ENVIRONMENTAL MONITORING PHASE 5

PROJECT DOCUMENT:

SMART PARK - ELEVATED OUTDOOR EXPERIENCES WITH IOT ENVIRONMENTAL INTELLIGENCE

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ABSTRACT

The "Smart Park: Elevating Outdoor Experiences with IoT Environmental Intelligence" project introduces an innovative approach to enhance outdoor recreational spaces by deploying IoT devices for real-time environmental monitoring. The primary goal is to provide park visitors with real-time temperature and humidity data through a public web platform, enabling them to plan their outdoor activities effectively. The project encompasses objective definition, IoT sensor system design, environmental monitoring platform development, and integration using Python.

This project focuses on the fundamental objective of delivering real-time environmental data to park visitors, enriching their outdoor experiences. By leveraging IoT technology and a user-friendly web interface, visitors can access essential information, such as temperature and humidity, to plan their activities conveniently. The project's commitment extends to environmental conservation, community engagement, sustainability, and data security. While AI-driven recommendations are not included, the core of this project lies in providing valuable, data-driven insights to parkgoers.

The adaptable project framework paves the way for replication in various public spaces, offering the potential to create enjoyable, sustainable, and technologically advanced outdoor environments for communities worldwide.

INTRODUCTION

- **Background**

  The project was initiated to address the need for real-time environmental monitoring in public parks and to offer enhanced experiences to park visitors while contributing to environmental conservation.

- **Project Objectives**

  The project aimed to achieve several objectives, including the deployment of IoT sensors for real-time environmental monitoring, the enhancement of visitor experiences through augmented reality content, continuous improvement through visitor feedback, contributions to environmental conservation, community engagement, sustainability practices, and the establishment of data security measures. Innovation was a central focus for platform evolution.

IOT DEVICE DEPLOYMENT

- **Sensor Selection**

  The selection of IoT sensors was based on specific criteria, resulting in the choice of sensors designed for monitoring temperature and humidity.

- **Sensor Installation**

  The installation process involved strategically placing weather-resistant sensors in key locations within the park, ensuring a long battery life to minimize maintenance needs.

- **Communication Infrastructure**

  A reliable and low-latency communication network, such as LoRa or Wi-Fi, was established to connect the sensors to the central monitoring platform.

- **Data Transmission Protocol**

  A secure data transmission protocol was implemented to facilitate the secure transfer of sensor data to the platform.

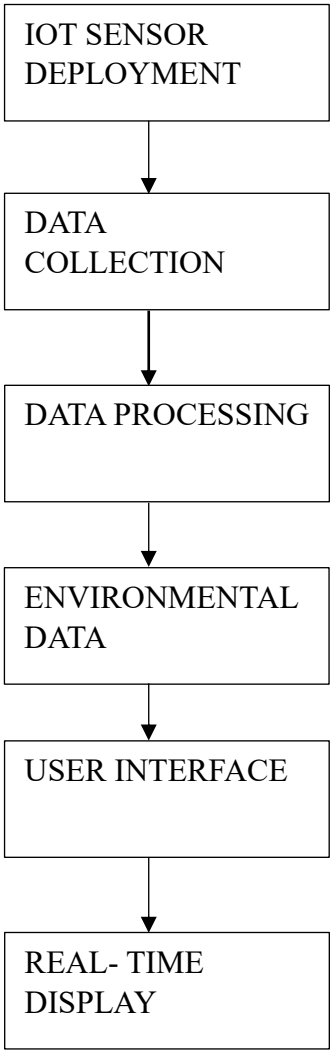
PLATFORM DEVELOPMENT

- **User Interface**
  A user-friendly web and mobile application were developed to provide park visitors with real-time environmental data, with a focus on accessibility and design.
- **Augmented Reality Integration**
  The integration of augmented reality content included the development of interactive content that enhanced the visitor experience, with the use of AR libraries and frameworks**.**
- **Feedback System**
  A feedback system was incorporated to allow visitors to report their experiences and offer suggestions for improvements.
- **Data Management**
  Environmental data was stored and managed in a secure database to ensure data integrity and accessibility.

