# Wireless Controller

ESW : Team 13

# Introduction

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This project involves deploying ESP32 modules on the ground and a drone for wireless environmental monitoring. The emphasis is on collecting sensor data, especially from an air quality index sensor for potential forest fire detection. Utilizing WiFi connectivity, real-time data is transmitted from the drone to the ground module. The ground-based system analyzes this data to identify critical conditions, triggering an alert system for prompt notification. The design is modular, allowing for sensor integration, and scalable for future expansion to address diverse environmental monitoring needs.

# Introduction

## PROJECT SCOPE

This initiative focuses on implementing wireless environmental monitoring using ESP32 modules on both ground and drone platforms. Key objectives include collecting data, particularly from an air quality index sensor, for potential forest fire detection.

## FUNCTIONALITIES

The system ensures real-time data transmission from the drone to the ground module through WiFi connectivity. The ground-based component analyzes the received data, prioritizing the identification of critical conditions such as smoke, triggering an alert system for timely notifications. The design is modular, accommodating various sensors, and scalable for potential future expansions, ensuring adaptability to evolving environmental monitoring requirements.

# HardWare

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## MQ2 AND MQ135

Employing MQ2 and MQ135 sensors enables the system to detect a variety of gases, crucial for monitoring air quality and identifying potential hazards such as smoke or other pollutants

## BMP

The BMP sensor adds precision to the environmental monitoring system by measuring barometric pressure. This data is valuable for assessing at pressure and locate where exactly the drone is to compare other quality indexes.

## DHT

The inclusion of the DHT sensor provides essential environmental data by measuring temperature and humidity. This information contributes to a comprehensive understanding of the monitored conditions.

# The Esps

## MAIN ESP

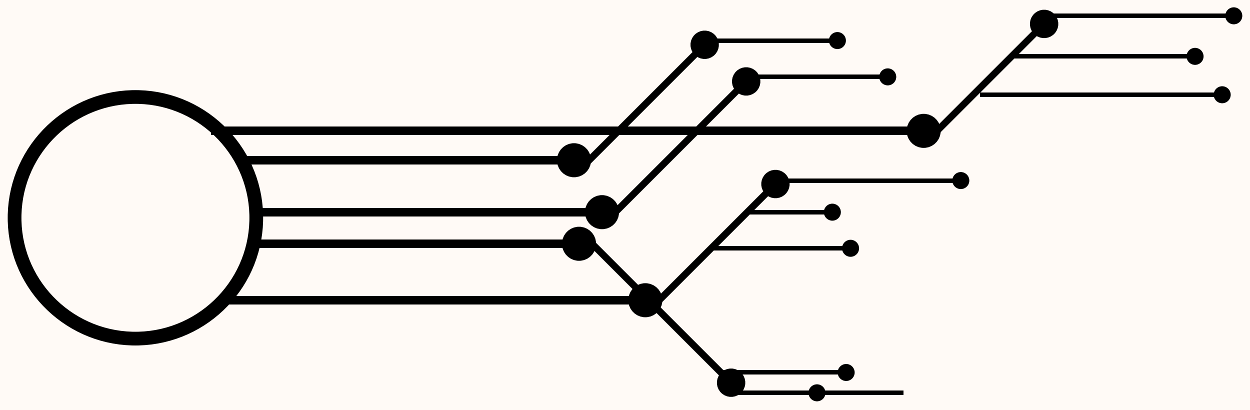
The ground-based ESP receives data transmitted by the drone, utilizing algorithms to analyze and visualize sensor data. Prioritizing critical conditions like smoke, the system triggers an alert mechanism for timely notifications. The design ensures adaptability with the potential to integrate additional sensors, contributing to a modular and scalable environmental monitoring solution.

## MOUNTED ESP

The ESP module on the drone collects data from sensors including MQ2, MQ135, DHT, and BMP, measuring gases, temperature, humidity, and barometric pressure. It wirelessly transmits real-time environmental data to the ground-based ESP module using WiFi, facilitating continuous monitoring during drone flights.

