

**CARBON SENSE: A REAL-TIME MONITORING SYSTEM OF CARBON EMISSION FROM
MOTORCYCLE VEHICLES WITH IOT**

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A Design Project Submitted to the Department of Computer Engineering
in Partial Fulfillment of the Requirements for the Course
CPE 406 - CpE Design 2

June 2022



TECHNOLOGICAL INSTITUTE OF THE PHILIPPINES
1338 Arlegui St., Quiapo, Manila



DEPARTMENT OF COMPUTER ENGINEERING

APPROVAL SHEET

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ACKNOWLEDGMENT

The authors would like to express their sincerest appreciation and gratitude to the following people who significantly contributed to making the completion of this project:

The Almighty God, for His provision of knowledge, good health, and well-being to the authors;

The panelists, Engr. Jennalyn Nicolas, and Engr. Ian Constantino, for their feedback, pieces of advice, and scholarly insights regarding the project during the proposal defense and final defense.

The authors' project adviser, Engr. Jennifer Enriquez, and class adviser, Engr. Rufo Marasigan Jr., for their assistance, patience, consideration, and understanding throughout the stages of this project.

The authors' parents, for providing immeasurable love and unflagging support, not only during the completion of this project but since the beginning of the authors' journey in reaching their ambitions in life; and

All the persons who have directly and indirectly contributed to the success of this academic venture.

The Authors



DEPARTMENT OF COMPUTER ENGINEERING

PROJECT ABSTRACT

Title: Carbon Sense: A Real-Time Monitoring of Carbon Emission from Motorcycle Vehicles with IoT

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College: College of Engineering and Architecture

School: Technological Institute of the Philippines Manila

Academic Year: 2021-2022

Climate change is an important, current, and ongoing issue that the world faces. In fact, all living things are affected with the varying climactic conditions and its effects could lead to many more changes. In drier regions, droughts will expand, and water level will eventually drop, thus the possibility of drought is more likely to occur in that area. In agriculture, climate change has the potential to disrupt crop productivity, and in turn affect the economy of a country, take Philippines as an example. Motorcycles are one of the major contributors of the following pollutants: particulate matter (PM), hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx), and other hazardous emissions resulting from the combustion of burned fuels. In terms of PPM emissions, a single motorcycle is equal to one-diesel powered truck and its HC emission can emit ten times more pollutants than gasoline-powered cars. In order to solve this problem, this project has certain objectives to be fulfilled. Objectives such as to measure different factors that contribute to the release of carbon emission through sensors without affecting the components when placed under certain conditions, transmit real-time data drivers on the measured different carbon compounds such as Carbon Monoxide (CO), Carbon Dioxide (CO₂), and Hydrocarbon (HC). More objectives are to alert users if their emission exceeds the threshold limit, to create cost-effective device capable of monitoring the motorcycle's carbon emission level, and lastly to test the accuracy and functionality of the system. Three (3) design options are considered for this project yet Design Option 2 is the most reasonable to be created due to constraints presented. After actual testing when the device is built, it has proven itself as the best option to be considered for this project. Having relatively low percentage of error (less than 20%) on measuring the carbon data is good enough compared to an industry-level gas analyzer which is used for testing and registration of the vehicles in the Philippines. The downside of the present gas analyzers is that it is too bulky, and not modular enough to be used from a place to another place. In talks about the GPS data that is received by the system, it also showed great range of accuracy with a confidence of at least 98.99% in geo-tagging and geo-locating. The proponents were able to properly complete the project considering the variables, objectives, and constraints present. The assessment and testing proved that the project objectives, which states that the device should measure the carbon emitted even under certain circumstances, accurately measure the Carbon data and GPS data, notify the user on certain scenarios such as anomalies, be cost-effective and capable, and be accurate and functional as much as possible, were all successfully achieved by the proponents.

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CHAPTER 1:

PROJECT BACKGROUND

This chapter discusses the project and its background, design problem, objectives, the client, the scope and limitations, and how the proponents plan to develop the project.

1.1 The Project

Climate change is an important, current, and ongoing issue that the world faces. In fact, all living things are affected with the varying climactic conditions and its effects could lead to many more changes. In drier regions, droughts will expand, and water level will eventually drop, thus the possibility of drought is more likely to occur in that area. In agriculture, climate change has the potential to disrupt crop productivity, and in turn affect the economy of a country, take Philippines as an example. In 2019, the Philippines has been hit by a prolonged drought brought by El Nino and the damage to its agriculture has reached almost eight billion pesos, according to the National Disaster Risk Reduction and Management (NDRRMC). The drought has affected a land planted of rice, a hectare of corn plantation, etc. Aside from this, the natural environment, and even our own health and safety are at risk. When the number of gases in our atmosphere continuously increases and cannot be controlled, then the Earth will continue to warm within a short time. The warmer the Earth gets, the greater the possibility of more severe changes to the climate and Earth's system.