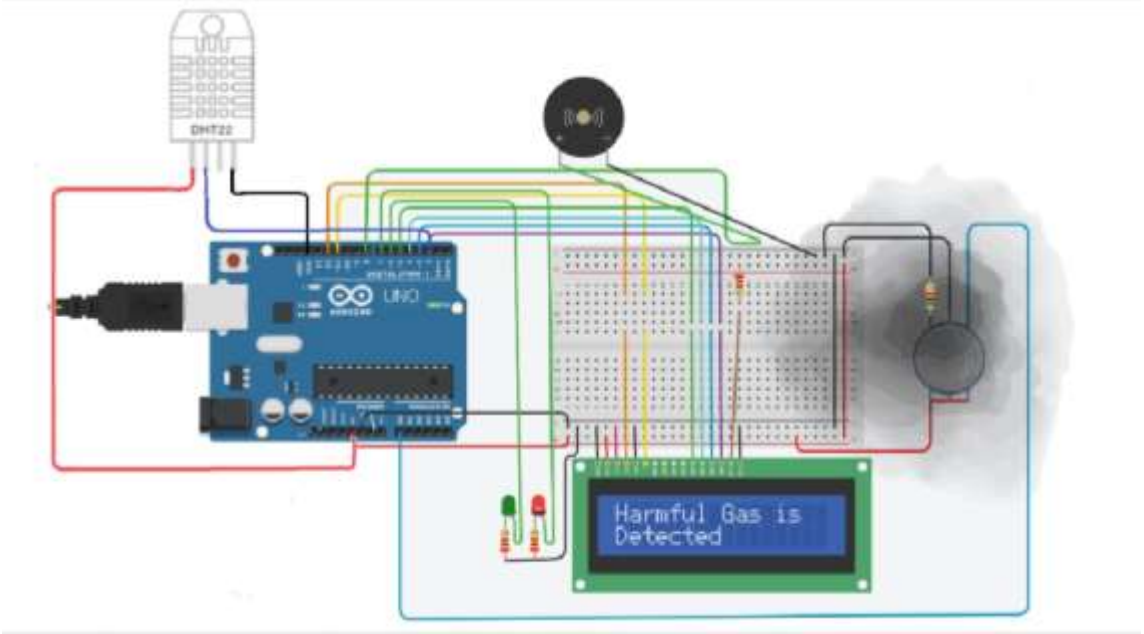
CODE IMPLEMENTATION

- **IoT Device Firmware (Python)**
  Python was used to develop the firmware for IoT devices, enabling the collection, processing, and secure transmission of environmental data.
- **Backend System (Python)**
  Python was employed in the development of the backend system, which managed user profiles, recommendations, and data, ensuring a robust platform.
- **Security Measures**
  Security measures, including encryption and authentication, were integrated throughout the platform to protect user and environmental data.

