A REPORT ON IoT BASED AUTOMATIC PLANT WATERING SYSTEM

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ABSTRACT

- In this project, we propose an IoT-based automatic plant watering system for garden-level applications.
- The primary goal of this project is to provide a hassle-free solution for maintaining optimal soil moisture levels and ensuring the healthy growth of plants.
- The system utilizes NodeMCU ESP8266 microcontroller and ThingSpeak software for monitoring and controlling the watering process.
- The Internet of Things (IoT) aspect of the system enables seamless connectivity and real-time data exchange between the hardware and the cloud-based platform.
- By harnessing the power of IoT, the system can remotely monitor and control the watering process, ensuring optimal soil moisture levels and promoting the healthy growth of plants.
- This report outlines the automatic plant watering system's design, implementation, working, notable features, societal usage and outcomes.

PROBLEM STATEMENT

- Many garden enthusiasts face the challenge of maintaining the ideal moisture levels in the soil for optimal plant growth.
- Regularly tending to the garden with watering cans or hoses can be time-consuming.
- This aspect can be particularly challenging for individuals with busy schedules or those who may not be able to attend to their gardens on a daily basis, especially during periods of hot and dry weather when plants require more frequent watering.
- During vacations or absences, finding someone reliable to water the plants can be inconvenient. As a result, plants might be left unattended, risking their health and survival in the absence of proper care.
- Also, manual watering may sometimes lead to overwatering or underwatering or uneven watering, affecting plant health.

PROPOSED SOLUTION & OBJECTIVE OF THE PROJECT

- To address this issue, we aim to design and implement an IoT-based automatic plant watering system using NodeMCU ESP8266 and ThingSpeak software.
- The system's objective is to provide a convenient and efficient solution for remotely monitoring and controlling the watering process, ensuring that plants receive the right amount of water at the right time.
- Its goals include automating the watering process to eliminate the need for constant manual intervention, conserving water by optimizing watering schedules based on real-time data, and creating a user-friendly interface for easy customization of watering preferences.
- By harnessing the power of IoT technology, we aim to create a reliable and sustainable plant care solution for garden-level applications, allowing gardeners to enjoy healthier and thriving gardens with minimal effort.

PROJECT DESCRIPTION

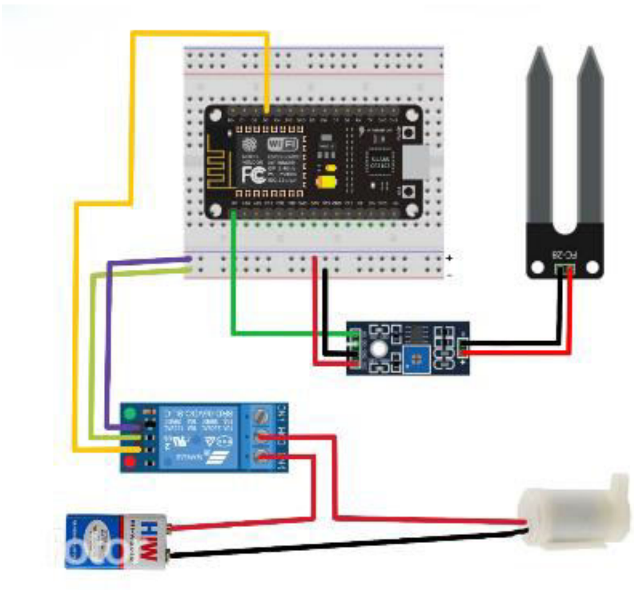
- The IoT-based automatic plant watering system utilizes NodeMCU ESP8266 and ThingSpeak software, and is designed specifically for garden-level applications.
- At the heart of the system lies the NodeMCU ESP8266 microcontroller, acting as the brain of the operation.
- It is equipped with a sensor to monitor the soil moisture level. This sensor plays a pivotal role in determining the watering requirements of the plants in real time.
- The system integrates seamlessly with the ThingSpeak cloud platform through IoT connectivity.
- The project offers a user-friendly interface on the ThingSpeak platform, enabling gardeners to remotely turn on and off the water pump through the ThingSpeak interface by using any internet-enabled device, such as a smartphone or computer.

