IoT based

Smart Soil Nutrition Monitoring System for Sustainable Agriculture

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Executive Summary

The IoT-Based Smart Soil Nutrition Monitoring System project aims to increase and enhance agriculture by integrating the Smart Sensor System with the Blynk web console. With the help of smart agriculture monitoring we can collect important data about the behavior of Crops in the field. With the help of this smart monitoring we can find out and observed the behavior of plants. After Collecting data, data could be send on IoT platform. The project follows a systematic approach, including requirement analysis, system design, implementation, testing, and deployment. Challenges such as integration complexity and software compatibility were addressed through collaboration and iterative development. Initial results show promising outcomes in terms of remote monitoring and control capabilities, with the system successfully integrating with the Blynk platform.

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Project Objective:

The objectives of an IoT based smart agriculture monitoring system is to use advanced technology to monitor and manage various environmental conditions affecting crops, such as soil moisture, temperature, light intensity, and air quality, among others. This system aims to provide farmers with real-time data and analytics to help them optimize crop yield, reduce water usage, lower costs, and enhance sustainability.

The specific objectives of an IoT based smart agriculture monitoring system may include: • To decrease the amount of manual labor.

• To Developing an integrated system of sensors and actuators that can collect and transmit real-time data about soil moisture, temperature, light intensity, air quality, and other relevant factors.

• To take the update about the crop behavior from anywhere when climate suddenly vary.

• To take action against toxic gases though fertilizers and antioxidant.

• To Providing farmers with access to this data through a user-friendly interface, allowing them to monitor crop conditions, analyze data trends, and make informed decisions about crop management.

• To Lowering costs by reducing waste and improving efficiency in crop management.

• To monitor the Temperature and Humidity level of the crops in the field.

Scope:

The scope of an IoT based smart agriculture monitoring system project can include several aspects such as hardware and software development, system design, testing, and validation, among others. The specific scope of the project may depend on the objectives, requirements, and resources available.

Some potential areas of scope for an IoT Based Smart Agriculture Monitoring System project could include:

- With the help of sensors, the labor need will decrease.
- The sensor allows precisely measure the moisture level of soil.
- The gas sensor will detect different toxic gases. With the help of gas sensor farmers and labors will take action on accurate time to save crops from bad growth.
- The temperature sensor detects the temperature level precisely and accurate than the manual process.
- This may involve using statistical methods and other analytical tools to process the data collected by the system and generate useful insights
- This may involve creating a user-friendly interface that allows farmers to easily access and interpret the data collected by the system.

Project Development Methodology

The project follows a systematic approach:

Requirement Analysis: Identifying the requirements for IoT integration and remote monitoring.

System Design: Designing the architecture for integrating the Soil Nutrition Monitoring System with the Blynk web console.

Implementation: Updating the hardware and software components, configuring the Blynk dashboard, and programming communication protocols.

Testing and Validation: Conducting testing to ensure the reliability and functionality of the IoT-based Soil Nutrition Monitoring System.

