**Introduction**

Maintain Optimal Conditions for plants is crucial for their growth, particularly in small urban homes. Soil moisture, temperature, and humidity are three essential factors that determine the health of plants. However, monitoring these parameters manually can be time-consuming and unreliable. To address these challenges, a smart gardening system can be developed to automate the monitoring process using sensors and real-time alerts.

This project uses modern IoT (Internet of Things) technologies, including Capacitive Soil Moisture Sensor v2.0 and the DHT11 sensor, to measure soil moisture, temperature and humidity. By integrating these sensors with Arduino IoT cloud and using IFTTT for alert notifications, I aim to create an efficient hands-off monitoring system.

**Problem**

Gardening, whether at home with a big garden or in an urban house/apartment, requires continuous monitoring of soil moisture, temperature, and humidity to ensure optimal conditions for plant growth. Manual monitoring, especially when managing multiple plants, is labour intensive and inefficient. The aim of this project is to create a Smart Gardening system the automates the monitoring of soil moisture and environmental conditions using IoT technology. This system will provide real-time alerts and record environmental data, allowing for timely interventions when necessary.

**Literature Review**

|  |  |  |
| --- | --- | --- |
| **Study/Project** | **Approach** | **Limitations** |
| Smart irrigation systems that automate water distribution based on sensor readings. From Dr Jagadeesh 2018 | Uses soil moisture sensors to monitor plant watering needs. Effective for irrigation. | By focusing solely on soil moisture, other environmental factors that affect plant growth are dismissed. |
| In 2019 Dr Alsaeedi’s Smart System utilised sensors to monitor Air Quality | These sensors gathered potential pollutants along with plant health indicators | This Setup requires multiple sensors that may not be feasible in-home gardens due to cost and complexity |

The literature suggests that current systems either lack comprehensive environmental monitoring or neglect the importance of timely alerts, which this project addresses. The use of both the Arduino IoT Cloud and IFTTT creates a well-rounded system capable of creating a well nurtured environment for your plants.

**Planned Method**

1. **Data Sources**

* Capacitive Soil Moisture Sensor v2: Measure Soil Moisture
* DHT11 Sensor: Measures Temperature and Humidity

1. **Data Destinations**

* Arduino IoT Cloud: Used to log data from sensors in Real Time
* IFTTT: Used to Send Notifications based on predefined conditions (e.g. Temperature Change Too HIGH/LOW)

1. **Data Types**

* Soil Moisture (Float): Percentage indicating Soil Dryness of Wetness
* Temperature (Float): Celsius
* Humidity (Float): Percentage indicating High and low humidity

1. **Data Capture**

* Data is captured from the sensors every 15 minutes
* The Arduino board reads data from the DHT11 and Capacitive Soil Moisture Sensor via the digital pins.

1. **Data Logging**

* Arduino IoT cloud dashboard will display real-time data and store it for long-term tracking.

1. **Data Storage**

* Cloud Storage: The primary storage is the Arduino IoT Cloud, which provides remote access and real time updates.

1. **Data Analytics and Pattern Identification**

* Average Soil Moisture: Over the last day/week
* Peak Temperature and Humidity changes over time
* Pattern Recognition: Identify daily or seasonal patterns that can help optimise plant care.

1. **Alerts**

* IFTTT will send notifications to the user’s phone or email based on custom triggers such as:

**Soil Moisture dropping below 20%.**

**Sudden spikes in temperature or humidity**

**Budget**

|  |  |
| --- | --- |
| **Component (Hardware/Software)** | **Price** |
| Arduino Nano 33 IoT | $45 |
| Capacitive Soil Moisture Sensor | $3 |
| DHT11 Temperature/Humidity Sensor | $3 |
| Wires | $6 |
| Breadboard | $3 |
| Arduino IoT Cloud | FREE |
| IFTTT | FREE |

|  |  |
| --- | --- |
| **Task** | **Estimated Man Hours** |
| Sensor Integration (Soil Moisture, DHT11) | 6 hours |
| Arduino IoT Cloud Setup | 2 hours |
| IFTTT Setup and Alerts | 2 hours |
| Testing | 5 hours |
| Report | 3 hours |

**Estimated Timeframe**

**Gantt Chart**

|  |  |  |  |
| --- | --- | --- | --- |
| **Task** | **Week 1 (Start 2nd of September)** | **Week 2** | **Week 3 (End 19th of September)** |
| Sensor Integration (Soil Moisture, DHT11) |  |  |  |
| Arduino IoT Cloud Setup |  |  |  |
| IFTTT Setup and Alert |  |  |  |
| Testing |  |  |  |
| Report |  |  |  |

**Ethical Considerations**

The system collects environmental data (e.g., temperature and humidity) without infringing on personal data privacy.

**Video of my Working Prototype**

<https://deakin.au.panopto.com/Panopto/Pages/Viewer.aspx?id=c8cef121-f6f9-424d-8836-b1ee0001c3e4>

When it came to soil moisture, the sensor constantly measured the moisture content of the soil. Once the level dropped below 20%, the system would trigger an action. In this case, I manually added water, and as it seeped into the soil, the moisture percentage gradually increased, showing the sensor's ability to detect and respond to dry conditions in real time. For temperature, I ran a simple test using a hairdryer to blow warm air over the DHT11 sensor, causing the temperature to rise. The sensor accurately detected this change, and once the temperature exceeded 20°C, the system reacted by sending a notification. I integrated IFTTT (If This Then That) to automate alerts. Whenever the soil moisture fell below 20%, or the temperature went above 20°C, IFTTT sent me an email notification. These thresholds were set as part of the testing phase, and it demonstrated the system's ability to alert users in real-time, ensuring plants could be watered and monitored remotely, without constant manual checking.

**PowerPoint Presentation**

<https://deakin.au.panopto.com/Panopto/Pages/Viewer.aspx?id=5ddefd9f-87fd-461a-9d81-b1ee00099af6>