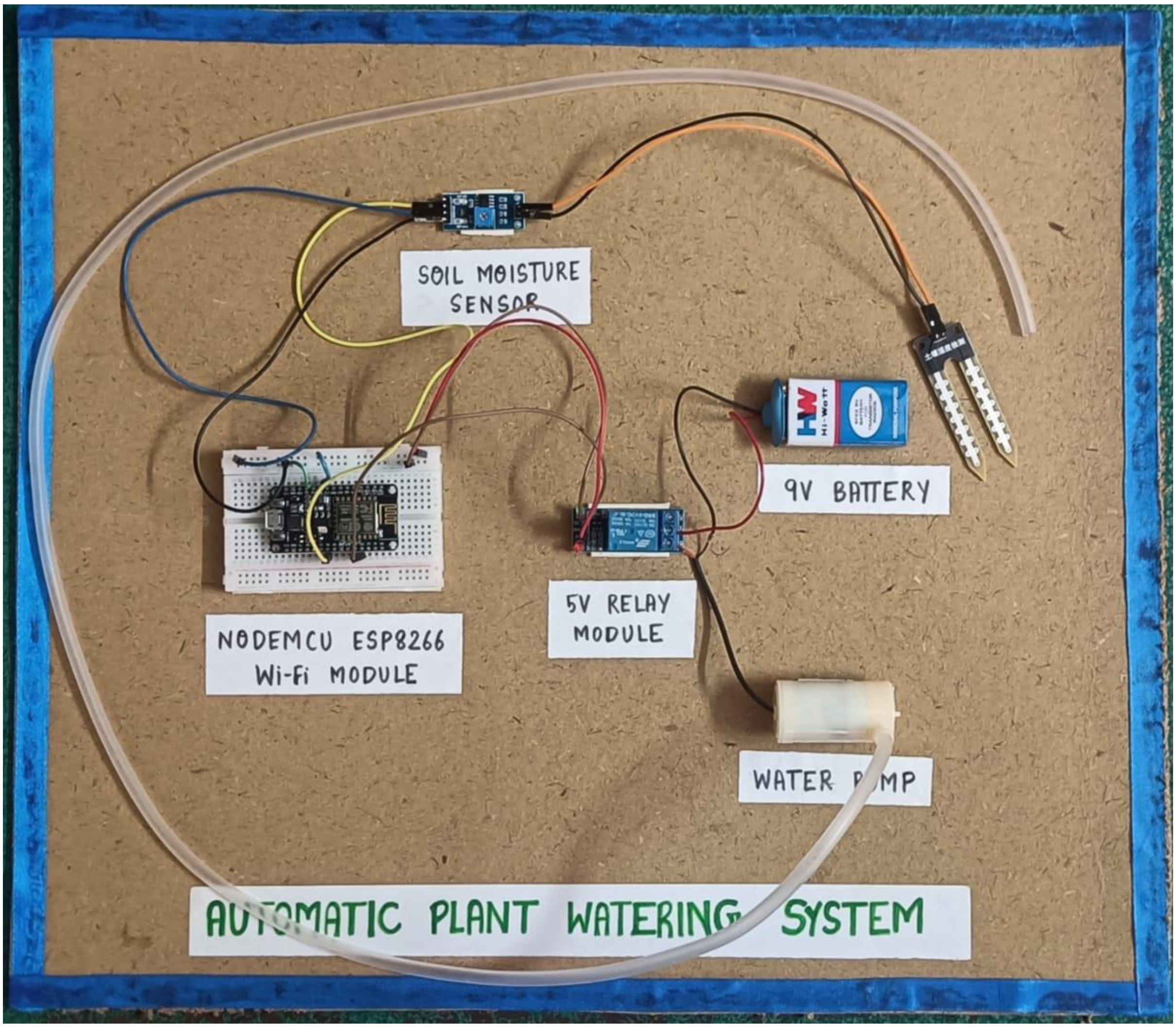
HARDWARE DESIGN

HARDWARE USED:

1. NodeMCU ESP8266 Microcontroller
2. Soil Moisture Sensor
3. 5 Volt Relay Module
4. Water Pump
5. 9 Volt Battery
6. Battery Connector
7. Breadboard
8. Jumper Wires
9. Micro USB cable

CIRCUIT DIAGRAM:





<u>CONNECTIONS</u>:

1. Connect the soil moisture sensor set with the NodeMCU as follows:

Soil Moisture Sensor	**NodeMCU**
GND	GND
3V	VCC
AO	AO

2. Connect the 5V relay module with the NodeMCU as follows:

5V Relay Module	**NodeMCU**
GND	GND
VCC	3V
IN	D3

3. Connect the positive terminal of the battery to the NO (Normally Open) pin of the relay module.

4. Connect the negative terminal of the battery to the COM (Common) pin of the relay module through the water pump.

SOFTWARE DESIGN

SOFTWARE USED:

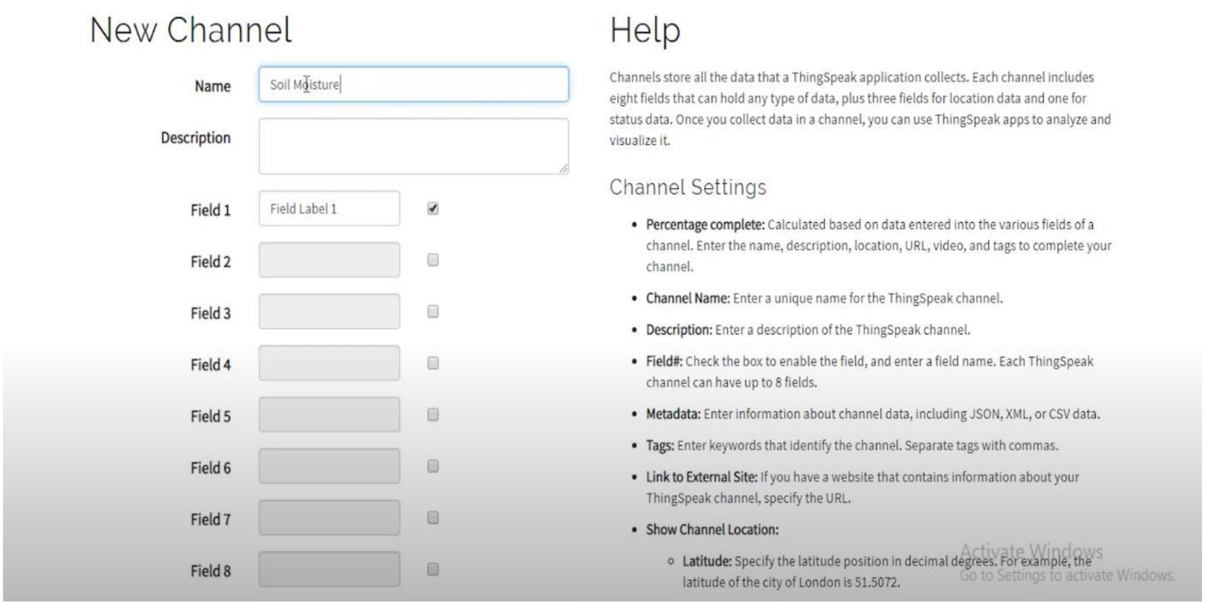
1. Arduino IDE
2. ThingSpeak Cloud

ARDUINO IDE:

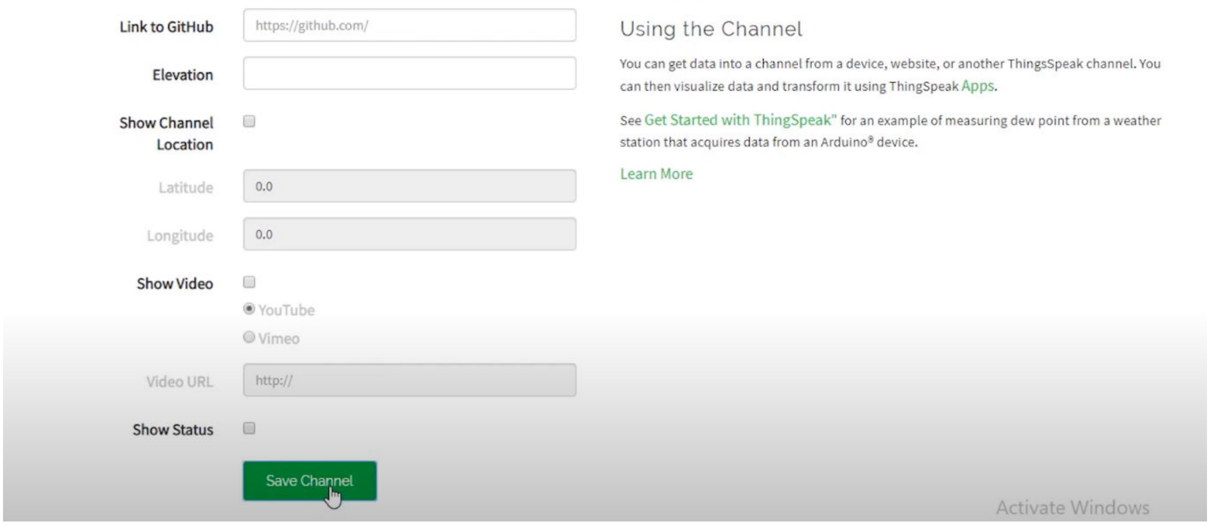
1. Install the IDE.
2. Write the code.

THINGSPEAK CLOUD:

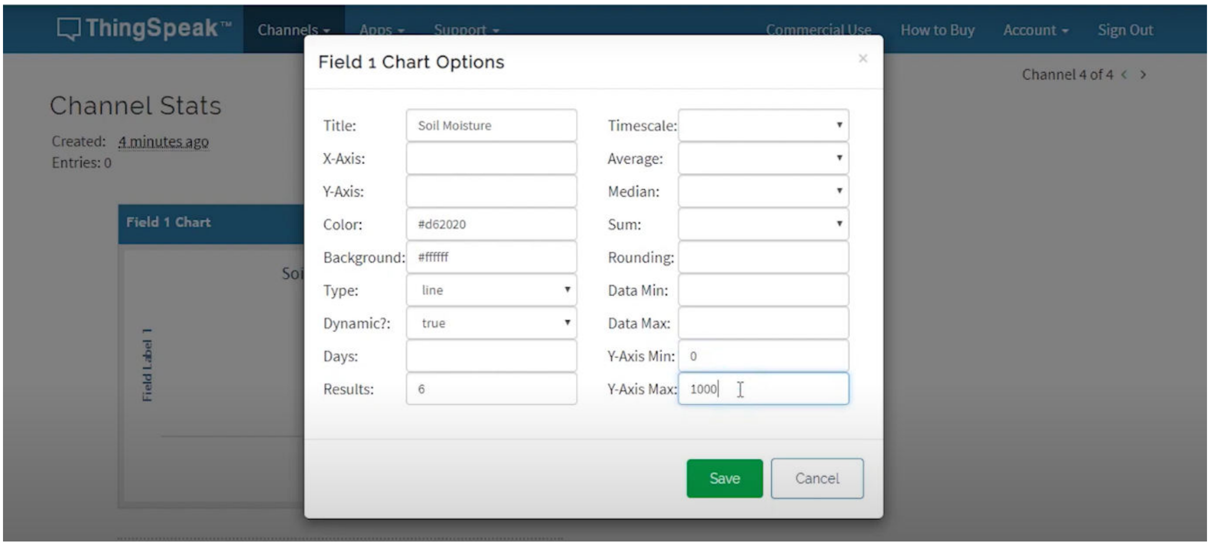
1. Create a ThingSpeak Account.
2. Create a new channel.



