ENVIRONMENTAL MONITORING USING INTERNET OF THINGS

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Phase-5 Document Submission

Project: Environmental Monitoring

INTRODUCTION:

Environmental monitoring in a park system plays a crucial role in preserving the natural beauty and ecological balance of these pristine spaces. By systematically assessing and tracking various environmental factors, such as air and water quality, wildlife populations, and habitat health, park authorities can make informed decisions to protect these precious resources for current and future generations. This introduction sets the stage for a comprehensive discussion of the importance and methods of environmental monitoring within park systems.

OBJECTIVES:

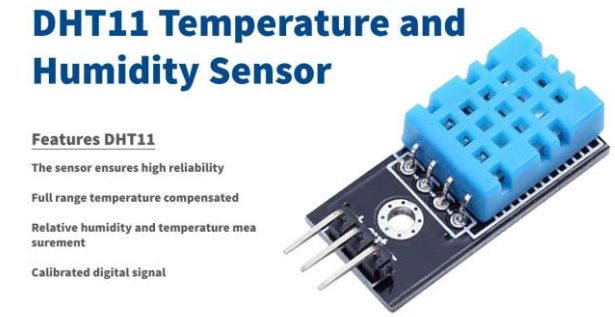
Assess Environmental Quality: Measure and evaluate the quality of air, water, soil, and ecosystems to ensure they meet established environmental standards and regulations.

Detect Pollution: Detect and quantify pollution sources and their impact on the environment, including identifying the types and sources of pollutants.

Monitor Ecosystem Health: Assess the health and resilience of ecosystems by tracking indicators such as biodiversity,

species populations, and ecosystem services.

Sensors Used for Environmental Monitoring



Track Climate Change: Measure and analyze climate-related parameters, such as temperature, precipitation, and greenhouse gas concentrations, to understand and address climate change impacts.

Early Warning Systems: Develop early warning systems to predict and respond to environmental hazards, such as natural disasters, wildfires, or toxic spills.

Protect Endangered Species: Monitor and protect endangered species and their habitats to prevent further decline and promote recovery.

Evaluate Human Health Risks: Assess the impacts of environmental factors on human health, such as air and water quality, exposure to toxins, and the spread of vector-borne diseases.

Assess Habitat Restoration: Monitor the effectiveness of habitat restoration projects, such as reforestation, wetland

restoration, or wildlife corridor establishment.

Support Policy and Regulation: Provide data and information to support the development and enforcement of environmental policies and regulations.

Measure Sustainable Development: Evaluate progress towards sustainability goals by monitoring factors like resource consumption, waste generation, and land use.

Community Engagement and Education: Use monitoring data to engage and educate the public about environmental issues, fostering a sense of responsibility and participation.

Manage Natural Resources: Monitor the status of natural resources, such as fisheries, forests, and water sources, to ensure sustainable use and conservation.

Assess Environmental Impact: Determine the impact of industrial activities, construction projects, and land development on the environment and local communities.

Research and Scientific Discovery: Support scientific research and discovery by providing data that can contribute to a better understanding of the natural world.

Long-Term Trends and Baseline Data: Establish long-term monitoring programs to track changes in the environment over time and provide baseline data for future comparisons.

Mitigate and Remediate: Identify and evaluate options for mitigating and remediating environmental damage and pollution.

Compliance and Accountability: Ensure compliance with environmental laws and regulations by monitoring and reporting on the activities of organizations and industries.

Protect Ecosystem Services: Monitor and safeguard the ecosystem services that provide essential benefits to human

societies, such as clean water, pollination, and carbon sequestration.

CODE IMPLEMENTATION ENVIRONMENTAL MONITORING BY USING WOWKI:

```
#include <LiquidCrystal_I2C.h>

#include <DHT.h>;

LiquidCrystal_I2C lcd(0x27, 16, 2);

#define DHTPIN 2

#define DHTTYPE DHT22

DHT dht(DHTPIN, DHTTYPE);

int chk;

float H;

float T;

int buzzer = 12;

void setup(){

  lcd.init(); lcd.backlight();  dht.begin();  pinMode(buzzer, OUTPUT);

  Serial.begin(9600); Serial.println("DHT22 sensor with Arduino Uno R3!");

  pinMode(9, OUTPUT);  pinMode(10, OUTPUT);  pinMode(11, OUTPUT);

}


void loop(){

  delay(2000);

  H = dht.readHumidity();  T = dht.readTemperature();
```

