IOT BASED AIR POLLUTION MONITORING SYSTEM

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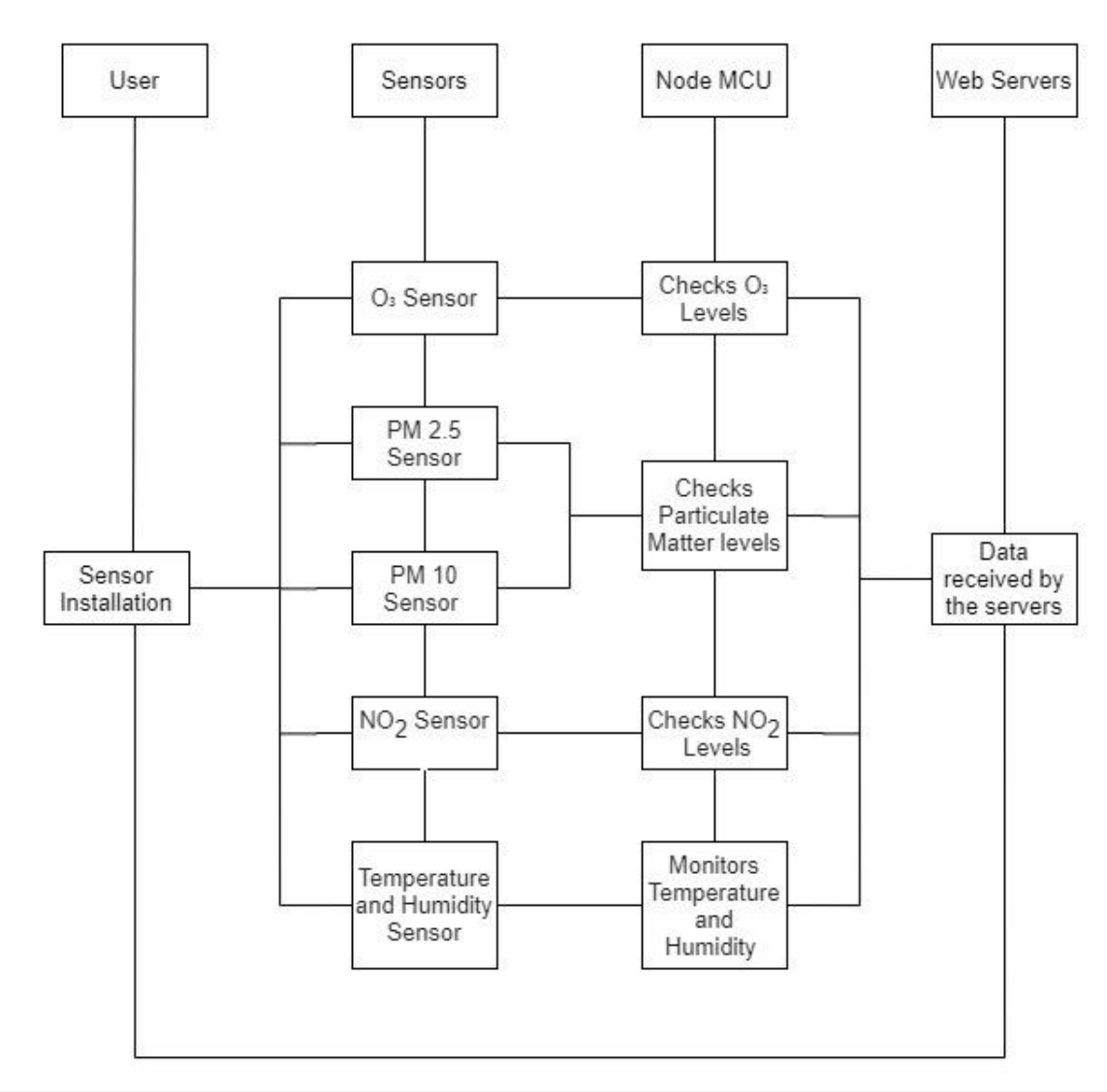
INTRODUCTION

- Air Pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other animals. There are different types of air pollutants such as gases (Ozone, Nitrogen Dioxide, Carbon Monoxide, etc.) and particulates (PM10 and PM2.5).
- Air pollution can cause health problems, like heart attacks, strokes, diabetes and high blood pressure, that have been identified as the pre-existing medical conditions that raise the chances of death from COVID-19 infection.
- Emerging research, including a study from Harvard T.H. Chan School of Public Health, finds that breathing more polluted air over many years may itself worsen the effects of COVID-19.
- Currently, the monitoring of air quality levels is achieved by placing sensors in various locations and the sensors alert if the pollution levels exceed the threshold level.
- However, there hardly exists a mobile solution wherein an individual can contribute to the pollution level checking from the convenience of their homes.
- Moreover, solutions for forecasting gas and particulate matter levels are location specific and require expensive training data (Meteorological data, wind speeds, etc.) which is unavailable in the reach of the common people.