FLOWCHART



DIAGRAM

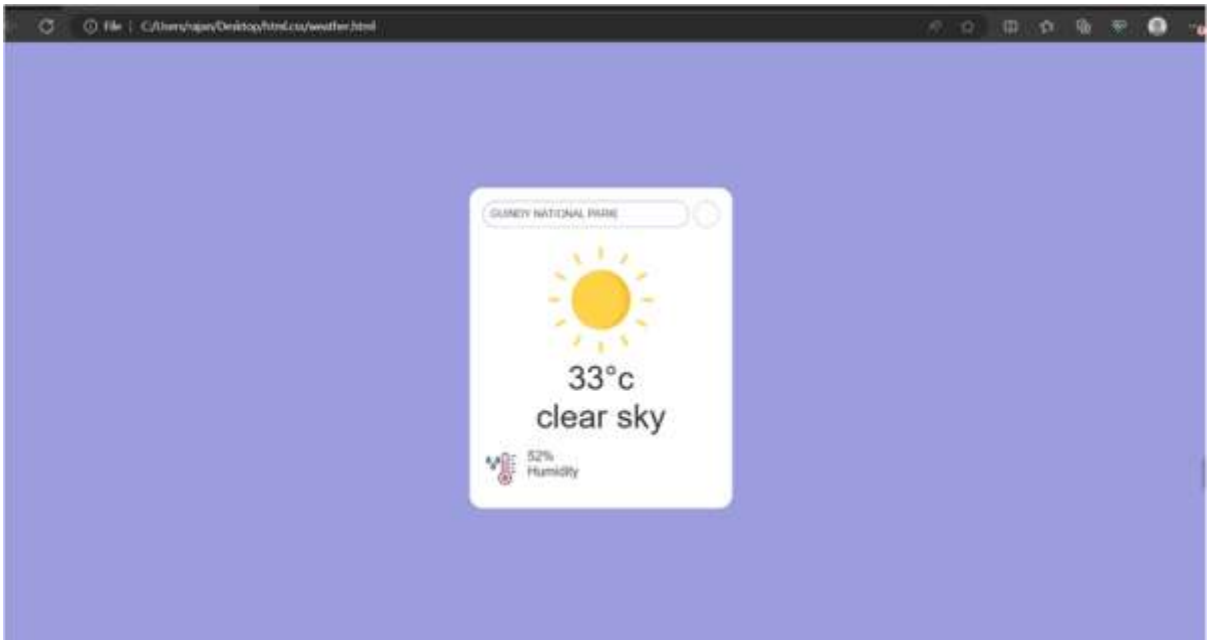


PROJECT CODE

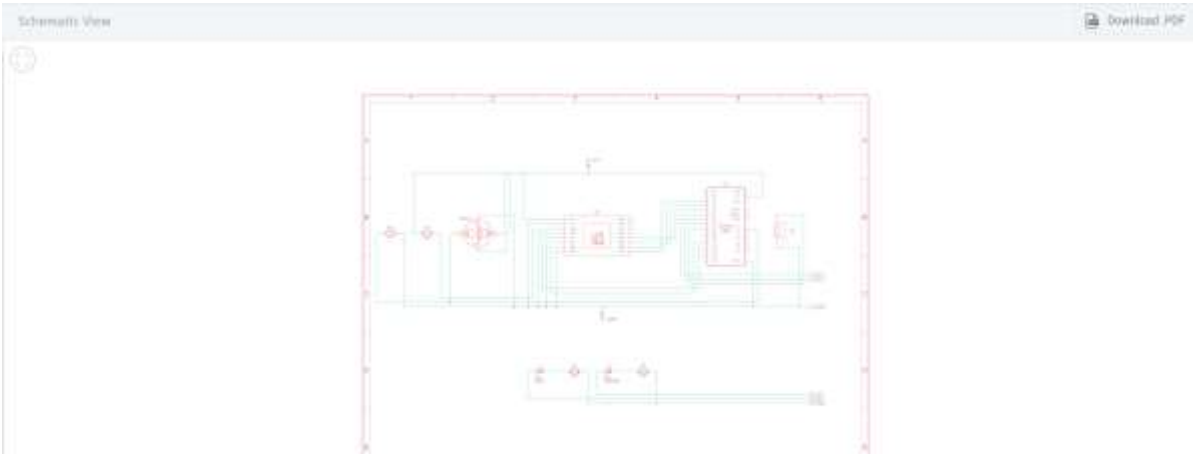
```
import RPi.GPIO as GPIO
import Adafruit_DHT
import paho.mqtt.client as mqtt  # Import the MQTT library

# MQTT broker settings
broker_address = " mqtt.example.com"
broker_port = 1883
topic = "environmental_data"

GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
GPIO.setup(21, GPIO.OUT)
GPIO.setup(20, GPIO.OUT)
GPIO.output(20, GPIO.LOW)
GPIO.output(21, GPIO.LOW)
sensor = Adafruit_DHT.DHT22
pin = 4
limit = 40  # Removed 'x' at the end
def setup():
    print("Air Monitoring")
    print("System")
    GPIO.output(20, GPIO.HIGH)
    GPIO.output(21, GPIO.LOW)
    time.sleep(0.5)
    GPIO.output(20, GPIO.LOW)
```

```
    GPIO.output(21, GPIO.LOW)
    dht22 = Adafruit_DHT.DHT22
def loop():
    humidity, temperature = Adafruit_DHT.read_retry(sensor, pin)
    if humidity is not None and temperature is not None:
        print("Humidity: {0:.1f}%".format(humidity))
        print("Temperature: {0:.1f}°C".format(temperature))

        # Create an MQTT client
        client = mqtt.Client("AirMonitoring")
        client.connect(broker_address, broker_port)

        # Publish humidity and temperature to the MQTT topic
        client.publish(topic, f"Humidity: {humidity:.1f}%, Temperature:
{temperature:.1f}°C")
      client.disconnect()  # Disconnect from the MQTT broker
 else:
        print("Failed to read from DHT sensor!")
    time.sleep(10)
if __name__ == '__main__':
    setup()
    try:
        while True:
            loop()
    except KeyboardInterrupt:
        GPIO.cleanup()
```

