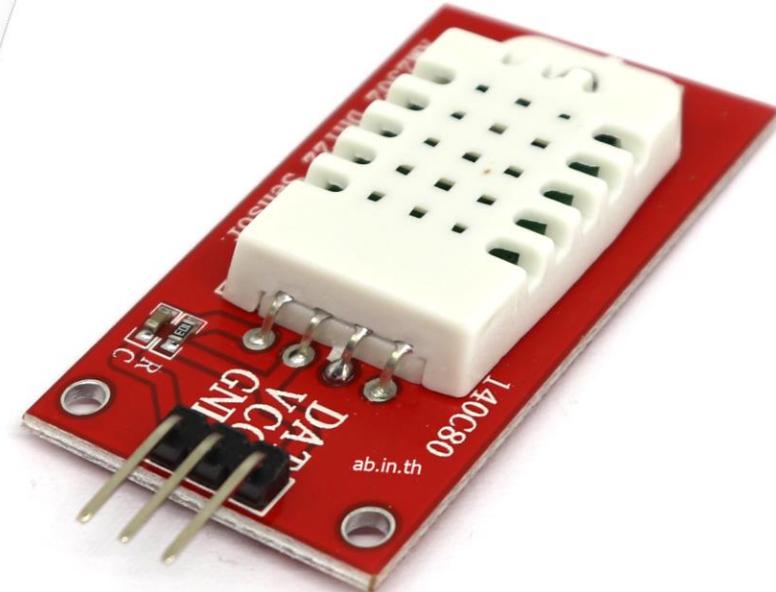


Proposed System Hardware



4. Temperature and Humidity Sensor:

- ❖ DHT22 is a commonly used Temperature and humidity sensor
- ❖ The sensor comes with a dedicated NTC
- ❖ The sensor can measure temperature from -40°C to 80°C and humidity from 0% to 100% with an accuracy of $\pm 1^\circ\text{C}$ and $\pm 1\%$.