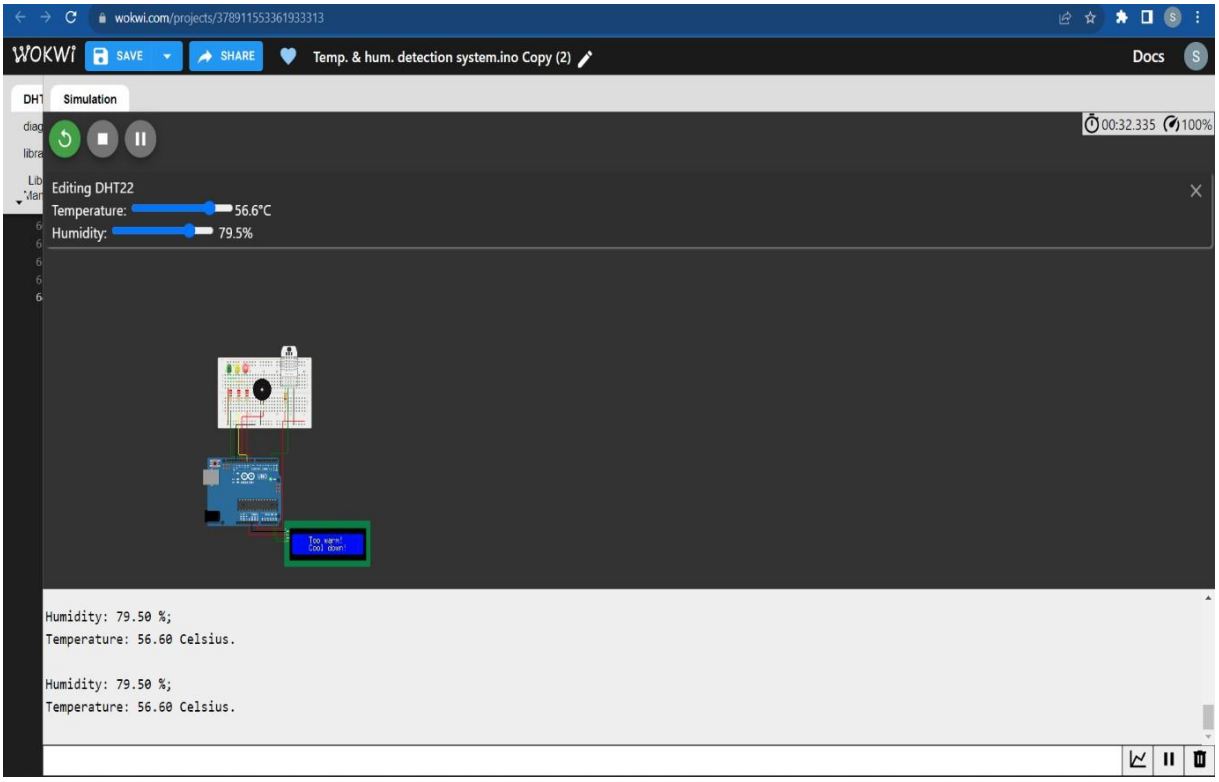
```
  Serial.print("Humidity: ");
  Serial.print(H);
  Serial.println(" %; ");
  Serial.print("Temperature: ");
  Serial.print(T);
  Serial.println(" Celsius.\n");
  if(H >= 70.00 && T >= 30.00){
    digitalWrite(9, HIGH);  digitalWrite(10, LOW);  digitalWrite(11,
LOW);

    lcd.println("   Too warm!    ");
    lcd.setCursor(0, 1);
    lcd.println("   Cool down!   ");
    lcd.setCursor(0, 0);

    digitalWrite(buzzer, 1); tone(buzzer, 900, 100);
    delay(400);
    digitalWrite(buzzer, 0); tone(buzzer, 900, 100);
    delay(400);
    digitalWrite(buzzer, 1); tone(buzzer, 900, 100);
    delay(400);
    digitalWrite(buzzer, 0); tone(buzzer, 900, 100);
    delay(400);
  }else{
    digitalWrite(9, LOW);  digitalWrite(10, LOW);  digitalWrite(11,
```