The Philippines is highly vulnerable to the impacts of climate change, including sea level rise, rapid weather events, rising temperatures, and extreme rainfall. According to a report issued by the Institute for Economics and Peace, the Philippines experienced a 0.62°C increase in the annual average mean temperature, with the rate of change increasing over time. This is due to the increasing carbon emission by over 0.12 over the figure of 1.11 CO₂ tons per person in 2015. And the statistics also says that the share of carbon dioxide emissions comes from the transport sector with the total of 34% GHG emissions in the country. The survey of carbon dioxide emissions from vehicles in the Philippines shows that major vehicle contributors of carbon dioxide are cars, jeepneys, motorcycles, and taxis.

Motorcycles are one of the major contributors of the following pollutants: particulate matter (PM), hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx), and other hazardous emissions resulting from the combustion of burned fuels. In terms of PPM emissions, a single motorcycle is equal to one-diesel powered truck and its HC emission can emit ten times more pollutants than gasoline-powered cars.

Based on the statistics of Transportation and Logistics, the Philippines has an estimate of 3.58 million motorcycles in the year 2021, of which more than 45% of the total carbon emission are emitted annually. On the average, motorcycles in Metro Manila produces 9.5, 9.7, 40.5, and 0.07 g/km of HC, CO, CO₂, and NOx, respectively. With these results, motorcycles fail to satisfy HC and CO emissions. Additionally, they produce greater HC and CO emissions than gasoline fueled private cars and diesel powered public jeepneys, taxis and buses on a per passenger-km.

To solve this problem, the Land Transportation Office, a sectoral agency of the Department of Transportation, mandated an emission test to check a vehicle's compliance with emission standards set by the LTO for their vehicle renewal. Unfortunately, some places in the country do not have emission testing centers. If given one, drivers are forced to wait for how many hours before they can get their vehicles tested, and they have to pay for money if their carbon emission did not meet the standards set by the LTO and thus they will not be qualified for vehicle renewal.

Today, there are various devices that are used in monitoring and even regulating a vehicle's carbon emission. These devices include installation in the automobile itself like EGR valve, catalytic converter, etc. These devices are primarily used just for the regulation of carbon emission. For the software solutions, websites such as Sustrax and carbon trust help measure and manage the carbon footprint of an organization.

With all these devices presented, the said technologies are only capable of measuring a specific variable for regulating the carbon emission. For the hardware devices, the only output that is considered is the physical parameters like the smoke itself. That solution is insufficient due to the reason that the user will not have any copy of the actual data regarding the carbon emission. For the software solutions, the limit will only focus on the inaccuracy of data especially when the physical parameters are not considered in calculating the carbon emission.

Identified Problems

The following are the identified problems that occur in tracking and monitoring the carbon emissions of the vehicle: 1) there is no measurement in detecting the carbon emissions' rate of motorcycles in a real-time manner. 2) Data is not accessible for analysis in the cloud. 3) There are no notifications/alerts that support the measurement of the carbon emission of a vehicle especially when the emission exceeds the threshold limit.

Proposed Solution

The solution consists of both hardware and software modules that are installed to monitor, analyze, and track the carbon emission of motorcycles.

1.2 Project Objectives

The general objective in this project is to help the motorcycle drivers to prolong the usage of their motorcycle engine. Specifically, the project aims to:

- Measure different factors that contribute to the release of carbon emission through sensors without affecting the components when placed under certain conditions like heat.
- Transmit real-time data to drivers on the measured different carbon compounds like Carbon Monoxide, Carbon Dioxide, and Hydrocarbon.
- Alert users if their emission exceeds the threshold limit.
- Create a cost-effective device capable of monitoring the motorcycle's carbon emission level.
- Test the accuracy and functionality of the system.

1.3 The Client

The client(s) of this project are considered to be those people who will be benefitting and using this design. These are the following:

- Metropolitan Manila Development Authority (MMDA) – This organization will be considered as the authorities where data from the real-time monitoring of carbon emission will be sent to them to help them monitor the concentrations of Carbon Dioxide, Hydrocarbon, and Carbon Monoxide from motorcycles.
- Motorcycle Drivers – These people are the ones who are going to use the device. In this way, monitoring their carbon emission could be of great help to them in monitoring their emission as stated in the Clean Air Act or Republic 8749. Aside from that, the device will also help the users to monitor

the state of their motorcycle based on their carbon emission specifically the levels of Hydrocarbon and Carbon Monoxide.