# The Connection

## HOW ARE TWO ESPS CONNECTED



The connection between the drone-mounted ESP module and the ground-based ESP module is established through a WiFi network. The drone-mounted ESP, configured as a client, transmits sensor data wirelessly to the ground-based ESP, configured as a server(Controller). This bidirectional WiFi connection facilitates real-time data exchange, enabling the ground-based module to receive, analyze, and respond to environmental data collected by the drone during its operations.

# Software

# Integration With ThingSpeak

The ESP modules, equipped with sensors, use the ThingSpeak library to establish a WiFi connection and send continuous sensor data, including readings from MQ2, MQ135, DHT, and BMP, to a specified ThingSpeak channel. This process involves specifying channel fields for each data type and configuring automated transmissions at regular intervals, enabling ThingSpeak to efficiently receive, store, and organize the real-time environmental data for visualization and analysis.

# The User-Interface

The website interface interacts with ThingSpeak through its API, using the channel's API key for authentication. The website retrieves the stored environmental data from the designated ThingSpeak channel, parsing the JSON responses to extract relevant information. This seamless integration allows the website to dynamically present the real-time and historical sensor data in a user-friendly manner. The website's user interface serves as a portal for users to monitor and analyze the environmental conditions collected by the ESP modules, enhancing their overall experience and facilitating data-driven decision-making.

# THE BLYNK

## THE CLOSE MONITORING

Incorporate a form widget within your Blynk app to allow users to input specific threshold values or parameters they want to monitor closely.

## THRESHOLDS

Enable users to set their own threshold values for critical parameters through the form. This provides a customized experience, allowing users to define what is considered a critical condition.

## DYNAMIC NOTIFICATION SETUP

Use the submitted form data to dynamically configure the notification system in your ESP code. This allows users to receive alerts tailored to their specified thresholds and parameters of interest.