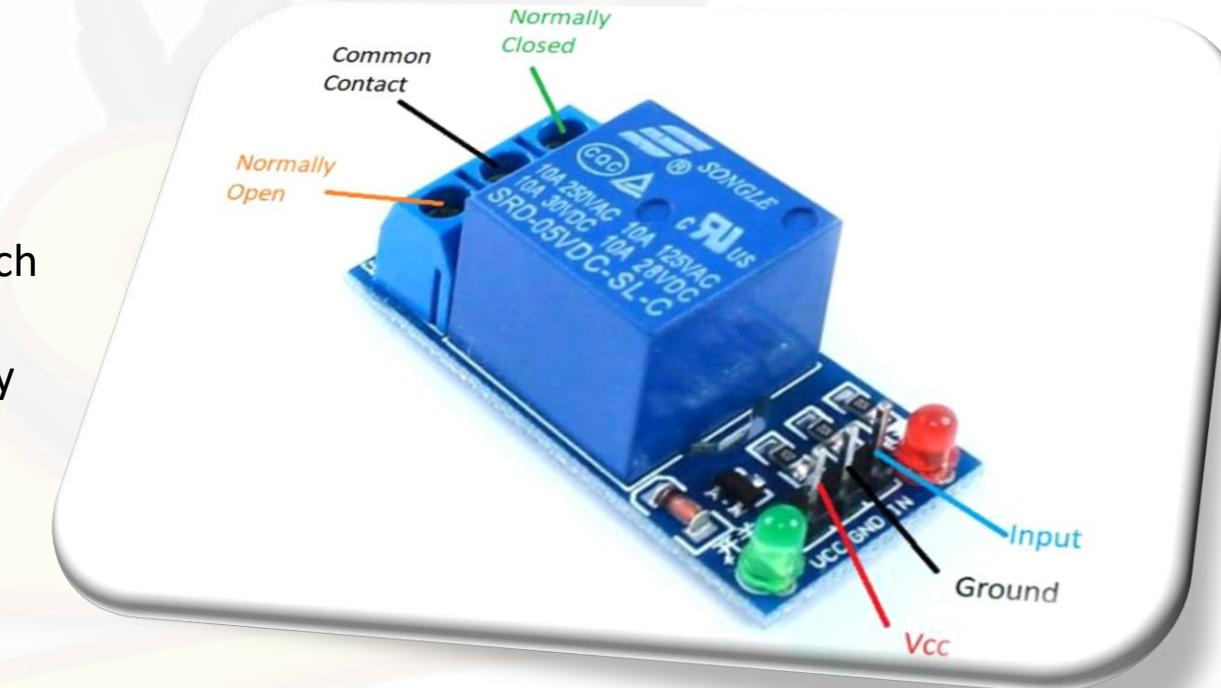


Proposed System Hardware



5. Relay:

The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle. [Figure](#) shown relay module.



Proposed System Hardware

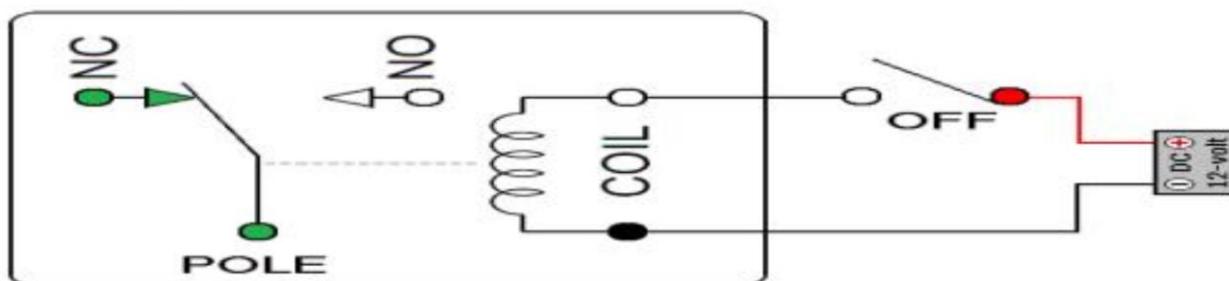


5. Relay:

How does relay Work?



(a) Relay Module



(b) Function diagram

Proposed System Hardware



6. Water Pump:

- A DC water pump is an electric pump with low voltage. They are quiet and use little power (**3.6W**).
- And we use it for pumping the water from the source to the pipes to irrigate crop that we need to irrigate it.