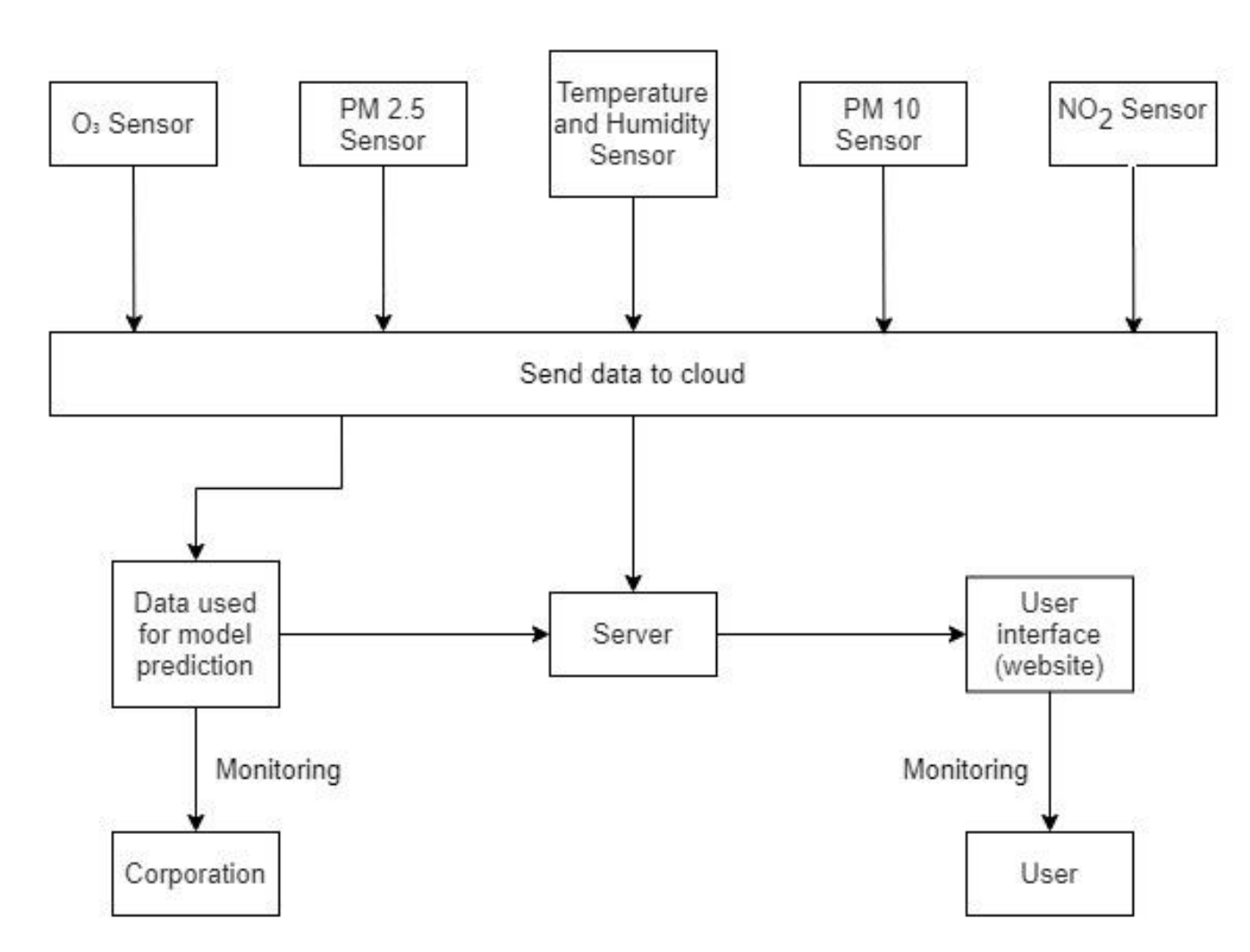
PROPOSED IDEA

- We aim to collect data about the concentration of NO_2, Ozone, PM2.5 and PM10 in different locations and host its visualization on a website.
- Furthermore, we also aim to predict their future concentrations using Machine Learning approaches.
- The future concentration levels that are being predicted is aimed to provide maximum accuracy based on the regions in which the system is placed.
- The proposed device can be placed anywhere in the user's home and the user can obtain real time data of the pollution levels in their immediate locality.
- The accuracy of the prediction model can be improved based on the data sensed from the user's surroundings.
- The data obtained can be also be used for further independent analysis.