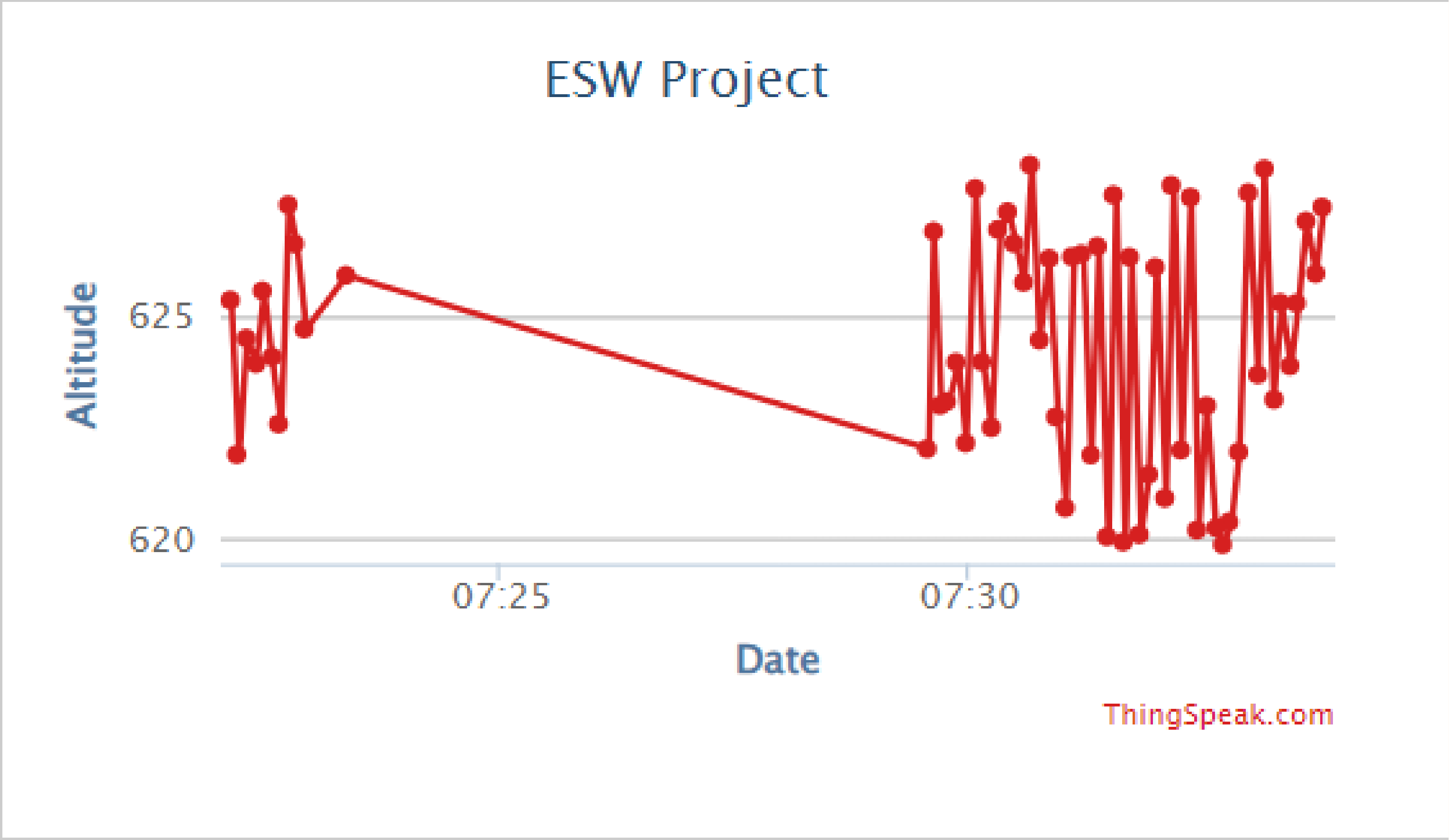
## PERSONALIZED MONITORING PREFERENCES

Extend the form to include options for users to choose specific parameters or environmental factors they wish to monitor closely. This adds a layer of personalization to their monitoring preferences

# THE FLOW

1. Sensor Data Collection: Two ESP modules equipped with sensors (MQ2, MQ135, DHT, BMP) capture environmental data. The drone-mounted ESP continuously reads sensor values during its operation.
2. Wireless Data Transmission: Drone-mounted ESP wirelessly transmits sensor data to ThingSpeak using ESP8266/ESP32 modules. Simultaneously, the ground-based ESP receives and pushes the data to ThingSpeak in real-time.
3. Cloud-Based Storage and Visualization: ThingSpeak, a cloud-based IoT platform, serves as a central repository for storing environmental data. The ThingSpeak user interface facilitates real-time and historical data visualization.
4. Blynk App Integration: Blynk IoT platform is integrated into the ESP code for enhanced user interaction. A Blynk app allows users to set personalized thresholds and parameters through an integrated form, triggering notifications for critical environmental conditions.

