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CO_2 MONITORING SYSTEM FOR PUBLIC TRANSPORT

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Abstract—*Suffocation while travelling in Public Transport leads the passengers to suffer from some heart and lung disorders. It will make easier for the passengers if we give the information of the suffocation free busses in a mobile app, making sure that the passengers are getting information on whether the surrounding is suffocation prone or not. The Carbon dioxide inside the bus is measured and according to the values of ppm, the information of the bus is given as Safe or Unsafe. The health issues will also be display, if any.*

Keyword—GPS 6m receiver, Android application, IoT (Internet of Things), ESP8266 Wi-Fi Module, Air quality sensor (MQ 135).

1. INTRODUCTION

Higher amount of Carbon Dioxide in the atmosphere would lead to suffocation, drowsiness and other health effects. This is caused because of the less ventilation in that place. In case of buses, this reduction in air ventilation occurs often. Due to this, the bus is prone to suffocation and other lung related diseases. Often exposed to such environment could lead to serious oxygen deprivation in our body.

2. RESPIRATORY LEVELS

Humans inhale oxygen and exhale Carbon dioxide as it is a part of our Respiratory System. Humans need sufficient level of oxygen in the surrounding atmosphere to breathe normally. In some places, due to poor ventilation and overcrowding, the oxygen in the atmosphere becomes less and Carbon dioxide level increases. It may lead to several health issues.

Exhaled breath of any person contains about 3% CO_2. This implies that when one breathes, the oxygen gets converted to CO_2. The oxygen level falls down. The breathing range determined by Occupational Safety and Health Administration, OSHA, is between 19.5 and 23.5 percent oxygen. If the oxygen levels falls below the safe zone, side effects in our health occurs. When the oxygen level falls below 17 percent, mental abilities will be impaired. The CO_2 level will rise to 4%, as oxygen levels drop from 21% to 17% in a sealed environment.

PPM LEVELS OF CO_2 IN AIR (ppm)	HEALTH EFFECTS
250-350	Normal ppm(parts per million) level in outside ambient air
350-1,000	Indoor occupied spaces with good air circulation
1,000-2,000	Drowsiness, Suffocation
2,000-5,000	Sleepiness, Headaches, loss of attention, poor concentration, increased heart rate and slight nausea
5,000	Workplace exposure limit (as 8-hour TWA). Stress, Severe Headaches
>40,000	Oxygen deprivation which could result in permanent brain damage

3. PROPOSED METHOD

The sensor MQ 135 and GPS module collects data of CO_2 content level and location data from the public transport system. The Wi-Fi module transmits the data to the cloud database, which stores the data. According to this data, the effects are displayed in the android application, "TRACKMAP". The real time updates are provided with the help of the cloud database and the sensors. The block diagram is shown in fig 1.

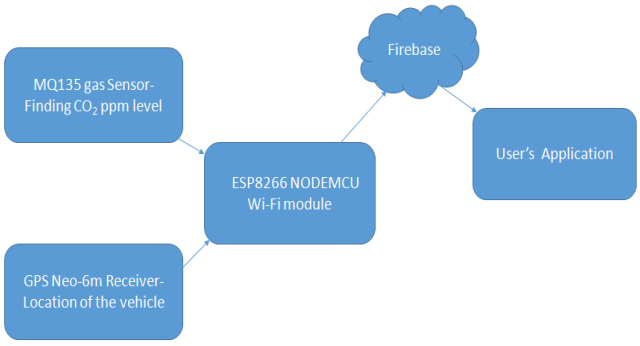


fig.1 Block Diagram

Steps:

1. The location and CO2 levels are provided by the sensors.

2. The Wi-Fi module is used to send the data to cloud.

3. The data in the cloud database is used by the user's application to display the location marker with additional information.

MQ-135 is an air quality sensor with SnO2 as sensitive material, which has a lower conductivity in clean air. When harmful gases are present in the air, the sensor's conductivity gets higher.MQ135 gas sensor has high sensitivity to ammonia, aromatics, sulfur, smoke and other harmful gases, with tested concentration range: 10 to 1000ppm.

GPS Neo-6m Receiver is a device which is connected to the vehicle. This device gives the exact location of the vehicle by returning the values of the vehicle's latitude and longitude position value to the cloud database. With the data from cloud database, we can show where the location of the bus.

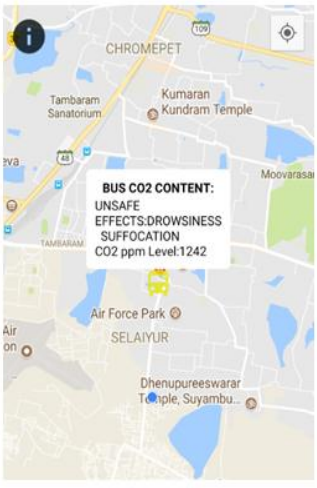
The data from these sensors will be segregated by the **NodeMCUESP8266-12E Wi-Fi Module**. The firmware NodeMCU is an open source IoT platform and is equipped with integrated TCP/IP protocol stack, which can provide access to the Wi-Fi network.

