



**MICROPROCESSOR BASED SYSTEM DESIGN (CS-301)**

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## **COMPLEX ENGINEERING PROBLEM REPORT**

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**NED UNIVERSITY OF ENGINEERING & TECHNOLOGY**

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## PROJECT: AIR QUALITY MONITORING SYSTEM

### OBJECTIVE

The primary objective of this project is to develop an Air Quality Index (AQI) detector using an ESP32 microcontroller, which will monitor and display the air quality in real time. The AQI will be determined based on the readings from multiple sensors, including the DHT22 sensor for temperature and humidity, the LDR light sensor and the GP2Y1010AU0F Optical Dust sensor for measuring dust particle's density. The data collected will be processed by the microcontroller and transmitted to the ThingSpeak, where it can be viewed on both computers and smartphones. We have also developed a website to monitor the readings of our sensors.

### COMPONENTS

The following components will be used in the project:

#### 1. ESP32 Microcontroller:

- Used as the central processing unit for controlling all connected sensors and transmitting data to the cloud.
- Features built-in Wifi for cloud communication.

#### 2. GP2Y1010AU0F Optical Dust Sensor:

- Detects dust particle's density and smoke in the air.
- Outputs an analog voltage that corresponds to the density of dust in the air

#### 3. DHT22 Temperature and Humidity Sensor:

- Measures temperature and humidity.
- Provides digital output, which is processed by the microcontroller

#### 4. LDR light Sensor:

- Measures light's intensity.
- Outputs an analog voltage that corresponds to the density of light.

### INTERFACE

#### 5. Arduino IDE:

- The development environment used to write and upload code to the ESP32.

## 6. Thing Speak:

- A cloud-based platform for monitoring and controlling devices remotely.
- Provides a user-friendly interface to display sensor readings.