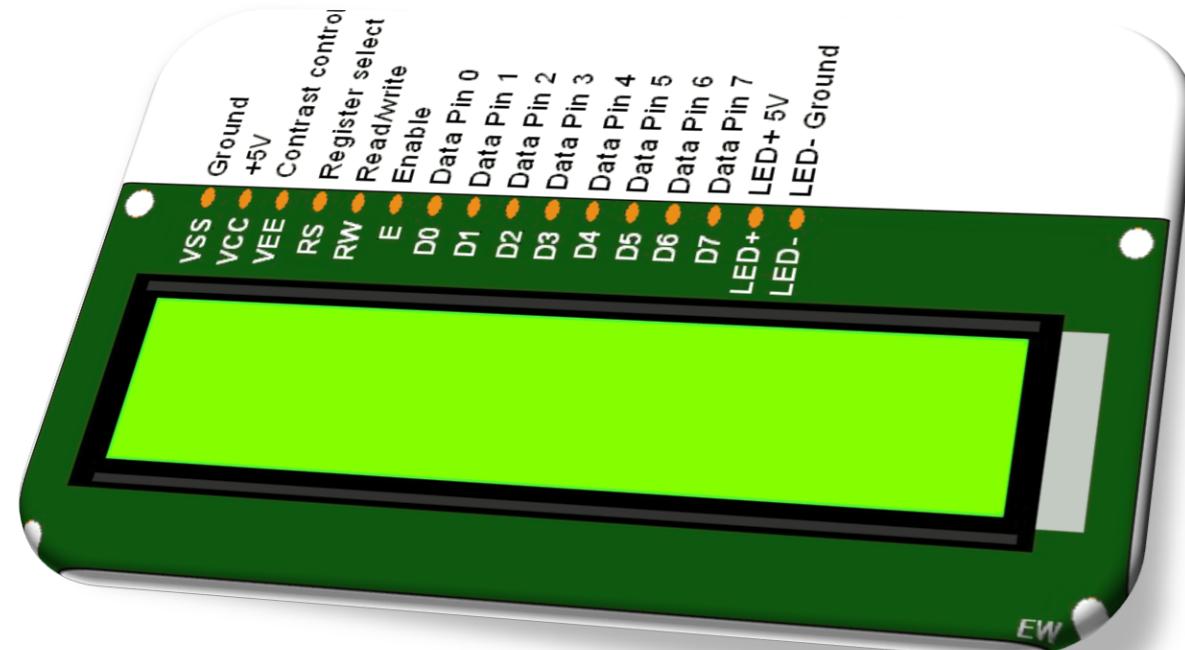


Proposed System Hardware



7. LCD16*2:

- **Display Type:** LCD 16x2: 16 characters per line, 2 lines.
- **Compact:** Small footprint, suitable for various electronic devices.
- **Interface:** Interfaces with microcontrollers using parallel or serial communication.
- **Backlighting:** Often includes backlight for visibility.
- **Application:** Used in embedded systems, DIY projects, appliances.
- **Versatility:** Displays text, numbers, symbols, basic graphics.
- **Low Power:** Consumes low power, ideal for battery-operated devices.
- **Cost-Effective:** Affordable solution for visual output in projects.

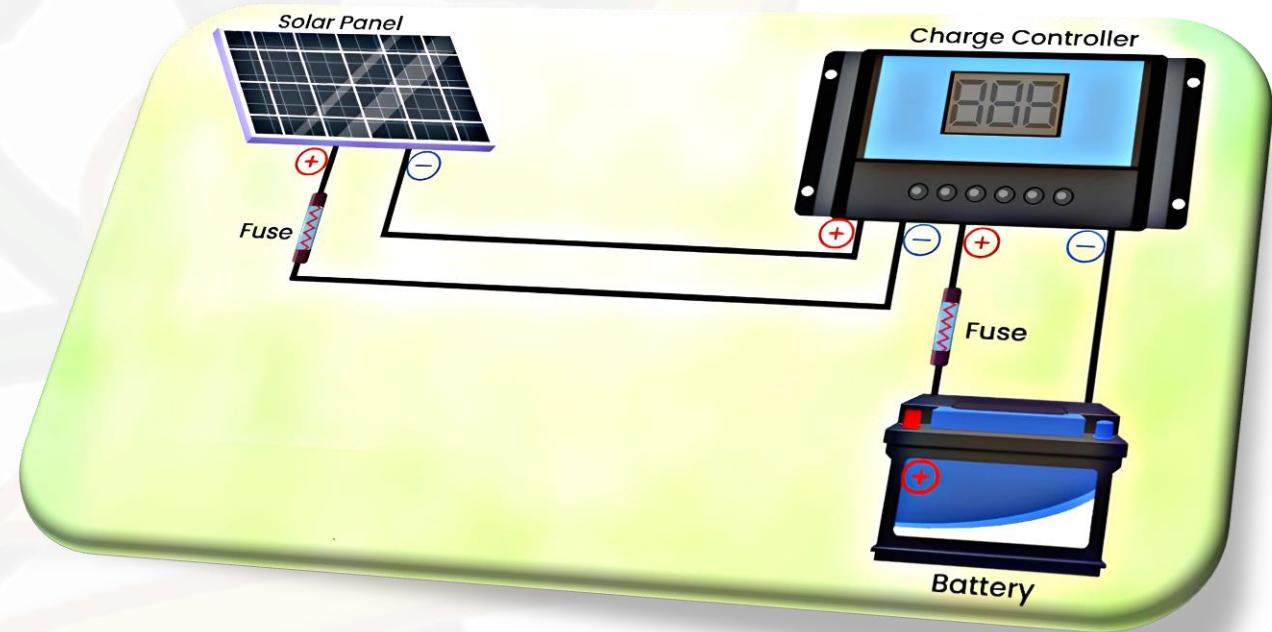


Proposed System Hardware



8. Solar System:

- ❖ **Solar Panel:** "Converts sunlight to electricity."
- ❖ **Charge Controller:** "Regulates solar panel output for efficient charging."
- ❖ **Battery:** "Stores solar-generated electricity."
- ❖ **Protection:** "Ensures battery longevity and safety."