3. Save the created channel.



4. Edit the channel stats and save the changes.



5. Copy the API Key and paste it in your code.

ARDUINO IDE:

3. Once, the code is complete, select the board and the port.
4. Upload the code.

PROJECT IMPLEMENTATION

STEPS:

1. Assemble hardware.
2. Upload code.
3. Insert the soil sensor electrode inside the soil to start getting reading on the ThingSpeak Cloud.
4. Dip the water pump motor in the water source.
5. Give power supply to the NodeMCU using power bank or any other suitable power source.
6. Now, start controlling the IoT device to water the plants.

WORKING OF THE PROJECT

- Initialization: The NodeMCU ESP8266 connects to the Wi-Fi network and initializes the pins for the soil moisture sensor and water pump.
- Reading Soil Moisture: The system reads the analog input from the soil moisture sensor connected to pin A0, obtaining the soil moisture value.
- Data to ThingSpeak: The soil moisture value is sent to ThingSpeak platform.
- Reading Virtual Switch State: The system now fetches the state of the virtual switch from ThingSpeak. The ThingSpeak API is used to read the state of the switch from the corresponding ThingSpeak channel.
- Pump Control: Based on the soil moisture reading and the state of the virtual switch obtained from ThingSpeak, the system determines whether to turn ON or OFF the water pump. If the soil moisture is below the threshold and the virtual switch is in the ON state, the system turns ON the water pump. If the soil moisture is sufficient or the virtual switch is in the OFF state, the system turns OFF the pump.

- Continuous Monitoring: The system continuously repeats the process of reading the soil moisture, sending data to ThingSpeak, and controlling the pump based on the moisture level and the state of the virtual switch.
- Remote Access: Gardeners can remotely access the real-time soil moisture data and control the water pump by toggling the virtual switch on ThingSpeak.

NOVELTY OF THE PROJECT

- Integration with ThingSpeak
- IoT Connectivity
- Scalability and Flexibility
- Automated Plant Care
- Sustainable Gardening
- Smart Water Management

SOCIETAL USAGE OF THE PROJECT

- Promoting Sustainable Gardening Practices: The project promotes sustainable gardening practices among individuals and communities. It encourages the use of IoT technology for smart plant care and highlights the importance of resource-efficient and eco-friendly approaches to gardening.
- Supporting Urban Gardening and Green Spaces: With the increasing popularity of urban gardening and community green spaces, the IoT-based plant watering system becomes a valuable asset.
- Remote Gardening: The remote monitoring and control capabilities of the system allow individuals to tend to their gardens even when they are away from home. This feature is particularly beneficial for frequent travelers or people with mobility challenges, enabling them to maintain their gardens conveniently.
- Reduced Plant Loss: The automated watering system helps reduce the risk of plant loss due to overwatering or underwatering.

In summary, by harnessing IoT technology for responsible plant care, the project fosters a more environmentally conscious and technologically advanced society.

PROJECT OUTCOMES

The outcomes for us in being involved in developing and implementing the IoT-based automatic plant watering system are as follows:

- Technical Skills Development: The project provided an opportunity to enhance technical skills in various areas, including programming the NodeMCU ESP8266, working with sensors, and integrating IoT technology. We learned about hardware interfacing, data communication, and cloud-based platforms like ThingSpeak.
- Understanding IoT Concepts: We learned how IoT enables smart and automated systems, connects devices, and facilitates remote monitoring and control.

- Hands-on Experience: We gained practical experience in assembling hardware components, troubleshooting, and testing.
- Problem-solving Skills: Developing the system involved overcoming challenges related to hardware connections, code debugging, and integration with ThingSpeak. We improved their problem-solving skills by identifying and resolving issues encountered during the project.
- Environmental Awareness: Implementing an automated watering system brought attention to the importance of gardening practices. We became more aware of the significance of efficient water usage and its positive impact on the environment.
- Practical Application of Theory: The project allowed us to see how theoretical knowledge in electronics, programming, and IoT can be applied practically to create real-world solutions with tangible benefits.

In summary, the project was a rewarding and enriching experience for all involved.

THANK YOU!