## 7. Website:

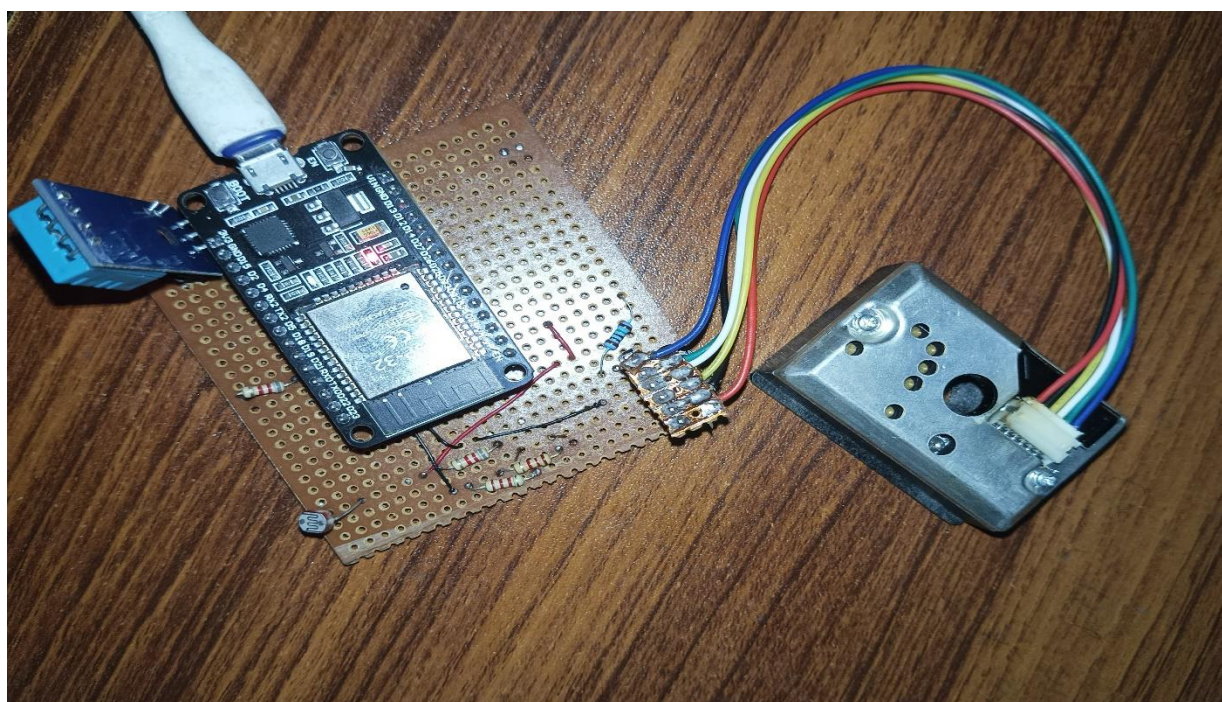
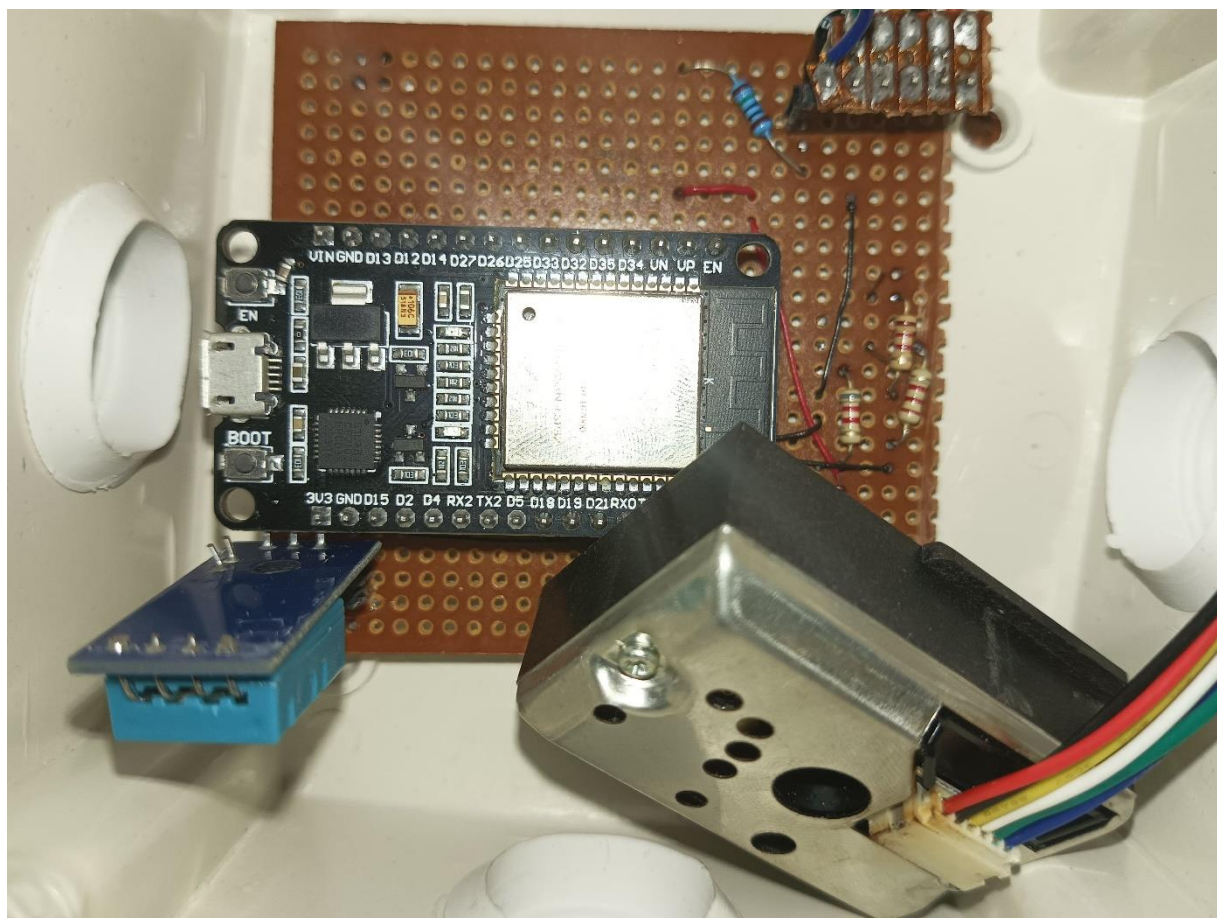
- Developed a responsive website using Flask, HTML, CSS, and JavaScript to display real-time sensor readings fetched from ThingSpeak.