Proposed System Hardware



Sensors	Voltage	Current	Power Drawn
Soil Moisture Sensor	5V	20mA	0.1W
Digital Temperature Sensor	5V	2.5mA	12.5mW
ADS1115 ADC	5V	10mA	0.05mW
Relay Module (2 Channels)	5V	70mA	0.35mW
Raindrop Sensor	5V	15mA	0.75mW

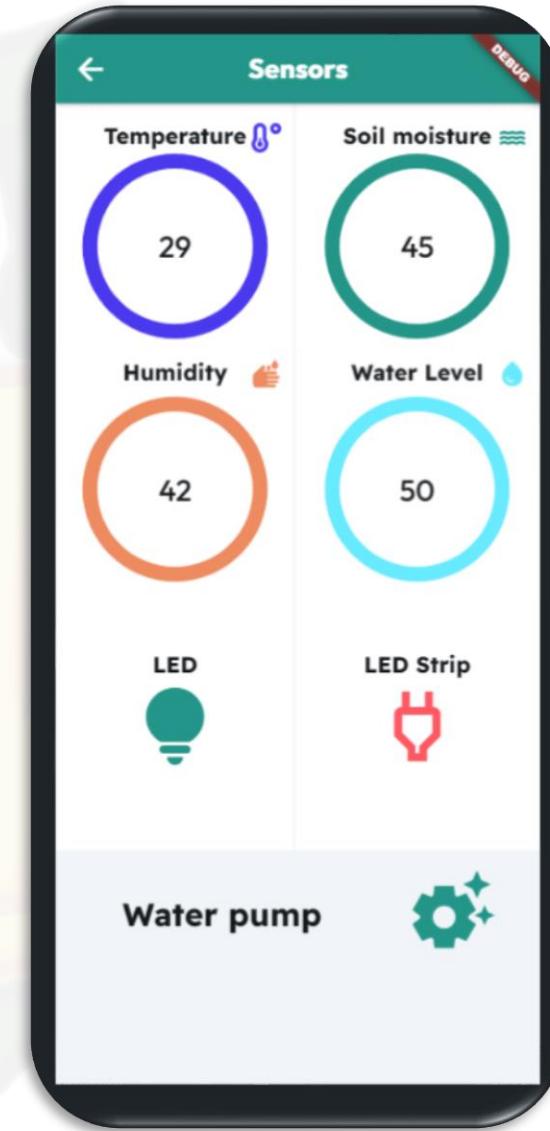
Solar Panel	18V	1.11A	20W
NodeMCU ESP32 WROOM 30-pin	2.2V to 6V	0.5A	1.1W to 3W