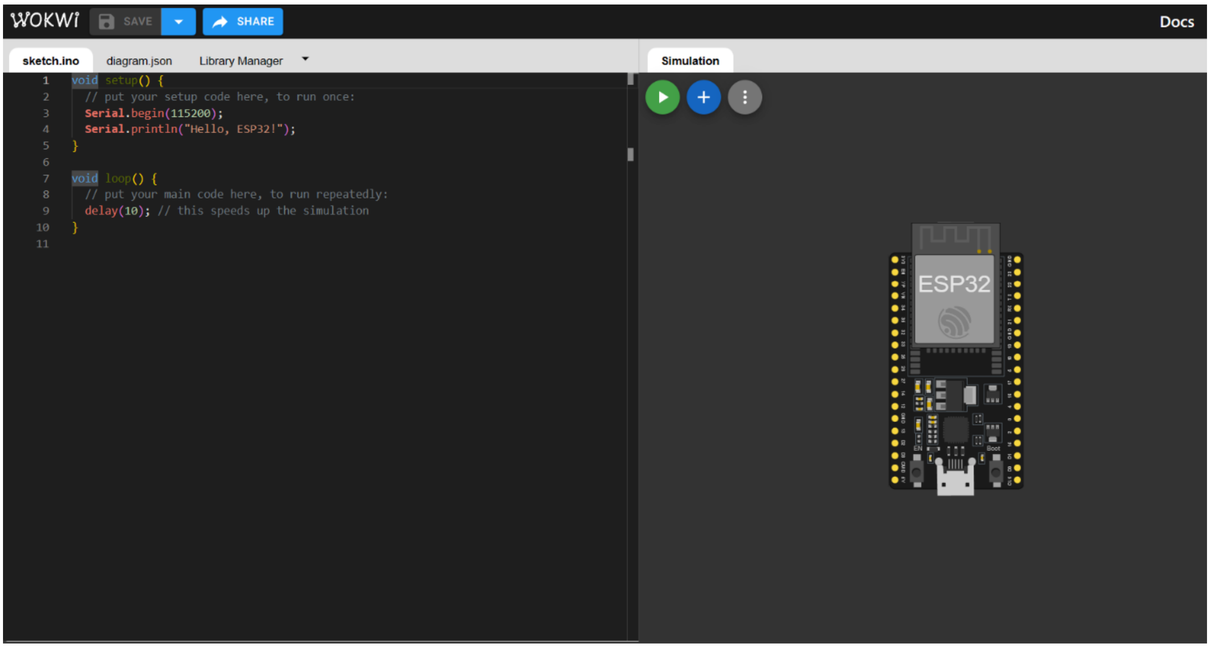
Deployment: Deploying the system and conducting real-world testing to verify performance.

Artifacts used

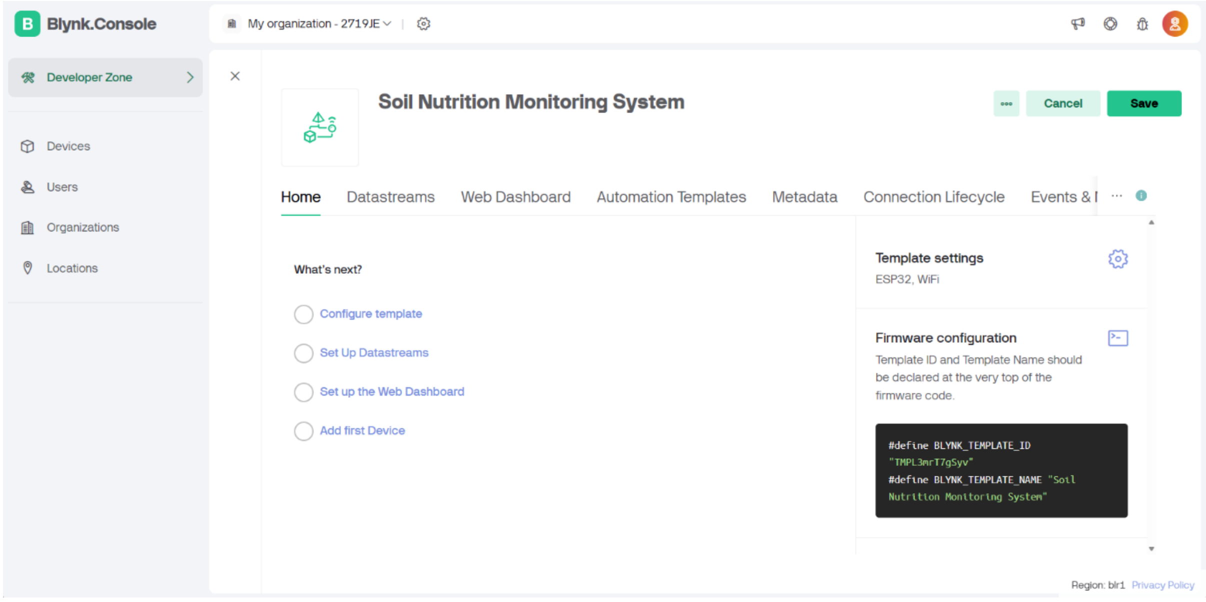
The following artifacts were utilized throughout the project:

The following artifacts were utilized throughout the project:

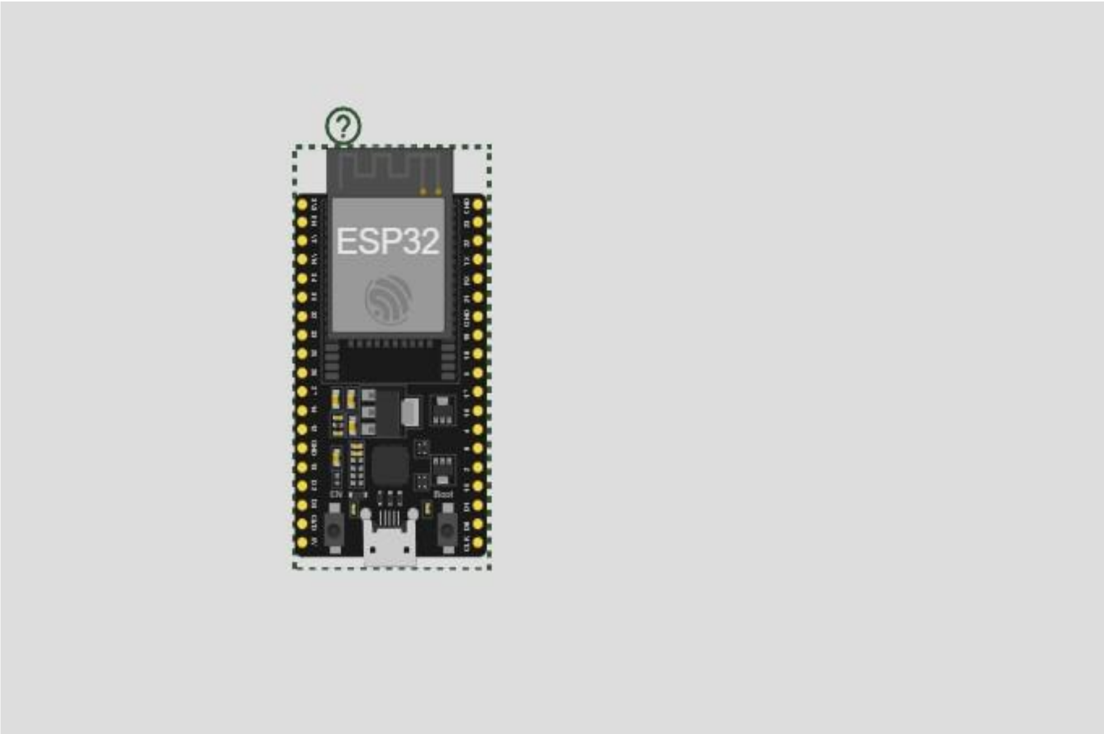
- **Traffic flow data:** Real-time traffic data collected from various intersections.
- **Blynk Library:** Arduino library for interfacing with the Blynk platform and sending/receiving data.
- **Wokwi online simulator tool:** Used for testing and debugging Arduino code.



- **Blynk IoT Platform:** Web console and mobile app for IoT device control and data visualization.



- **ESP8266 or ESP32 Wi-Fi Module:** Hardware platform for enabling Wi-Fi connectivity and IoT capabilities.



Technical coverage:

Those places where temperature suddenly vary with the help of this we can monitor temperature easily.

• Crops where we can't monitor the different required parameters of crops. • All those areas where industrial toxic gases effect on crops health.

• Areas where labor can't go and unable to access, we can easily monitor crop variable on real-time.