# THE GRAPHS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Altitude
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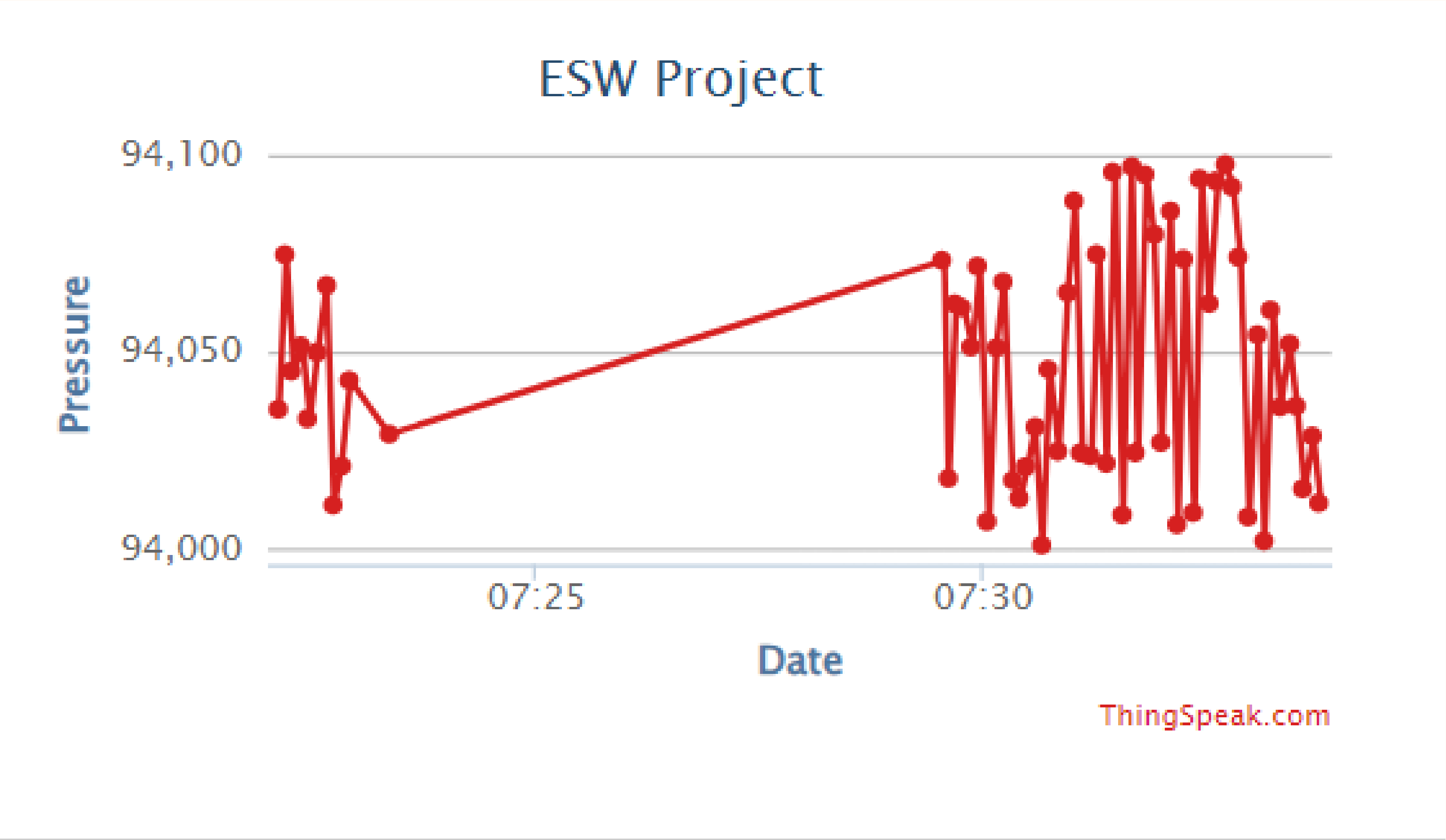
07:25
07:30
Date
ThingSpeak.com