# WHAT WE HAVE IMPLEMENTED

In this project, we have successfully implemented an IoT-based environmental monitoring system utilizing the ESP32 microcontroller. The system is designed to collect real-time data from multiple sensors and transmit it to the cloud for visualization and analysis. The key accomplishments are as follows:

- Successfully interfaced the dust sensor, DHT22 temperature and humidity sensor, and LDR light sensor with the ESP32 to monitor environmental parameters.
- Configured the ESP32 to transmit real-time data to the ThingSpeak cloud platform using its built-in Wi-Fi capabilities.
- Developed a responsive web application, which retrieves the latest 20 sensor readings from ThingSpeak at five-minute intervals and displays them in an organized format.
- Implemented Over-The-Air (OTA) firmware update functionality to allow remote updates of the ESP32, ensuring maintainability and ease of future enhancements.

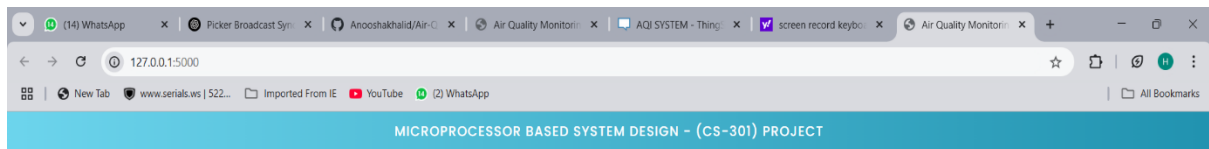
## HARDWARE CIRCUIT





# DASHBOARD

## Index Page



## AIR QUALITY MONITORING SYSTEM

Using ESP32 and multiple environmental sensors, this project monitors dust, humidity, temperature, and light intensity – providing real-time data to a smart dashboard.

### Roll Numbers:

CS22101 • CS22104 • CS22107 • CS22108

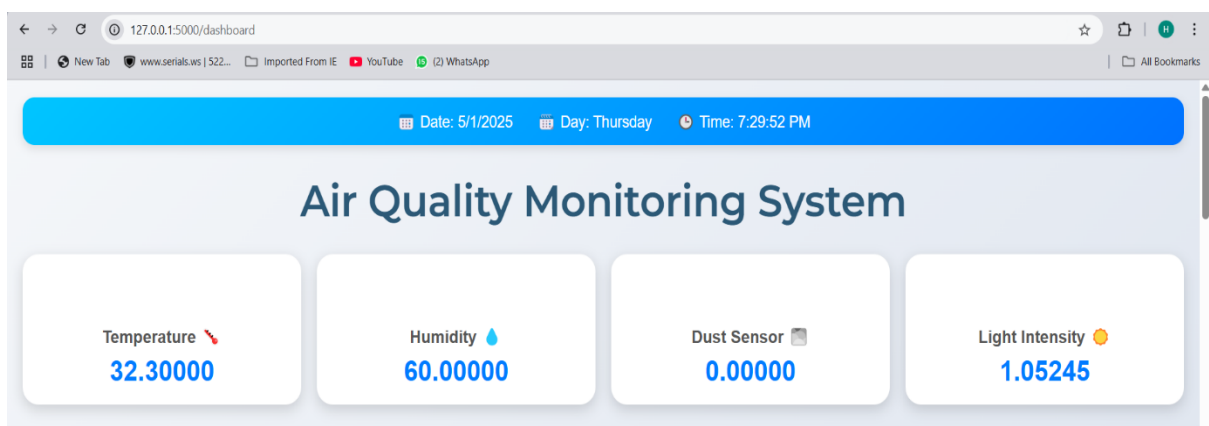
### Instructor:

Dr Muhammad Khurram

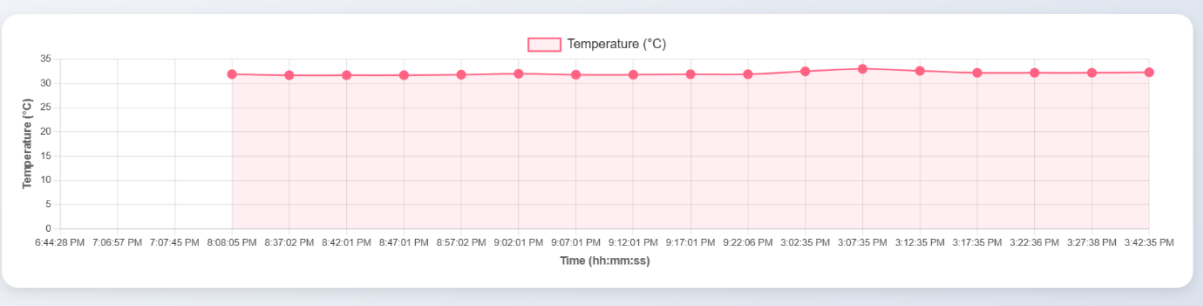
[Go to Dashboard](#)



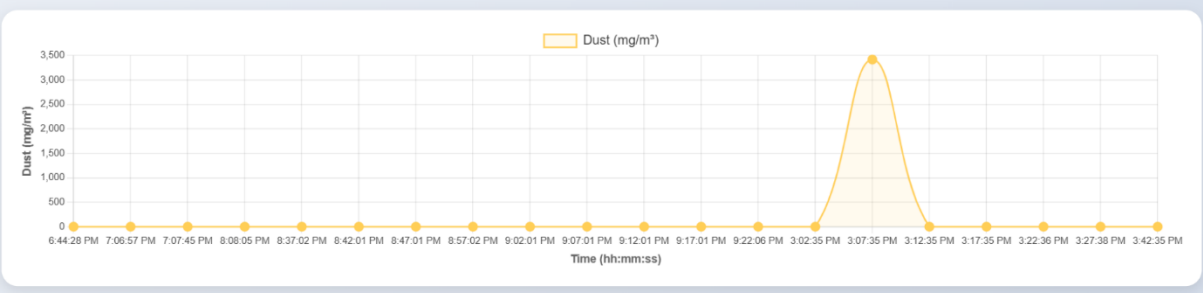
## Readings



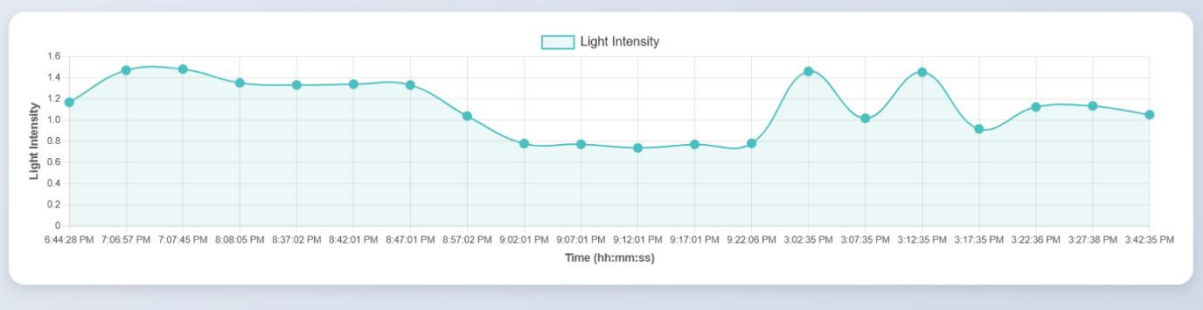
## Temperature



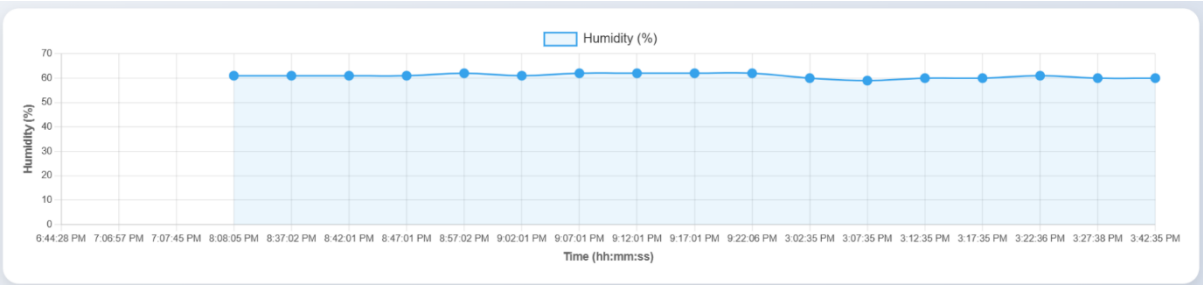
## Dust



## Light Intensity



## Humidity



# Raw Readings Table

127.0.0.1:5000/dashboard

New Chrome available

New Tabwww.serials.ws | 522...Imported From IEYouTube(2) WhatsAppAll Bookmarks

Raw Data Table

Entry ID	Timestamp	Temperature (°C)	Humidity (%)	Dust (mg/m³)	Light
165	4/26/2025, 6:44:28 PM	nan	nan	0.00000	1.16930
166	4/26/2025, 7:06:57 PM	nan	nan	0.00000	1.47150
167	4/26/2025, 7:07:45 PM	nan	nan	0.00000	1.48278
168	4/27/2025, 8:08:05 PM	31.90000	61.00000	0.00000	1.35304
169	4/27/2025, 8:37:02 PM	31.70000	61.00000	0.00000	1.33289
170	4/27/2025, 8:42:01 PM	31.70000	61.00000	0.00000	1.34095
171	4/27/2025, 8:47:01 PM	31.70000	61.00000	0.00000	1.33209