Proposed System Hardware



9. Application to Mobile Application Development :

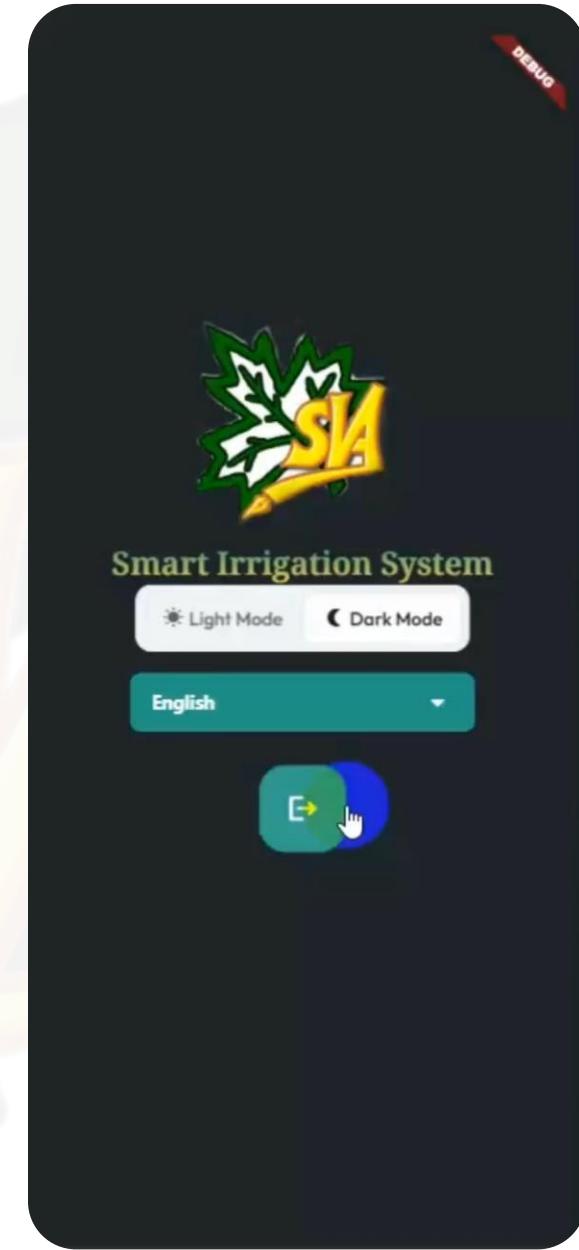
1. Sensor reading page



Proposed System Hardware

9. Application to Mobile Application Development :

2. Practical application within the application



Topics



Introduction

Problems Of Agriculture

What's the importance of Agriculture?

Smart Irrigation System Advantages

Plant Disease Identification System

Mobile Application Development

Aim and Objective

Challenges

Diagram

Internet of Things (IOT)

Proposed System Hardware

Flowchart

Simulation

Conclusion



Intr

Introduction



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Internet of Things (IOT)



