GNANAMANI COLLEGE OF TECHNOLOGY

DEPARTMENT:BIO MEDICAL ENGINEERING

YEAR: Third Year

TOPIC: ENVIRONMENTAL MONITORING

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PROBLEM:

Let’s consider a common environmental monitoring problem:

Monitoring soil moistures in a garden to optimize irrigation and conserve water resources.

SOLUTION USING IOT AND ARDUINO:

COMPONENTS NEEDED:

1.ARDUINO BOARD:

You can use an Arduino Uno or Arduino Nano for this project.

2.SOIL MOISTURE SENSOR:

A soil moisture sensor to measure the moisture level in the soil.

3.WIFI MODULE:

An IOT Wi-Fi module like a ESP8266 or ESP32 for internet connectivity.

4.POWER SOURCE:

A power source for your Arduino and Wi-Fi module (e.g. Batteries or a power adapter).

5.BREAD BOARD AND JUMPER WIRES:

To connect and prototype the circuit.

6.CLOUD PLATFORM:

Choose an IOT cloud platform AWD IOT,google cloud IOT or adafruit.

SOLUTION STEPS:

1.CONNECT THE HARDWARE:

* Connect the soil moisture sensor to the Arduino board.

* Connect the wifi module to the Arduino for internet connectivity.

2.CODE THE ARDUINO:

* Write Arduino code to read data from the soil moisture sensor.

* Use the Wi-Fi module to send this data to your choose IOT cloud platform.

3.SET UP CLOUD PLATFORM:

* Create an account on your choose IOT cloud platform.

* Set up a device and topic for your Arduino to publish data to.

4.PUBLISH DATA:

* Modify your Arduino code to publish soil moisture data to the cloud platform at regular intervals(e.g. Every 15 minutes).

5.DATA STORAGE AND VISUALIZATION:

* Use the cloud platform services to store and visualize the data.

* Create graphs or dashboards to monitor soil moisture levels remotely.

6.THRESHOLD AND ALERTS:

* Define moisture level threshold for your specific plants.

* Set up alerts or notifications throw the cloud platform when moisture levels fall below or exceed these thresholds.

* With this IOT and Arduino solution, you can monitor soil moisture levels *remotely, enabling you to optimize irrigation and prevent under watering.*

* It conserves water resources by ensuring that plants receive the right amount of water.

* Alerts and notifications help you take timely action when moisture levels or not with in the desired range.

* The data collector over time can also provide insides into plant health and watering patterns, helping you make informed decisions.

USES:

*Environmental monitoring often involves the use of strategically placed data collection points to gather information about various environmental factors such as air quality, water quality, temperature and more.

*These points can be sensors or monitoring stations that help assess the state of the environment and track changes over time.

ADVANTAGES:

Resource Management:

* Helps in the sustainable management of natural resources like water, air, soil, ensuring their preservation for future generations.

Public Health Protection:

* Monitoring can identify threats to public health, such as air quality issues or contaminated water sources, allowing for interventions.

DISADVANTAGE:

Environment Impact:

*The monitoring process itself can have environmental consequences.

Data Management:

* Storing, managing, and analyzing large volumes of data can be challenging.

DEVELEOMENT OF ENVIRONMENTAL MONITORING:

Selecting soil moisture sensors:

* Choose appropriate soil moisture sensors. There are various types, including Capacitance sensors, resistance and TDR sensors. Select the one that suits your specific needs And budged.

Sensor placement:

* Install the sensors at various depths in the garden to monitor moisture levels throughout the soil profile. Ensure they are evenly distributed to get a comprehensive view of moisture content.

Data collection:

* Connect the sensors to a data logging system. This could be a microcontroller, IoT device, or a dedicated soil moisture monitoring system. Collect data at regular intervals
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Weather data integration:

*Integrate local weather data into your system. This can help you make irrigation decisions based on weather forecasts, preventing overwatering when rain is expected. Set

Setting thresholds:

*Define moisture level thresholds that trigger irrigation. For instance, if the soil moisture drops below a certain level, the system should initiate irrigation.

Smart integration control:

*Use actuators like solenoid valves to control integration. When the system detects that soil moisture is below the define threshold, it can automatically turn on the integration system.

Remote monitoring and control:

*Implement remote monitoring and control capabilities. This allows you to access the system's data and make adjustment from a smartphone or computer.

Feedback Loop:

*Continuously monitor the effectiveness of your system and make improvement as needed. Adjust the threshold levels and irrigation schedules based on the performance of your garden.

Alerts and Notification:

*Implement an alert system to notify you of any issues or emergencies, Such as sensor malfunction or unusually dry conditions.

Maintenance:

*Regularly maintain the sensors and irrigation equipment to ensure accurate and efficient operation.

Documentation:

*Keep detailed records of sensors readings, irrigation schedules, and any adjustment mode. This documentation can be valuable for future reference and improvement.

APPLICATION:

1.Air quality monitoring:

This involves measuring the concentration of pollutants such as particulate matter, ozone, and carbon monoxide to assess and mitigate air pollution.

2.Water quality monitoring:

To ensure the safety to drinking water and protect aquatic ecosystems, water quality monitoring measures parameters like pH, dissolved oxygen, and contaminants like heavy metals.

3.Climate change tracking:

Monitoring changes in temperature, carbon dioxide levels, and sea level rise to understand and address the impacts of climate change. Data from weather stations, satellites, and climate models are used.

4.Biodiversity conservation:

Environmental monitoring helps protect endangered species populations, habitat quality, and illegal activities such as poaching. Camera traps, GPS tracking, and acoustic monitoring are employed.

5.Soil health assessment:

Monitoring soil parameters like nutrient levels and erosion to optimize agricultural practices and prevent land degradation. Soil moisture sensors and remote sensing are commonly used.

6.Waste management:

Monitoring waste disposal sites and recycling efforts to reduce pollution and landfill use. Sensors and tracking systems are used to optimize waste collection and disposal

7.Disaster preparedness:

Monitoring natural disasters such as earthquakes, floods, and wildfires to provide early warning systems and coordinate disaster response efforts. Seismometers, weather satellites, and fire detection systems are involved.