1.4 Project Scope and Limitations

This project will only focus on monitoring and tracking the carbon emission of a vehicle, particularly motorcycles. The data collection will consider two motorcycles that will be used for comparing and confirming the tests and results of the device that will be created. The project will also be done by using a variety of sensors, a hardware module which will collect the sensor data related to the motorcycle's carbon emission, and software platform which will analyze the incoming data and provide feedback and control of carbon emissions. The sensors will only read the carbon dioxide, hydrocarbon, and carbon monoxide of the emission. The system will provide feedbacks and suggestions that could help drivers reduce their carbon emission. The system will also determine if there is a motorcycle anomaly based on the readings of the hydrocarbon and carbon monoxide sensors. The system will also determine the measurement of the carbon emission in a real-time manner.

1.5 Project Development

The project will go through a process in order to determine the best possible system for the best possible hardware and software combined. The Gantt chart below shows the progress of the project by determining on how long a certain task should be.

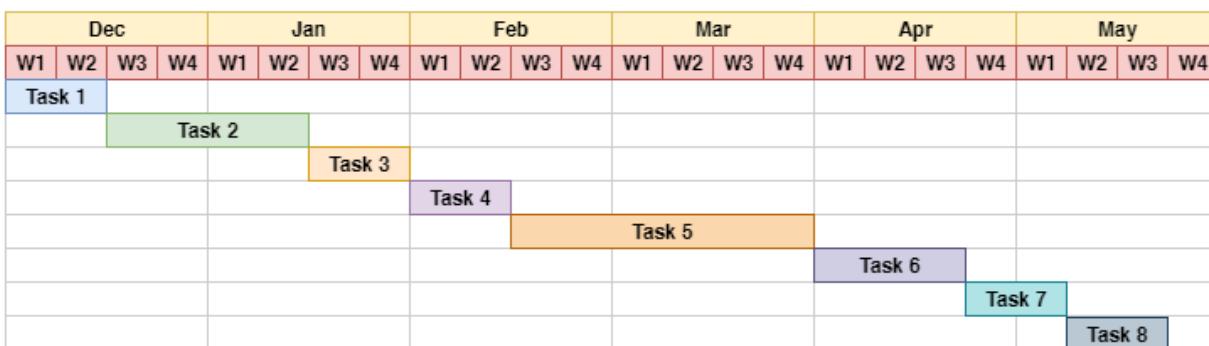


Figure 1-1. Gantt Chart of Project Development

The chart has eight (8) tasks that are distributed on the schedule according to the length of time needed in order to finish the certain task. Task 1 focuses on finishing the draft of Chapter 3 that will then be evaluated eventually on the latter part of the schedule. Task 2, on the other hand, is the evaluation of the panel with regards to the draft of chapters 1 up to 3, all revisions should be done by this time frame. Task 3's main focus is the finalization of chapter 3 which is the conceptualization, creation of design and the overall project setup. Task 4 is the finalization of the decided design(s) or concept(s) of the system. Because of the idea that the project will have several designs, the finalization of these designs are done at this specific timeframe. Task 5 is the lengthiest of all the tasks because it is the actual creation of the designs that are made at chapter 3. Also included in Task 5 is the simulations of these prototypes as well as the testing process which determines the overall performance of the prototypes made. After this, the prototypes will then be evaluated whether which is the best to use accordingly. After the evaluation, determining the best design is the main focus of Task 7 as well as putting the overall data of comparison of these prototypes. Lastly at Task 8, further debugging, flaw checking and error checking is then done to the best selected prototype to avoid problems and flaws in the system.

CHAPTER II:

DESIGN INPUTS

This chapter analyzes the client requirements, design criteria and constraints, and other relevant information needed in brainstorming for possible solutions.

2.1 Client Requirements

This section will provide a complete vision for the client's needs under the development and supports the contract between the development organization and the funding authority. The document is written from the client's requirement and perspective, focusing on all vital points to the features of the system and acceptable levels of quality. The following list are the requirements that the client wants to have:

- Implement a sensor where the measurement of sensor data is consistent enough to produce a satisfactory output.
- Create a cost-effective device capable of monitoring the motorcycle's carbon emission level.
- Measure different factors that contribute to the release of carbon emission through sensors without affecting the components used for measuring when placed under certain conditions like heat.
- Send sensor data to analyze the total carbon emission emitted by the user while allowing the device to withstand prolonged operations.