ESW Project
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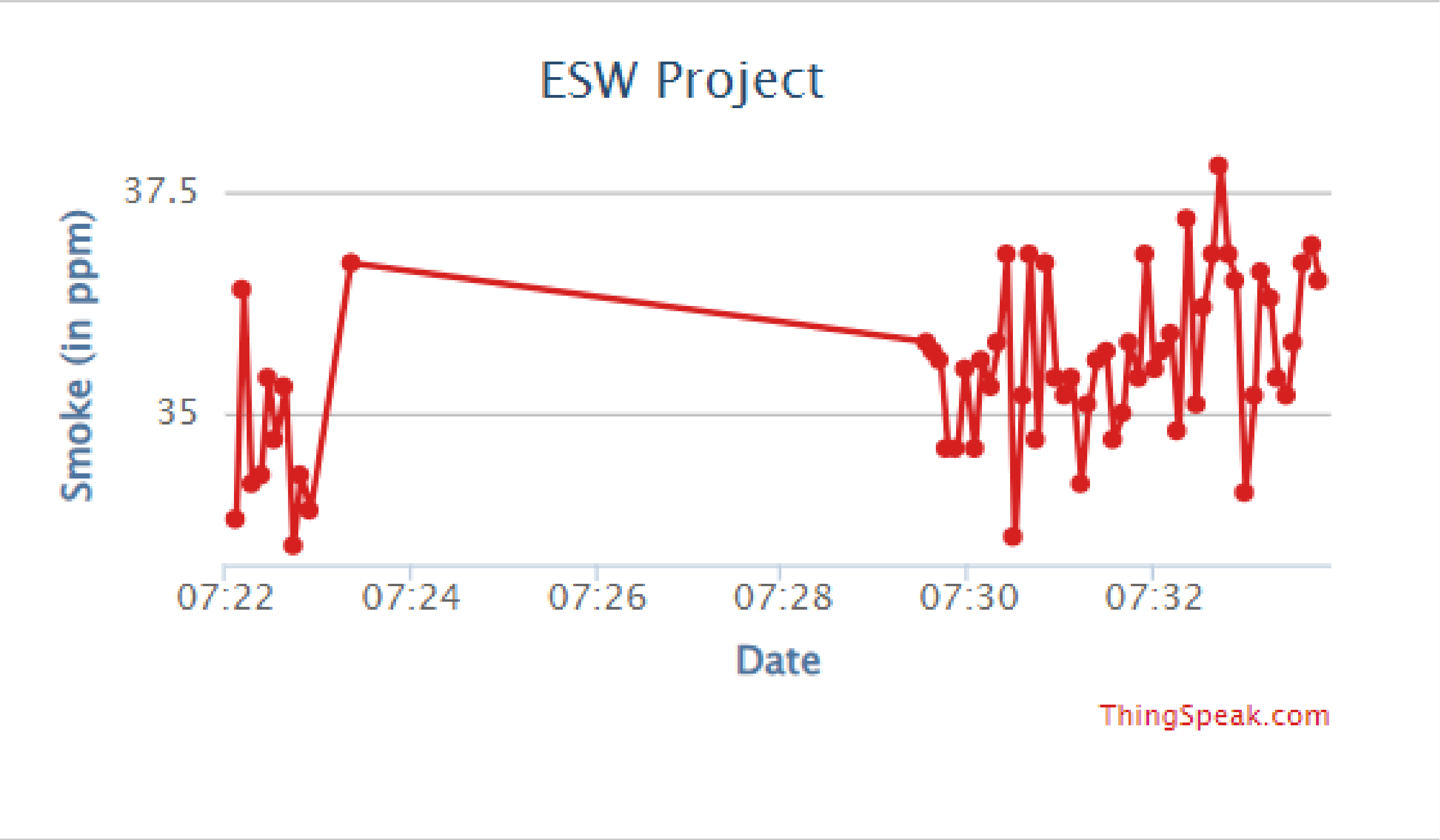
ESW Project
Smoke (in ppm)
37.5
35
07:22
07:24
07:26
07:28
07:30
07:32
Date
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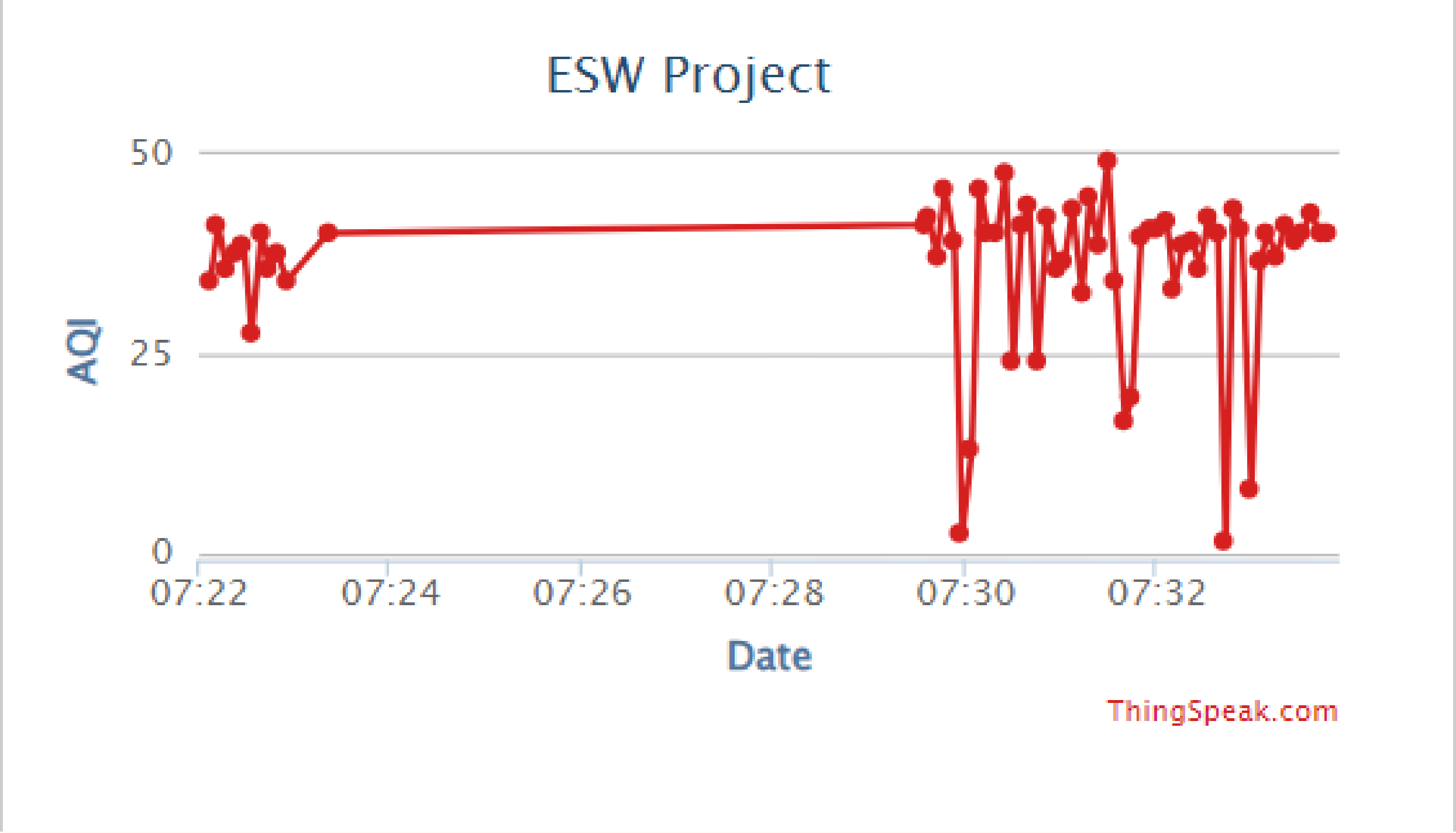
ESW Project
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07:22
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07:26
07:28
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Date
ThingSpeak.com