The Wi-Fi module transmits the data collected to the **Firebase**, which is a mobile and web application development platform developed by Firebase, Inc. It offers many services such as analytics, storage, hosting, real time database, different APIs, multiple authentication types and hosting platform.

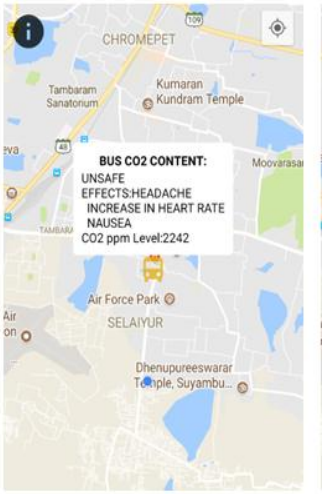
The Android application shows the location of the bus with a marker. When the marker or the information button is clicked, the details of the level of CO_2 with its effects will be displayed. The application receives the required data from the cloud database. The values will be updated periodically.

The Latitude, longitude positions are used to plot the location of the bus in Google map. The ppm values of the sensor is attached with the latitude, longitude values to plot the marker and update the overall CO_2 value in the vehicle. The bus is represented in red or green color to indicate its whether safe or not to travel in this vehicle.

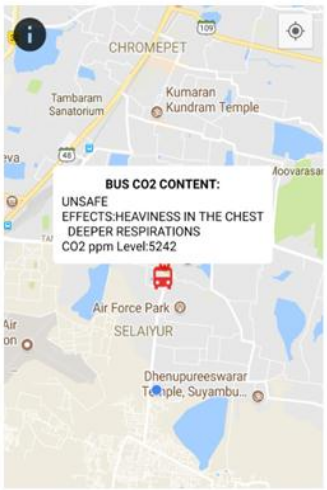
CO_2 PPM > 1000



CO_2 PPM > 2000



CO_2 PPM > 5000



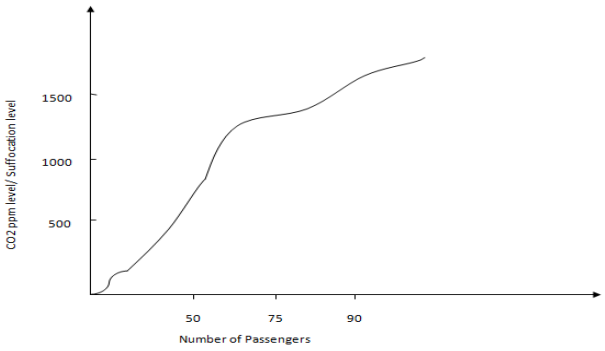
CO_2 PPM < 1000

4. FIELD SETUP

The Gas Sensor and GPS setup will be placed inside the bus. The sensors are placed at the centre of the bus where there is a high probability of many passengers. The sensors periodically update the CO_2 ppm values and the location of the bus. Then, the microcontroller is used to send the value to the cloud database which sends the same to the user's interface. So, to get more accurate results it is mandatory to update the values to the user or passenger periodically through the application and place multiple sensors in each passenger's seats. This could provide a combined accurate value which can be sent to the passengers waiting at the bus stand through mobile application. They will also be warned of the apparent effect on their health.

5. RESULT

The vehicle will have different CO_2 level based on the number of people inside the vehicle. If there is an increase in the number of people, the CO_2 level gradually increases. This was tested in a bus for a time period of 5 hours and it was found that as more people board the bus, there is an increase in the CO_2 level. So, to get more accurate results it is mandatory to update the values to the user or passenger periodically through the user application.



6. CONCLUSION

By using the concept of the Internet of things, we provide the quality of air in public transport systems to the passengers.This application for CO_2 Monitoring System for Public Transport will help you to know about the information about amount of CO_2 in the bus and its health effects.

7. REFERENCE

- The Daily Telegraph, "Crowded buses CO2 levels ten times higher than outside and Hills commute among worst", March 7, 2014.
- Plos One, "Carbon Dioxide Concentrations and Temperatures within Tour Buses under Real-Time Traffic Conditions", Chun-Fu Chiu, Ming-Hung Chen, Feng-Hsiang Chang, April 29, 2015.
- GPS based bus tracking system; LeezaSingla ,Parteek Bhatia, September 2015.
- Smartphone-based crowdsourcing for position estimation of public transport vehicles; Pankaj Mukheja ,Mukesh Kiran K , Nagendra R. Velaga , R.B. Sharmila, October 2017.
- An embedded system for counting passengers in public transportation vehicles; Nicola Bernini , Luca Bombini , Michele Buzzoni , Pietro Cerri , Paolo Grisleri, September 2014.
- Smart vehicle monitoring system for air pollution detection using WSN; E Suganya ; S Vijayashaarathi, April 2016