2.2 Design Criteria and Design Constraints

To develop the project, the design criteria based on the requirements given by the client was followed to ensure that the standards are met based on the liking of the client. These constraints are presented below:

Table 2-1. Design Criteria and Constraints

Design Constraints	Criteria
Economical Constraint	In this specific criterion, one of the most important aspect of creating a device or a system that requires a hardware is the constraint economically because it is best to have the least cost of the device for mass production and profit. The design cost is bound to be expected be less than 5,000 PHP.
Consistency Constraint	In this specific criterion, the main constraint being tackled is the performance of the main device of the system. In terms of how consistent the sensors are especially when placed under the condition like heat for a period of time. The consistency of data should obtain at least 70% to 99% of the values.
Durability Constraint	In this specific criterion, durability is defined to be the quality of the device when placed in conditions like heat. It is focused on the quality of it being able to last a long time without causing a remarkable deterioration. The heat conduction of the device so that it will be able to withstand the muffler's temperature should be lesser than 120 degrees Celsius.
Power Usage Constraint	In this specific criterion, the constraint that is being focused is on how long the device will be used in terms of power in a day. The device should be able to last for at least 8 hours a day.

Economical Constraint

The project should be able to produce a design that cost-effective. In a business dictionary, cost is the amount of something that needs to get paid for a purchase. In business, the cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. For this project, the materials should fall under the range set by the client which is 5,000 pesos. The total cost can be defined as:

$$\text{Cost} = \sum \text{cost of components (PHP)} \quad (2.1)$$

To compute the cost of the design, the cost of each material will be considered and calculate as its overall cost. The lesser the overall cost of the design, the better it is.

Consistency Constraint

The project focuses on the performance of the main device of the system in terms of getting the data that is needed for measurement. The device will be tested based on how consistent the sensors are especially when placed under the condition like heat for a period of time. The computation in getting the consistency of the device can be tested using the Pearson Product-Moment Correlation. This formula measures the strength of a linear correlation between two variables. The consistency of the device in terms of acquiring the data can be computed by using the following:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (2.2)$$

To compute the consistency of the device in terms of acquiring the data needed for analysis, the data will be obtained from each of the design options and it will be compared to the gas analyzer that will be considered as the true value of the emission. The interpretation of the result will be as follows:

Table 2-2. Pearson r Interpretation

r	Interpretation
0.00	Zero correlation
0.01-0.20	Negligible correlation
0.21-0.40	Low
0.41-0.70	Moderate
0.71-0.90	High
0.91-0.99	Very high

Durability Constraint

The project focuses on the ability of the device to withstand heat for a long time without becoming damaged. The device will be placed near the exhaust of the motorcycle which will require it to be at least heat-free for it to not wear for longer period of time. The computation will be based on the datasheet whether which one device in each design option can withstand the heat of the muffler from the motorcycle. The device should

be able to withstand a heat conduction with a temperature of less than 120 degree Celsius. The thermal load simulation of Solidworks will be used in obtaining the result for the heat test of the devices.

Power Usage Constraint

The project focuses on the ability of the device to keep on working for a period of time. The computation of the power usage of each design option will be

$$\text{Operating Time} = \frac{\text{Battery Capacity} * \text{Battery Voltage}}{\text{Power Consumption}} \quad (2.3)$$

The device should be able to last for 8 hours a day.

2.3 Storyboard

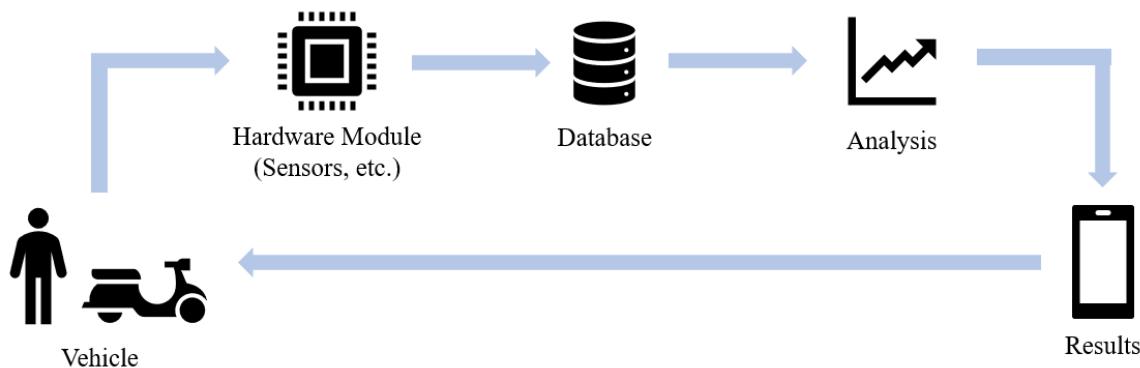


Figure 2-1. Storyboard

The proposed solution of this project is visualized in the figure above. The system is composed of four major processes:

1. Carbon emission sensing process: This process includes the installation of hardware modules in the motorcycle that will be used in collecting sensor data that corresponds to the vehicle's carbon emissions.
2. Data collection process: The data from the sensor will be sent to the database for further visualization and analysis.
3. Sensor Analysis Notification: An alert notification will be sent to the user if the carbon emission levels (CO CO₂, HC) exceed the number of expected levels. If there will still be an increase in the following days, an alert notification will also be sent to the authorities to notify them that a certain user has reached the threshold limit of carbon emission. In this way, they will be able to track the carbon emission of the drivers.
4. Results process: The results from the analysis will be sent to the cloud for monitoring purposes. The data regarding the user's total carbon emission for a day and the areas in which he emitted the gases will be visualized in the application in his device. These sets of data will also be visible to the authorities in order for

them to monitor the emission of motorcycles. The system will also provide feedbacks and suggestions that could help drivers reduce their carbon emission once the levels of their carbon emission exceeds the threshold limit.

2.4 Relevant Information

Before going further in the design process, the team acquired and assembled all significant information available from different sources (e.g. textbooks, the internet, journals, magazines, etc.) that is relevant to the problem. Then, the information will be evaluated to ensure that it is accurate and complete. Finally, the information gathered will be organized into topics and subtopics.

2.4.1 Motorcycles

In the statistics made by the Asian Development Bank, Asia has the most number of total registered vehicles in 2013 and in 2016. As indicated in table 2-3, the worldwide population of these vehicles increased gradually by 4.10%. In the Philippines, the increase in registered motorcycles is higher than the increase in the total registered vehicles, which give indication that Filipinos are opting to use motorcycles for mobility.

Table 2-3. Total Registered Vehicles and Registered Motorcycles, 2013 and 2016

Continent/ Area	2013			2016		
	Population	Vehicles	Motorcycles	Population	Vehicles	Motorcycles
Asia	4,231,620,460	862,391,534	321,945,349	4,396,231,185	1,024,309,230	407,677,238
Middle East	42,671,027	12,275,280	289,182	48,761,765	14,970,962	354,483
Southeast Asia	618,374,908	218,233,129	166,499,218	641,352,601	266,601,274	201,688,136
Philippines	98,393,547	7,690,038	4,250,667	103,320,224	9,521,565	5,329,770
Africa	818,574,154	36,246,073	9,160,662	898,411,546	50,662,954	11,351,846
Central America	186,057,263	47,032,333	5,278,220	194,115,520	54,691,754	7,050,120
North America	355,232,420	287,409,632	9,098,954	358,469,440	305,236,252	9,310,194
South America	376,082,211	129,352,842	36,457,924	388,611,245	147,638,761	45,727,052
Europe	544,541,540	339,141,924	32,713,428	543,077,921	356,984,397	39,029,910
Oceania	35,691,800	20,574,804	868,741	37,410,630	22,138,750	967,456
World	6,547,799,848	1,744,592,976	417,754,454	6,816,327,487	1,961,662,098	521,113,816

According to Statistica, the number of registered private motorcycles and tricycles in the Philippines decreased by approximately 4 million in the Philippines in the year 2021. It has totally decreased compared to the previous year's total of over seven million.

As the Land Transportation Office (LTO), begins to mandate a Motor Vehicle Inspection System or MVIS, the sound level of the motor vehicle for exhaust or muffler shall not exceed 99 dB (decibels), taken at an engine speed of 2,000 to 2,500 rpm. Once an exhaust is louder than this, the driver will fail the test and will have to go for repairs or corrections to stabilize the motorcycle.

Motorcycles are relatively simple machines. Despite the simplicity, it is still a requirement for motorcycle maintenance to be done from time to time. Normally, the engine oil of the motorcycles are changed anywhere between 1500 to 5000 kilometers or more, or 2 months or 1 year. Oils are also major contributor of the maintenance of the motorcycle. There oils such as conventional, semisynthetic, and fully synthetic. Among the three, fully synthetic, although it is more expensive, is the most resistant to wear and tear.

The fuel of the motorcycle also plays an important role in the maintenance of the motorcycle. Regular fuel (91 RON) is the bare minimum for some countries and it contains less amount of octane. This fuel is commonly used in remote areas. Premium and super-premium fuel (95-100 RON) makes use of higher octane ratings, in which the octane level is a measure of how well a fuel type can prevent damages like engine knock.

Carburetor is also essential in keeping a motorcycle clean. Maintenance of this carburetor include tuning, cleaning, and gasket replacement.

2.4.2 Carbon Emission in Motorcycles

In the study made by the WSO, motorcycle collectively emit 16 times more hydrocarbons, three times more carbon monoxide, and high amounts of other pollutants as compared to other vehicles.