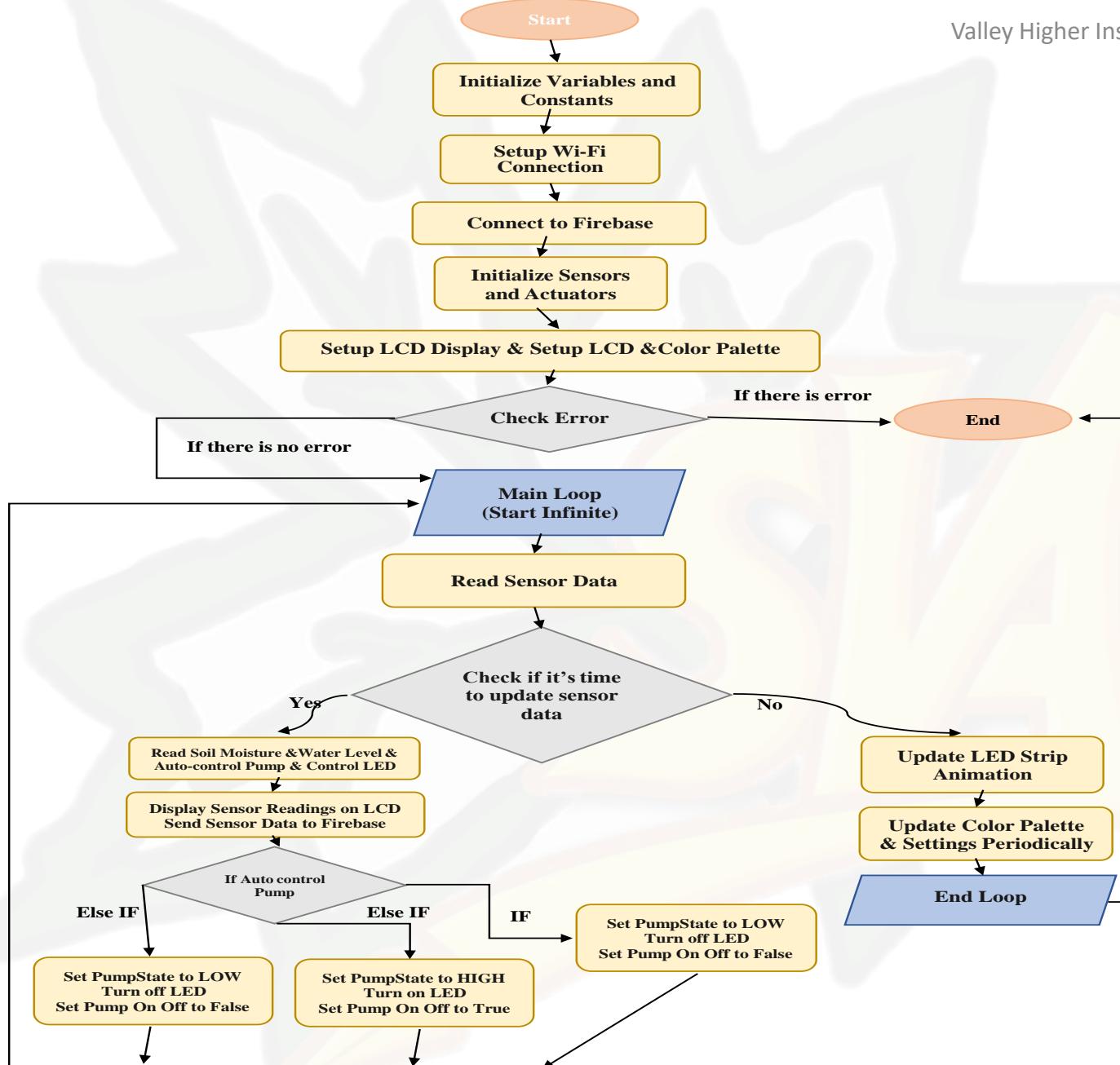
Proposed System Hardware



Conclusion



Flowchart



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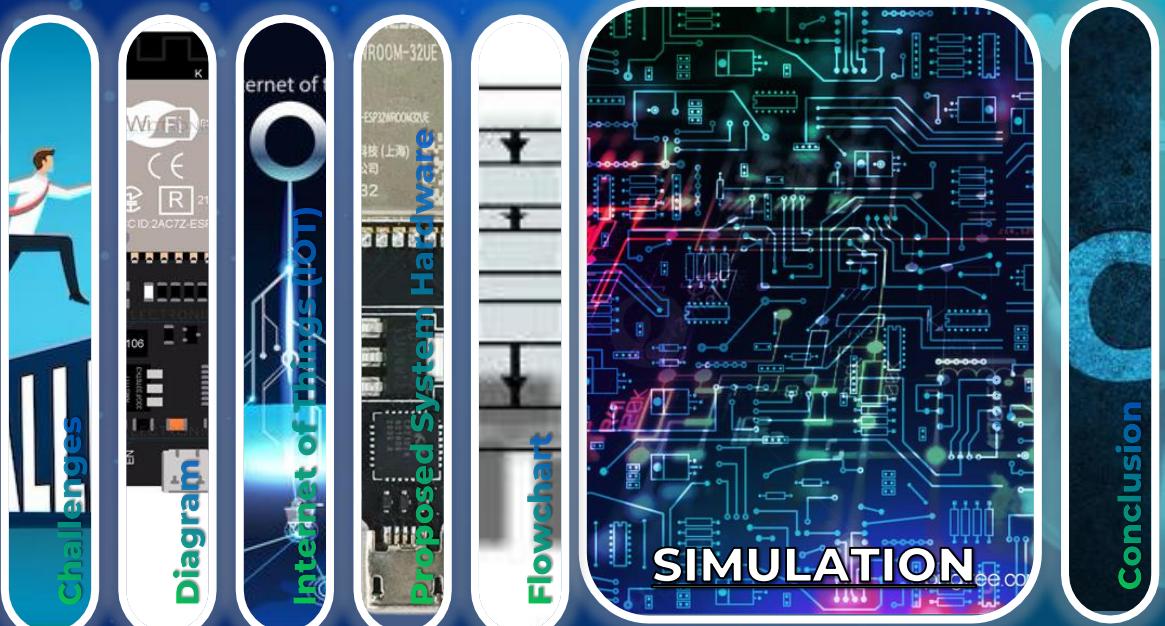
Internet of Things (IOT)