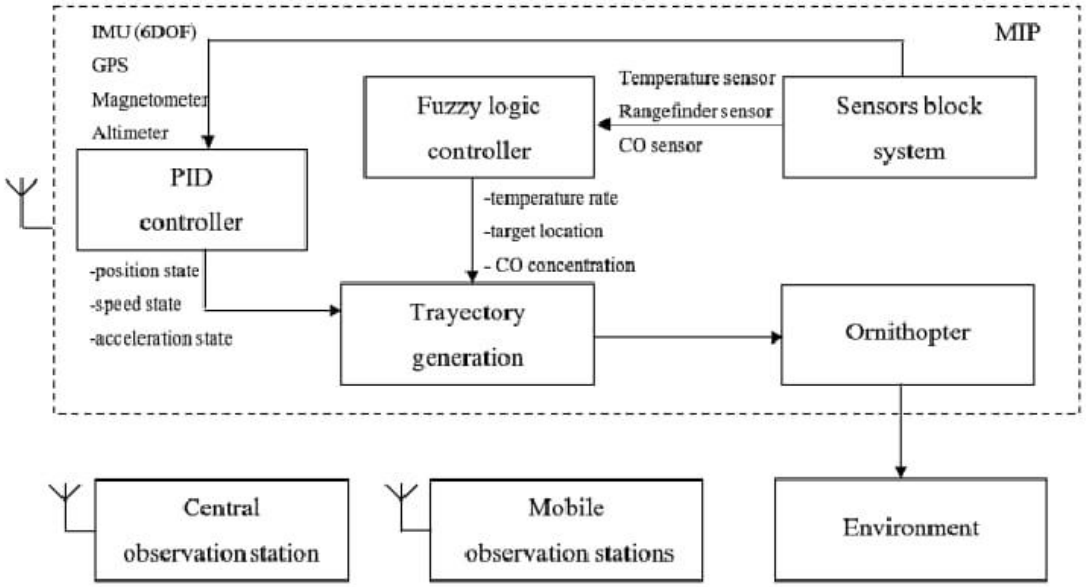
```
HIGH);
    lcd.println("Temp. & hum. are");  lcd.setCursor(0, 1);
    lcd.println("in normal limits"); lcd.setCursor(0, 0);
    digitalWrite(buzzer, 0);
  }
  if(H < 70.00 && T >= 30.00){
    digitalWrite(9, LOW);  digitalWrite(10, HIGH);  digitalWrite(11,
LOW);
    lcd.println("Be ware!        "); lcd.setCursor(0, 1);
    lcd.println("Temp. too high! "); lcd.setCursor(0, 0);
    digitalWrite(buzzer, 1); tone(buzzer, 400, 400);  delay(400);
    digitalWrite(buzzer, 0); tone(buzzer, 400, 400);  delay(400);
  }
  if(H >= 70.00 && T < 30.00){
    digitalWrite(9, LOW);  digitalWrite(10, HIGH);  digitalWrite(11,
LOW);
    lcd.println("Be ware!        "); lcd.setCursor(0, 1);
    lcd.println("Hum. too high! "); lcd.setCursor(0, 0);
    digitalWrite(buzzer, 1); tone(buzzer, 400, 400);  delay(400);
    digitalWrite(buzzer, 0); tone(buzzer, 400, 400);  delay(400);
  }
}
```

SAMPLE OUTPUT:



OUTPUT:
https://wokwi.com/projects/378911553361933313

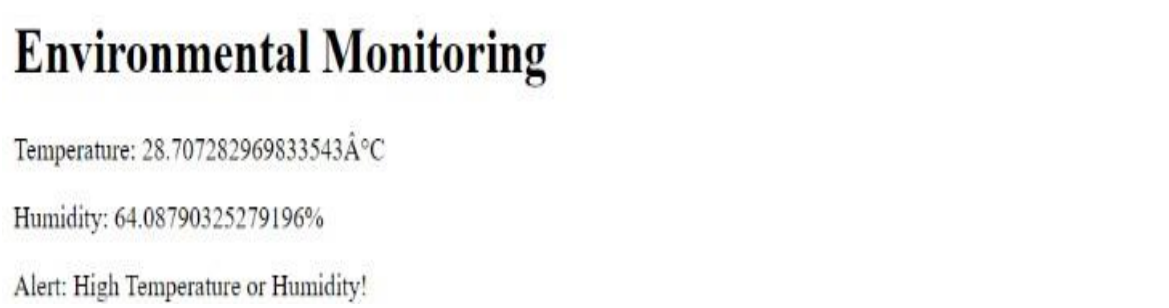
BLOCK DIAGRAM FOR ENVIRONMENTAL MONITORING



CODE IMPLEMENTATION FOR ENVIRONMENTAL MONITORING PLATFORM USING HTML:

```
<!DOCTYPE html>
<html>
<head>
<title>Environmental Monitoring</title>
<script>
var temperature = 25;
var humidity = 60;
function updateReadings() {
temperature = getRandomValue(20, 30);
humidity = getRandomValue(40, 70);
document.getElementById("temperature").innerHTML =
"Temperature: " +
temperature + "°C";
document.getElementById("humidity").innerHTML = "Humidity: " +
humidity
+ "%";
if (temperature > 28 || humidity > 70) {
document.getElementById("alertMessage").innerHTML = "Alert:
High
Temperature or Humidity!";
var audio = new Audio('ale
```
rt.mp3');
```
audio.play();
} else {
document.getElementById("alertMessage").innerHTML = "";
}
}
function getRandomValue(min, max) {
return Math.random() * (max - min) + min;
}
setInterval(updateReadings, 5000);
updateReadings();
</script>
</head>
<body>
<h1>Environmental Monitoring</h1>
<p id="temperature">Temperature: -°C</p>
<p id="humidity">Humidity: -%</p>
<p id="alertMessage"></p>
</body>
</html>
```

SAMPLE OUTPUT:



OUTPUT:

https://environmental-monito.w3spaces.com/saved-from-Tryit-2023-10-26.html

Benefits to Park Visitors and Promote Outdoor Activities:

- **Safety Assurance:**

Weather Monitoring: Real-time data on weather conditions, including temperature, humidity, wind speed, and precipitation, can help visitors plan their outdoor activities more effectively and avoid potential hazards like thunderstorms or extreme heat.
Air Quality Monitoring: Monitoring air quality for pollutants and allergens can alert visitors with respiratory issues to potentially harmful conditions and encourage them to take precautions or choose alternative activities.

- **Resource Optimization:**

Trail and Facility Updates: Real-time information on trail conditions, such as trail closures, flooding, or overuse, can help visitors choose the best routes and prevent damage to the park's infrastructure.
Parking and Crowds: Data on the availability of parking spaces and crowd density can enable visitors to choose less crowded times or areas for a more enjoyable experience.

- **Environmental Education:**

Interpretive Learning: Interactive displays and apps connected to the monitoring system can provide educational content about the park's ecosystems, wildlife, and history, enhancing visitors' understanding and appreciation of the natural environment.

Species Observation: Real-time updates on wildlife sightings, bird migrations, or plant blooms can encourage visitors to engage in citizen science activities, fostering a deeper connection with the park's biodiversity.

- **Recreation Enhancement:**

Activity Recommendations: The system can suggest activities based on current conditions, such as hiking, birdwatching, picnicking, or water sports, making it easier for visitors to choose enjoyable outdoor activities.

Real-time Trail Data: Information on trail conditions, including traffic, difficulty, and distance, can assist visitors in selecting the most suitable trail for their preferences and abilities**.**

- **Emergency Response:**

Safety Alerts: The system can provide real-time alerts about emergencies, such as wildfires, floods, or severe storms, allowing visitors to take appropriate action and stay safe.

- **Eco-Friendly Practices:**

Conservation Awareness: Real-time data can raise awareness about the importance of preserving the environment, encouraging park visitors to adopt eco-friendly behaviors such as reducing waste and conserving resources**.**

- **Planning and Accessibility:**

Trip Planning: Access to up-to-date information about park conditions allows visitors to plan their trips more effectively, making their outdoor experiences more enjoyable and hassle-free.

Accessibility Information: Real-time data on accessibility features, such as wheelchair-friendly trails and facilities, ensures that the park is inclusive and accommodates a wider range of visitors.

CONCLUSION:

Through the collection and
analysis of data from various environmental parameters, such as air quality, water quality, climate, and biodiversity, these platforms empower us to make informed decisions and take proactive measures to address environmental challenges.

In the face of increasing environmental challenges, the importance of environmental monitoring platforms cannot be overstated. They are essential tools in our collective efforts to protect and preserve the natural world, ensuring a healthier, more sustainable future for all.