Recent estimates in the Philippines show that in 2008, emission of CO₂ from motorcycles emitted a total of 30 million tons and 56000 tons of particulate matter. The EMB-DENR estimates that the transport sector contributed 31% of total PM emissions with 85% of CO emissions.

With the increasing amount of emission happening annually, the Land Transportation Office focused on the impacts of policies from the transport sector in order to stabilize the growing rate of emission every year. The following are the policies considered: (1) Vehicle Management and Monitoring System, (2) Implementation of the Motor Vehicle Inspection System in different areas in the country, (3) Introduction of Compressed Natural Gas buses, (4) Two stroke motorcycle switching to four-stroke motorcycles, (5) Improvement of motorcycles by the use of diesel traps, and maintenance.

2.4.3 Existing Solutions

The current software solutions for tracking and monitoring vehicles give a step for the IoT technologies to take place in this problem.

Geotab provides both monitoring and tracking of carbon emission while sending the data to a private cloud platform. The hardware component of this device uses a connection to the onboard diagnostic system of the device and collects data about fuel consumption, travelled distance of the vehicle, and other parameters. Its cloud platform provides the visualization of vehicles with suboptimal carbon emission. Unfortunately, Geotab solutions does not provide control over vehicle's parameters and does not detect the anomalies of the vehicle based on the rates of carbon emission.

MadgeTech provides functionality of regulating the rate of carbon dioxide levels in the vehicle. It measures the carbon emissions in the exhaust system of vehicles and sends the data to the cloud.

The CanTrack solution provides a module for GPS in determining the location of vehicles. It also supports Driver Behavior Module which are based on key driving elements which includes driving style, speeding, and idling. In other cases, it also assists user to avoid traffic, blocked roads and accidents, through real-time and directional traffic information. Unfortunately, the GPS data is the only data that hardware uses and that other parameters are not taken into account.

A system that measures the levels of gases that are involved in carbon emission such as Carbon Monoxide and Particulate Matter was designed as part of the work of Samreen et.al. The microcontroller that he used in his paper was Node MCU and the data that was sent to the cloud was done by using the ESP8266 module. Thingspeak and Blynk applications were also used for the visualization fo data from th sensors to the cloud in order to monitor the data. There is also an alert system that notifies the authorities where there is a need to limit the emission of the driver.

Gupta et.al made a system that monitors and measures the quality of the air of the city dwellers and it is retrieved and analyzed in real-time via intelligent devices. The system consists of different devices that are involved in the detection of carbon emission such as the humidity, temperature, Carbon Monoxide, liquid petroleum gas, smoke and other dangerous particles like PM2.5 and PM10. Thingspeak was also used in the visualization process as it can also be viewed in a tabular form.

2.4.4 ABS Plastic Cases

It is a thermoplastic terpolymer made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. ABS is quite resistant to chemical corrosion and possesses good toughness and dimensional stability. One advantage of plastics is that moldings of complex shapes can produced in cheaply, accurately, and with a good surface finish. Other advantages can be their low density and the fact that they do not corrode.

ABS can not only be used to get good texture but the weight of the product can be considerably reduced and in addition to this various properties like appearance, mechanical strength in our system can be considerably improved. Abs is still the most widely used plated plastic all over the world in various industries like toys manufacturing, electronics, etc.

According to CREATIVEMECHANISM , ABS is very resistant to corrosive substances as well as physical forces. It is simple to machine and has a low melting temperature, making it ideal for use in injection molding production processes or 3D printing on an FDM machine. ABS is also reasonably priced (now roughly \$1.50 per pound), falling between Polypropylene ("PP") and Polycarbonate ("PC"). Because of its low melting point, ABS plastic is not frequently an employed in high heat settings. Because of these properties, ABS utilized in a wide variety of applications across a wide range of industries.

2.4.5. Carbon Fiber Plastic Cases

Technology-oriented applications are becoming more important in today's world and the use of technological processes continues to grow rapidly, day by day. Because of the advantages offered by composite materials, there is a great deal of interest in this material group in various industrial applications. Composite materials continue to develop on, as it is a great pace in parallel with the developments in metallic, ceramic and polymeric materials. Therefore, composite materials have found wide usage in engineering materials in recent years. In this material group, carbon fiber reinforced polymer (CFRP) composite materials, from the advanced composite material class, are commonly preferred in strategic applications due to their outstanding features such as high load-carrying capacity and low density. In this project, the production, characteristics and industrial usages of CFRP composite materials, milling and drilling operations carried out on them are presented along with current technology-oriented applications. Ozkan, Dervis & Gok, Mustafa & Karaoglanli, Abdullah. (2020).