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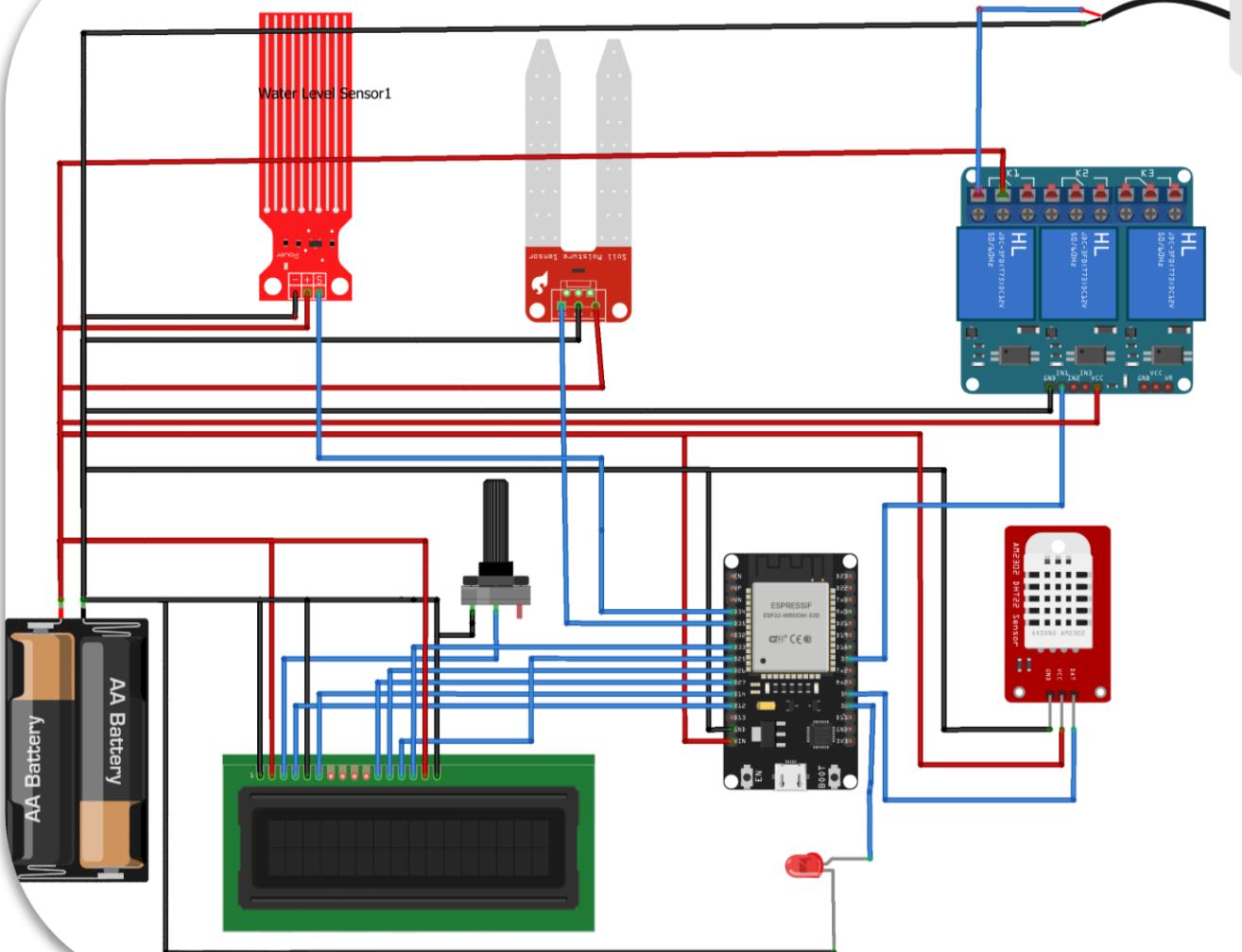
Conclusion



