

INDOOR AIR QUALITY MONITOR

PG11

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OVERVIEW

The aim of our project is to design an Indoor Air Quality Monitoring System . The two main features of the system are:

- Utilizing MQ sensors and DTH 11 to detect various air parameters, temperature and humidity.
- Maintaining a record of the values in an Excel sheet which can be accessed remotely via OneDrive.
- Integrating ESP32's Wi-Fi capabilities for mobile connectivity to send instant alerts to mobile devices based on our indoor air quality sensor readings.

COMPONENTS and PARTS:

- **Twilio**, a cloud-based communication platform provides a set of APIs for the integration of SMS from ESP 32 to Smart phone and is used in our project for the same.
- Various **MQ** sensors are used to detect gases via resistance changes. These sensors utilize metal oxide semiconductor coatings. Gas interaction changes the sensor's resistance, proportionate to gas concentration.
- The **MQ-2** sensor serves as a pivotal element in our project, specifically aimed at gauging smoke concentration in the vicinity. Besides that it also detects gases like *LPG, butane, propane, methane, alcohol, smoke, and hydrogen*. Its competence in detecting smoke particles makes it an integral part of fire detection systems etc.

DESIGN PARAMETERS:

- **Sensor Integration and Compatibility**

Communication: Establishing protocols to ensure seamless communication between these MQ sensors, DTH 11 and the central processing unit (i.e. "ARDUINO UNO" and "ESP 32") is essential for synchronized data collection.

Mapping Values: Mapping the values received from the sensors within appropriate range of respective processing unit . Deriving the right ppm values for Correct detection of danger levels of the gases.

- **Data Transmission and Notification System**

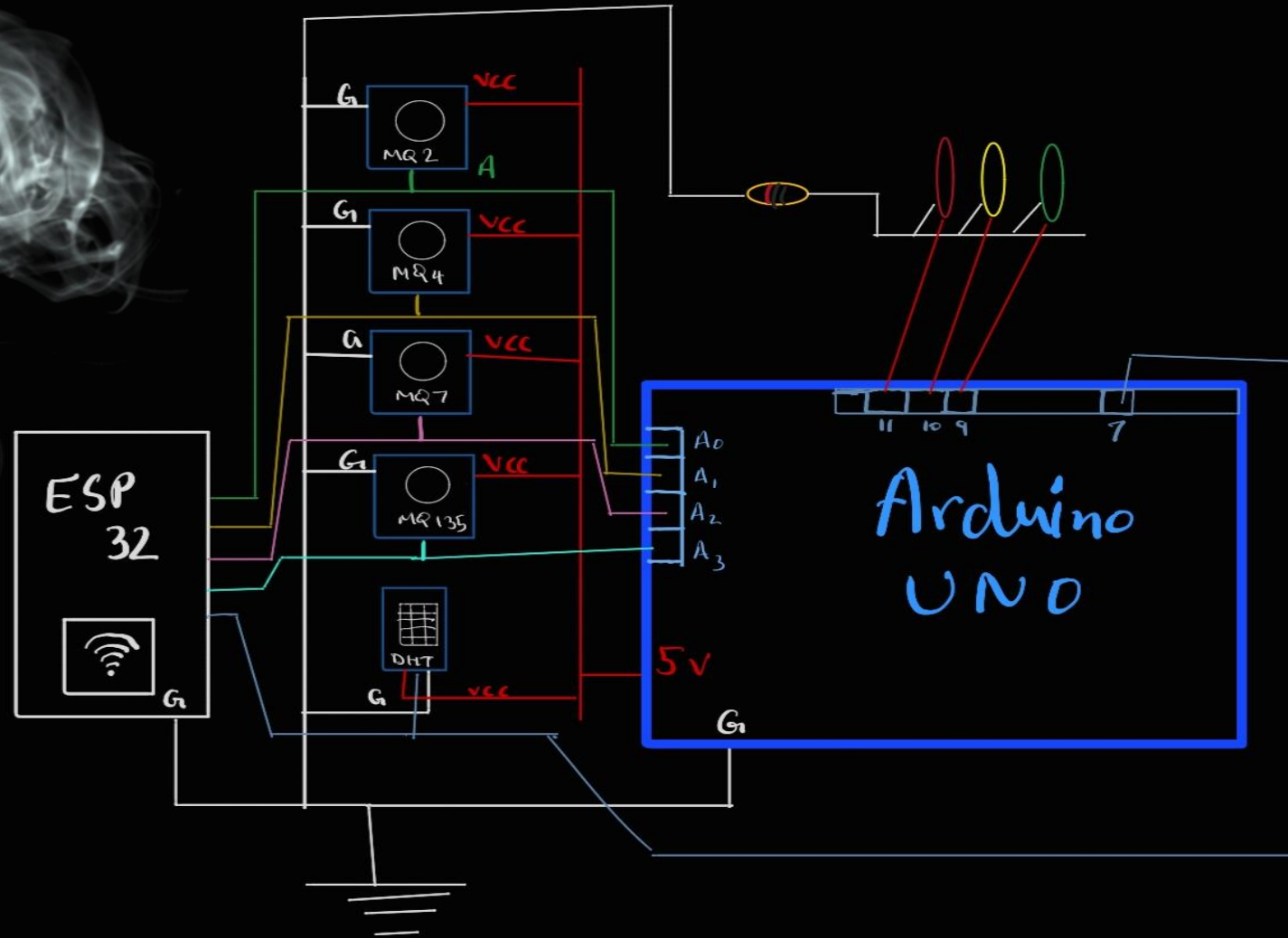
Twilio Integration: The ESP32 integrates with Twilio's API to enable communication between the device and the Twilio platform. This integration allows the ESP32 to send SMS or other notifications through Twilio's service.