Carbon fiber reinforced polymer (CFRP) composite materials, which belong to the advanced composite material class, are widely used in strategic applications due to their outstanding characteristics such as high load-carrying capacity and low density.

Carbon fiber reinforced plastics postured at 375°C retain up to 90% of their mechanical properties at 400°C ($\tau_{12} = 60\text{--}80 \text{ MPa}$). The first one shown that prepgs can produced from phthalonitrile resins using the melt technology and composites from them can obtained by hot pressing. *Timoshkin, I.A., Aleshkevich, V.V., Afanas'eva, E.S. et al. (2020)*.

2.4.6 Cast Carbon Steel

According to Dr. Redwing R. (2020), Alloy is a mixture of a metal with another element, either metal or nonmetal. Start with a base metal and add impurity atoms there are two possible outcomes if the two mix. The two different cases are highlighted in the figure below. In the substitutional solid case, the impurity atoms replace the host atoms in the lattice. In the interstitial situation, impurity atoms squeeze between the host atoms.

Metal alloys are well – known for their strength, durability, and resistance to corrosion. Engineers, architects, and others use these alloys in the industrial sphere to build buildings, cables, pipelines, bridges, machinery, and much more.

Metal alloys is suitable above 1200°F and built on iron, nickel, and cobalt, and contain components that create precipitates that harden the matrix after solution treatment and aging. These alloys have structural stability as well as resistance to oxidation and corrosion at high temperature.

CHAPTER 3:

PROJECT DESIGN

3.1 Introduction

This chapter presents the different options and discusses the assessment and evaluation of each design option to determine the optimal method for the final design. It provides comparison between the three designs including its parameters that involves the attainment of the design objectives, output, layouts, functionality, precision, and other set of comparisons that will lead to the best design. The different models are shown through graphical representations expressed as the system architecture.

3.2 System Architecture

The proposed solution of this project is visualized in the figure above. The system is composed of four major processes:

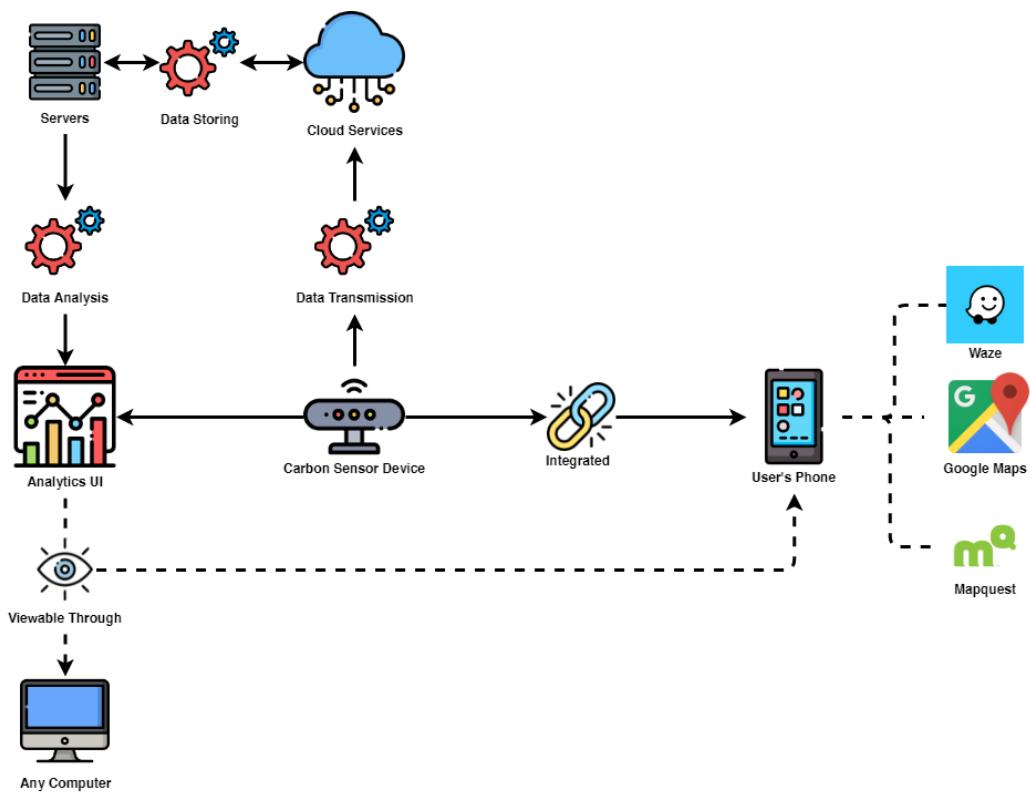


Figure 3-1. General System Architecture

1. Carbon emission sensing process: This process includes the installation of hardware modules in the motorcycle that will be used in collecting sensor data that corresponds to the vehicle's carbon emissions.
2. Data collection process: The data from the sensor will be sent to the database for further visualization and analysis.
3. Sensor Analysis Notification: An alert notification will be sent to the user if the carbon emission levels (CO, CO₂, HC) exceed the number of expected levels. If there will still be an increase in the following days, an

alert notification will also be sent to the authorities to notify them that a certain user has reached the threshold limit of carbon emission. In this way, they will be able to track the carbon emission of the drivers.