Simulation



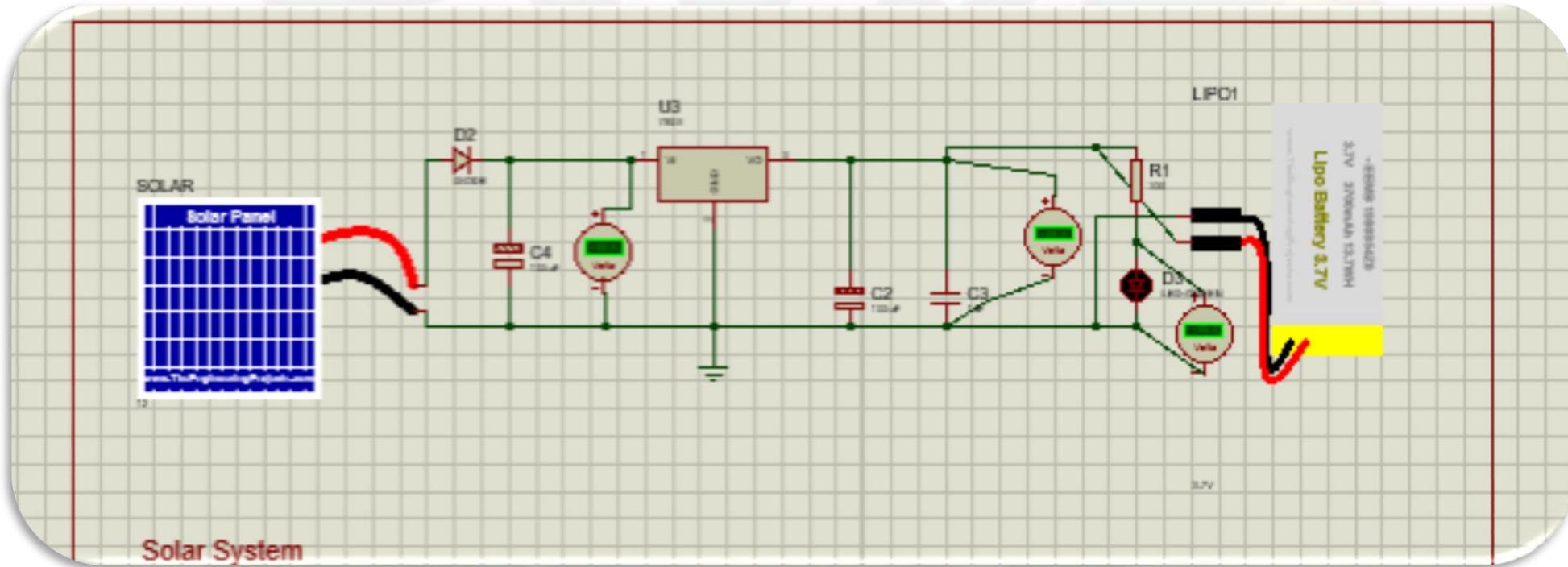
Part_1:



Simulation



Part_2:



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Aim and Objective

Challenges

Diagram

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Proposed System Hardware

Flowchart

Simulation

Conclusion

CON

CONCLUSION



Intr

Introduction



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Diagram



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Conclusion



- ❖ Smart irrigation has proven to be the system that automates using IOT the irrigation system and regulates water for irrigation.
- ❖ Integration of Innovative Technologies: Our project combines cutting-edge technologies such as Flutter, FlutterFlow, and Gemini AI to revolutionize agricultural IoT and mobile app development.
- ❖ Powerful Mobile Application: Through this integration, we've developed a powerful and user-friendly mobile application capable of plant disease identification and smart irrigation management.
- ❖ Seamless Communication: Leveraging ESP32 for IoT functionality and Firebase services like Firestore, our system ensures seamless communication and real-time data handling between the mobile app and the cloud.
- ❖ Feasibility Demonstration: Through meticulous coding in Flutter, Dart, and ESP32, we've demonstrated the feasibility of creating a robust and efficient solution for precision agriculture.
- ❖ Vision for the Future: Moving forward, we envision our project making significant contributions to sustainable farming practices and enhancing agriculture in the future.
- ❖ Gratitude: We extend our heartfelt thanks for the support and encouragement throughout this journey.



Conclusion



The final practical application for the graduation project for students of the High Valley Institute of Engineering and Technology, Department of Communications and Electronics Engineering, Class of 2019.



Resources and References



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16. All files and resources of our graduation project



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Questions





THANK YOU



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