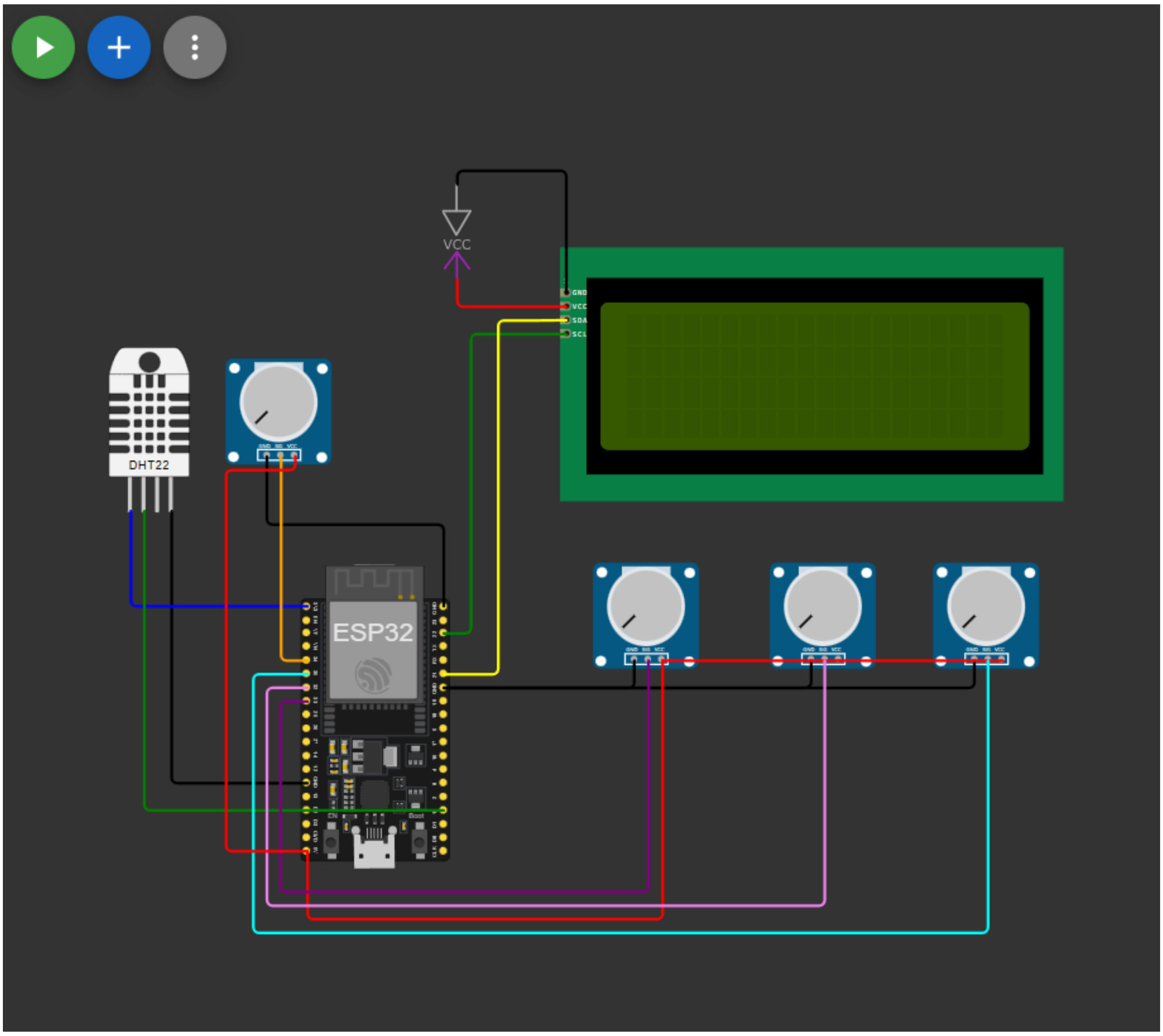
Coding:

```
#include "DHTesp.h"
#include <LiquidCrystal_I2C.h>
#define BLYNK_TEMPLATE_ID "TMPL3HcUN0170"
#define BLYNK_TEMPLATE_NAME "Soil Nurition Monitor"
#define BLYNK_AUTH_TOKEN "kksLCoi_iaIYokNmL8czbgvuWQBeVTG1"
#define BLYNK_PRINT Serial
#define I2C_ADDR    0x27
#define LCD_COLUMNS 20
#define LCD_LINES   4
#define NITROGEN_PIN 33
#define TEMPERATURE_PIN 0
#define HUMIDITY_PIN 1
#define PHOSPHORUS_PIN 32
#define POTASSIUM_PIN 35
#define SOIL_MOISTURE_PIN 34
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
char ssid[] = "Wokwi-GUEST";
char pass[] = "";
BlynkTimer timer;
const int DHT_PIN = 15;
DHTesp dhtSensor;
int Temp;
int hudi;
LiquidCrystal_I2C lcd(I2C_ADDR, LCD_COLUMNS, LCD_LINES);
void myTimerEvent()
{
  int nitrogenValue = analogRead(NITROGEN_PIN);
  int phosphorusValue = analogRead(PHOSPHORUS_PIN);
  int potassiumValue = analogRead(POTASSIUM_PIN);
  int soilMoistureValue = analogRead(SOIL_MOISTURE_PIN);

  float nitrogen = map(nitrogenValue, 0, 4095, 0, 100);
```