SEQUENCE DIAGRAM



BLOCK DIAGRAM



HARDWARE REQUIREMENTS

- For monitoring Ozone levels – MQ131 sensor
- For monitoring NO2 and general Air Quality – MQ135
- For monitoring Temperature And Humidity – DHT11
- For monitoring PM2.5 levels – GP2Y1010AU0F
- For Displaying data – D1286464 OLED Display module
- NodeMCU

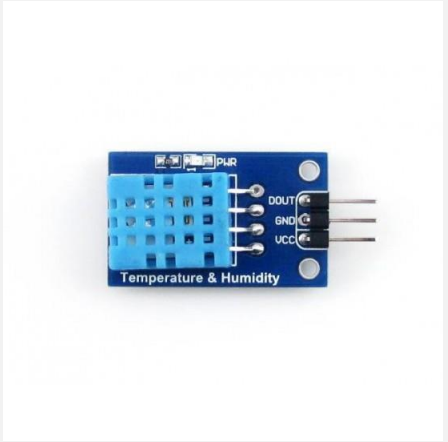
SOFTWARE REQUIREMENTS

- HTML, CSS, Javascript – For designing the website
- Webserver hosted via NodeJS
- Google Collaboratory for model training and prediction.
- Amazon Cloud Services
- Arduino IDE 1.6.13

HARDWARE DIAGRAMS

ESP8266

MQ131



DHT11

MQ135

GP2Y1010AU0F

OLED Display

ABSTRACT

- For monitoring the air quality level, we have used:
  - Gas sensors: To determine Ozone, NO2 and in general the air quality level, we have used gas sensors like the MQ135 and the MQ131.
  - Particulate Matter Sensors: In order to detect PM2.5 levels, which are a threat to the respiratory tract, we have used the Sharp GP2Y1010AU0F sensor.
  - Temperature and Humidity Sensor: Temperature and Humidity also plays a crucial role in determining the overall air quality, so we use the DHT11 sensor for the same

The data we obtain from the sensors is sent at regular intervals to the server using the NodeMCU, which connects to the website, where the sensor values will be displayed and visualized in real time.

At the same time, the data is also sent to the prediction model to check and improve on the accuracy of the model.

The values obtained from the prediction model will also be sent to the server which connects to the website.

Due to Geographical and Time Constraints, the model is initially trained using existing datasets of India's Air Pollution from 2015 to 2020. The training of the model is done in Google Collaboratory.

BILL OF THE MATERIALS

Items	Quantity	Cost (in Rs)
ESP8266-12E Board (NodeMCU)	1	390
GP2Y1010AU0F (Particulate Matter Sensor)	1	500
MQ135 (Gas Sensor)	1	120
MQ131 (Gas Sensor)	1	2500
DHT11 (Temperature and Humidity Sensor)	1	240
OLED Display Module	1	240
Connecting Wires	-	250
Breadboard	1	
Grand Total		4240

PROJECT FLOW

Planning and Procurement March 4th Week

- Develop Design Plans
- Gather the Sensors and Modules
- Check for Proper Functionality
- Start working on the Networking Aspect

Development April 1st Week

- Building the Design using the hardware and testing the connections
- Testing is done locally
- Designing Website UI
- Begin training and testing the prediction model on the existing datasets

Integration and Testing April 2nd & 3rd Week

- Using networking protocols for communication
- Testing the IoT Connections
- Deploying and testing the prediction model using real time input
- Improving the accuracy and the process

Execution and Performance Monitoring May 1st Week

- Final Testing and Checking the Performance
- Working on making the device mobile

TEAM MEMBERS AND ROLES

- V. SHRI SARVESH (ECE-108118109)

  Interfacing sensors and sending data to cloud

- ADITHYA SINEESH (ECE-108118005)

  Analytics, Model Training and Prediction, Improving the website UI Experience

- BALAJI K S (ECE-108118021)

  Web Hosting and Networking, Setting up Communication with web server and Cloud.