ESP32 Integration: The ESP32 is configured to connect to the internet via Wi-Fi enabling it to interact with Twilio's servers. A code is developed for the ESP32 to handle sensor data, trigger notifications, and communicate with Twilio's API.

- **Power Consumption**

Using Laptop USB port 5V is provided to MQ, DTH11 sensors, Arduino UNO and 3.3V for ESP32.

CIRCUIT:



CHALLENGES FACED WITH HARDWARE:

- *Power management between Arduino – UNO and ESP32:*

ESP-32 works on approximately 3.3 V, Arduino UNO works on 5 V and Gas sensors work on 5 V. Due to this difference in voltages, Arduino and ESP32 cannot be used to perform standard communication protocols.

- *Identifying which pins can be used for the required purpose:*

There are a variety of purposes for which an ESP32 pin can be used. It was hard to select the pins which would serve our purpose.

- *Heating Up time for the sensors:*

The sensors require a lot of heat up time to be able to detect the values efficiently.

CHALLENGES FACED WITH SOFTWARE:

- *Updated apps:*

Although there are various sites and applications which can be used in sync with *ESP-32* to send mobile notifications. But the tutorials present on the internet end up being old and useless but only increase the confusion associated with the process.

- *Large number of Libraries:*

To use multiple sensors more than one libraries must be included in our code. But unfortunately for certain sensors such as *DHT* sensor there are more than one possible libraries. It was a laborious task to figure out which libraries to include.

- *Figuring out critical values of Gas sensors:*

Analog range is different for different boards (like Arduino, ESP32), hence figuring out these values was difficult as their manuals don't mention them explicitly.

GROUP MEMBERS AND INDIVIDUAL CONTRIBUTIONS

S. No.	Name	Entry Number	Individual Contribution:
1.	Patel Ayush	2022CSB1101	Research, Circuiting, Ideation, Code debugging
2.	Jyoti	2022CSB1319	Research, Coding, Ideation, Code debugging
3.	Hartik Arora	2022CSB1314	Research, Circuiting, Ideation, Code debugging
4.	Aniket Kumar Sahil	2022CSB1067	Management, Research, Coding, Ideation, Comm. Protocol, Report Writing
5.	Pranav Menon	2022CSB1329	Research, Coding, Ideation, Messaging, Comm. Protocol

APPLICATIONS IN INDUSTRIES

- Industrial Safety Monitoring
- Smart Agriculture using air quality monitoring
- Environmental monitoring
- Research and Education
- Smart Cities
- Greenhouse monitoring
- Can be used in sensitive chambers such as nuclear power plant, submarines etc. for safety enhancement.

FURTHER REFINEMENTS TO MAKE IT MORE MATURE.

- Custom Sensor Integration as per application:
- Custom user interface for better communication with user.
- Alert mechanisms such as email, push notification, etc.
- Geolocation / Geofencing and mapping.
- Power efficiency and sustainability.
- Integration with External system (Like connecting with AI)
- Data Analysis / Research and visualization.

*Thank
you ☺*