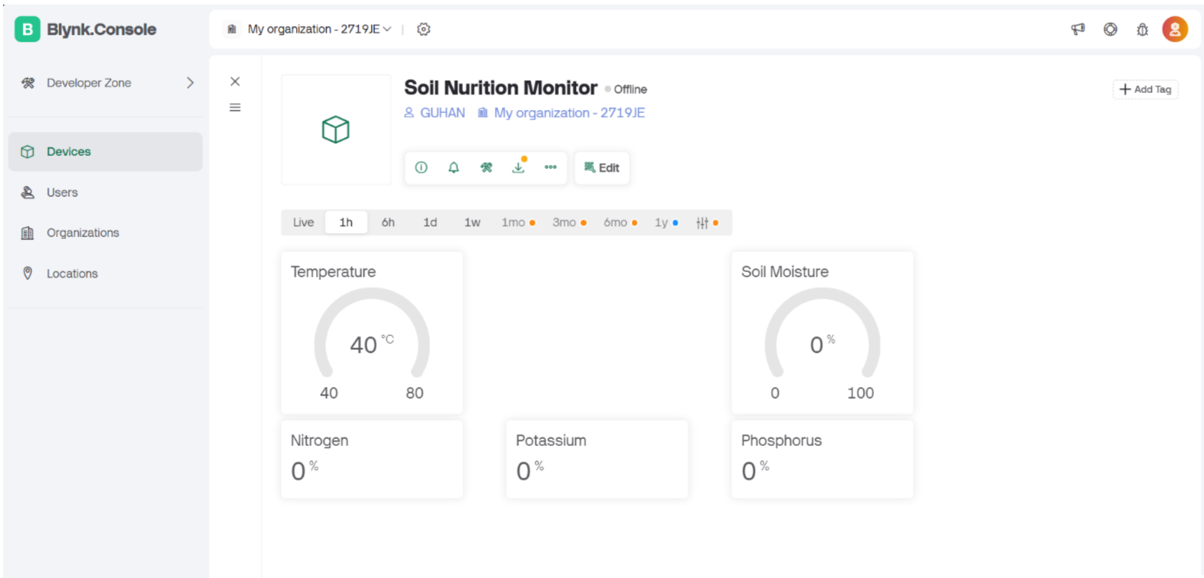
```
  float phosphorus = map(phosphorusValue, 0, 4095, 0, 100);
  float potassium = map(potassiumValue, 0, 4095, 0, 100);
  float soilMoisture = map(soilMoistureValue, 0, 4095, 0, 100);
  TempAndHumidity  data = dhtSensor.getTempAndHumidity();
  Temp=data.temperature;
  hudi=data.humidity;
  Blynk.virtualWrite(V0,Temp);
  Blynk.virtualWrite(V1, hudi);
 Blynk.virtualWrite(V2,soilMoisture);
  Blynk.virtualWrite(V33, nitrogen);
  Blynk.virtualWrite(V32,phosphorus);
  Blynk.virtualWrite(V35, potassium);

}

void setup() {
  Serial.begin(115200);
  Serial.begin(15200, SERIAL_8N1, 16, 17);
      dhtSensor.setup(DHT_PIN, DHTesp::DHT22);
  Blynk.begin("kksLCoi_iaIYokNmL8czbgvuWQBeVTG1"
  , ssid, pass);
  timer.setInterval(1000L, myTimerEvent);
  lcd.init();
  lcd.backlight();
    Serial.begin(115200);
}
void loop() {
  Blynk.run();
  timer.run();
  int nitrogenValue = analogRead(NITROGEN_PIN);
  int phosphorusValue = analogRead(PHOSPHORUS_PIN);
  int potassiumValue = analogRead(POTASSIUM_PIN);
  int soilMoistureValue = analogRead(SOIL_MOISTURE_PIN);
  float nitrogen = map(nitrogenValue, 0, 4095, 0, 100);
  float phosphorus = map(phosphorusValue, 0, 4095, 0, 100);
  float potassium = map(potassiumValue, 0, 4095, 0, 100);
  float soilMoisture = map(soilMoistureValue, 0, 4095, 0, 100);
  TempAndHumidity  data = dhtSensor.getTempAndHumidity();
  Serial.println("Temp: " + String(data.temperature, 1) + "°C");
  Serial.println("Humidity: " + String(data.humidity, 1) + "%");
  Serial.println("---");
  lcd.setCursor(0, 0);
  lcd.print("Temp     : " + String(data.temperature, 1) + "\xDF"+"C  ");
  lcd.setCursor(0, 1);
  lcd.print("Humidity: " + String(data.humidity, 1) + "% ");
delay(4500);
lcd.clear();
  lcd.setCursor(0, 2);
```

```
  lcd.print("NPK SENSORS READING!");
delay(1500);
lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Nitrogen     :" + String(nitrogen,1)+"%");
  lcd.setCursor(0, 1);
  lcd.print("Phosphorous  :" + String(phosphorus,1)+"%");
  lcd.setCursor(0, 2);
  lcd.print("Potassium    :"+String(potassium,1)+"%" );
delay(4500);
lcd.clear();
  lcd.setCursor(0, 1);
  lcd.print("  MOISTURE SENSOR   ");
  lcd.setCursor(0, 2);
  lcd.print("      READING!!!" );
delay(1500);
lcd.clear();
   lcd.setCursor(0, 1);
  lcd.print("MOISTURE LEVEL IN  " );
  lcd.setCursor(0, 2);
  lcd.print("   THE SOIL :"+String(soilMoisture,1)+"%" );
delay(4500);
lcd.clear();
}
```