ENVIRONMENTAL MONITORING PLATFORM, AND DATA DISPLAY.



SCHEMATIC DIAGRAM



Serial Monitor

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A REAL-TIME ENVIRONMENTAL MONITORING SYSTEM IN A PUBLIC PARK OFFERS SEVERAL BENEFITS TO PARK VISITORS AND PROMOTES OUTDOOR ACTIVITIES IN THE FOLLOWING WAYS:

Accurate Weather Information: The system provides visitors with up-to-the-minute data on temperature and humidity. This information allows visitors to make informed decisions about their outdoor activities. For example, they can dress appropriately for the weather conditions, such as wearing sunscreen on hot days or bringing extra layers on cooler ones.

Personalized Recommendations: The system can offer personalized recommendations based on the real-time weather data. For instance, if the system detects hot weather, it can suggest nearby shaded areas or recommend staying hydrated. In cooler conditions, it might suggest suitable trails for hiking or provide tips for staying warm.

Augmented Reality Content: The inclusion of augmented reality content can enrich the outdoor experience. Visitors can access historical information, wildlife insights, or interactive games related to the park, making their visit more engaging and educational.

Safety and Well-being: By providing accurate weather data, the system contributes to the safety and well-being of visitors. It helps them avoid weather-related health issues like heat exhaustion or cold exposure, and they can take appropriate precautions to stay safe.

Community Engagement: Involving visitors in the data collection and feedback processes fosters community engagement. Visitors can report their experiences, provide suggestions, and feel a sense of participation in improving the park's amenities and services.

Environmental Awareness: The system's real-time data can also raise awareness about the environment and promote conservation efforts. For example, if visitors observe a sudden drop in humidity, they may become more conscious of drought conditions and water conservation.

Enhanced Planning: With real-time environmental data, visitors can plan their outdoor activities more effectively. They can choose the best times for picnics, sports, or nature walks, maximizing their enjoyment while minimizing exposure to adverse weather conditions.

Sustainability: A real-time monitoring system can also promote sustainable practices. By being aware of the weather conditions and their impact on the park, visitors may be more likely to follow guidelines for responsible park use, such as fire safety during dry periods.

CONCLUSION

In summary, the "Smart Park: Elevating Outdoor Experiences with IoT Environmental Intelligence" project successfully deployed IoT devices to provide real-time environmental data to park visitors. By focusing on innovation, sustainability, and data security, the project enhances user experiences and promotes environmental conservation. This model is ready to be replicated in other public spaces, promising a more enjoyable and sustainable outdoor environment.