172	4/27/2025, 8:57:02 PM	31.80000	62.00000	0.00000	1.03956
173	4/27/2025, 9:02:01 PM	32.00000	61.00000	0.00000	0.77927
174	4/27/2025, 9:07:01 PM	31.80000	62.00000	0.00000	0.77282
175	4/27/2025, 9:12:01 PM	31.80000	62.00000	0.00000	0.73817
174	4/27/2025, 9:07:01 PM	31.80000	62.00000	0.00000	0.77282
175	4/27/2025, 9:12:01 PM	31.80000	62.00000	0.00000	0.73817
176	4/27/2025, 9:17:01 PM	31.90000	62.00000	0.00000	0.77121
177	4/27/2025, 9:22:06 PM	31.90000	62.00000	0.00000	0.78088
178	5/1/2025, 3:02:35 PM	32.50000	60.00000	0.00000	1.46103
179	5/1/2025, 3:07:35 PM	33.00000	59.00000	3417.58228	1.01861
180	5/1/2025, 3:12:35 PM	32.60000	60.00000	0.00000	1.45458
181	5/1/2025, 3:17:35 PM	32.20000	60.00000	0.00000	0.91788
182	5/1/2025, 3:22:36 PM	32.20000	61.00000	0.00000	1.12498
183	5/1/2025, 3:27:38 PM	32.20000	60.00000	0.00000	1.13465
184	5/1/2025, 3:42:35 PM	32.30000	60.00000	0.00000	1.05245

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