# WHY THIS PROJECT?

1. Early Hazard Detection: Enabling swift detection of environmental hazards like forest fires and gas leaks, minimizing response times and potential damage.
2. Data-Informed Decision-Making: Facilitating data-driven decision-making by continuously monitoring environmental data, improving resource allocation and response strategies.
3. Environmental Conservation: Contributing to environmental conservation efforts by monitoring air quality, temperature, humidity, and identifying areas requiring conservation measures.
4. Public Safety and Awareness: Enhancing public safety through real-time data visualization and alerts, ensuring individuals are informed and can take necessary precautions.
5. Scalability and Adaptability: Offering a modular and scalable design for adaptability to evolving environmental monitoring needs and potential future innovations.
6. IoT Technological Innovation: Showcasing the practical application of IoT technology in environmental monitoring, contributing to technological advancements in the field.

# FUTURE PLANS

1. **Enhanced Sensor Capabilities**: Invest in advanced sensors or additional sensor types to broaden the scope of monitored environmental parameters. This could include sensors for specific pollutants, particulate matter, or other emerging environmental concerns
2. **Machine Learning for Anomaly Detection**: Implement machine learning algorithms for anomaly detection, allowing the system to identify unusual patterns or behaviors in the environmental data that might indicate emerging issues or threats.
3. **Establish integration** with local emergency services to enable automatic notifications in the event of critical environmental conditions. This would streamline emergency response efforts and ensure a faster and coordinated reaction
4. **Explore the integration of geospatial data** for a more location-specific understanding of environmental conditions. Geospatial information can provide insights into localized variations and trends.

# OUR TEAM

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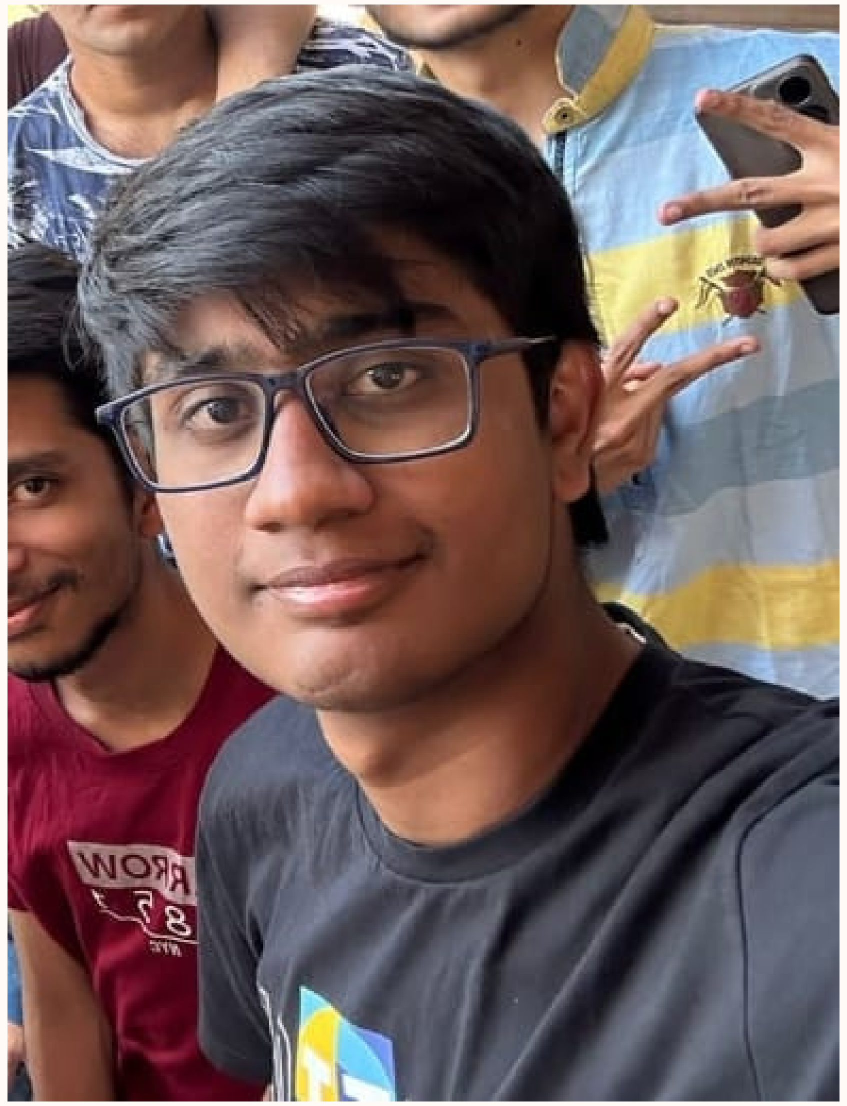

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# THANK YOU