1. Circuit Diagram:



2.**Blynk Web Console:**



Results

The initial results of the project demonstrate promising outcomes, particularly in terms of remote monitoring and control capabilities:

reasons why soil moisture sensor is useful in this context:

1. Automation of Irrigation System: By measuring the soil moisture levels, the sensor can be used to control the irrigation system to automatically provide water to the crops only when it is needed, improving the efficiency of water usage and reducing waste.

2. Real-time monitoring: The sensor can be connected to the internet through a microcontroller or gateway and the data can be monitored in real-time using a mobile application or web portal, enabling farmers to make informed decisions about irrigation.

3. Early warning: By monitoring the soil moisture levels, the sensor can provide early warning of potential issues, such as dry soil or waterlogging, allowing farmers to take action before the problem becomes severe.

4. Adaptability: Soil moisture sensors can be used in a variety of crops and soil types, making them a versatile tool for farmers and growers.

5. Cost-effective: Soil moisture sensors are relatively inexpensive, making them a cost effective solution for automating irrigation systems.

6. Water saving: By providing accurate data about the soil moisture, the sensor can help farmers to save water and reduce the water consumption.

Conclusion

In conclusion, the IoT-based smart agriculture monitoring system offers a practical and effective solution for farmers to monitor and optimize the growth of their crops. By collecting and analyzing data on various environmental factors such as temperature, humidity, soil moisture, and light intensity, the system provides farmers with valuable insights into the health and growth of their crops.

Through the use of sensors, the system can detect potential problems such as pests, diseases, and nutrient deficiencies, allowing farmers to take prompt action to prevent or mitigate these issues. The system also enables farmers to automate various tasks such as irrigation and fertilization, saving time and resources while improving crop yields. Looking to the future, there is great potential for further advancements in smart agriculture technology.

For example, integrating artificial intelligence and machine learning algorithms could improve the accuracy of data analysis and prediction of crop growth and yield. Additionally, incorporating drone technology for aerial monitoring of crops could provide even more detailed insights into crop health and growth.

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