4. Results process: The results from the analysis will be sent to the cloud for monitoring purposes. The data regarding the user's total carbon emission for a day and the areas in which he emitted the gases will be visualized in the application in his device. These sets of data will also be visible to the authorities in order for them to monitor the emission of each vehicle. The system will also provide feedbacks and suggestions that could help drivers reduce their carbon emission once the levels of their carbon emission exceeds the threshold limit.

3.3 Design Breakdown

Three (3) design options are used in choosing the best design for the implementation of this project. The flowchart that the design options will follow is presented in figure 3-2. The sensors will first be initialized to read sensor data, after that calibration follows where the sensor data will be sent to the server. If the sensor data exceeds the threshold value, an alert notification will be sent to the driver. The visualization is presented in figure 3-2:

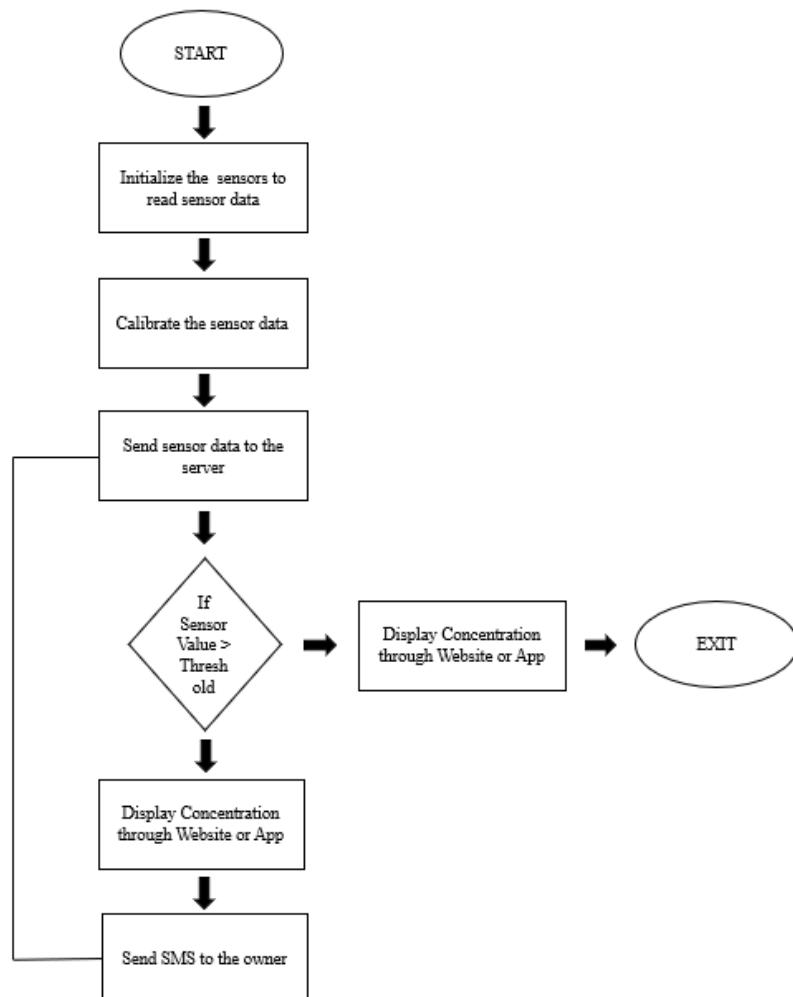


Figure 3-2. Flow Chart of the System

These design options will vary according to the constraints named: Cost, Consistency, Durability, and Power Usage. In the cost constraint, the varying factors will be the Arduino Nano BLE for design option 1, Arduino UNO Rev3 for design option 2, and Gizduino UNO SE for design option 3. In the consistency constraint, the varying factors will be the MQ- for design option 1, MQ-7 for design option 2, and TGS-203 for design option 3. In the durability constraint, the varying factors will be the CFRP casing for design option 1, ABS casing for design option 2, and metal casing for design option 3. In the power usage constraint, the varying factors will be the removable PP3 battery pack, 6000 mAh rechargeable battery, and interchangeable C batteries.

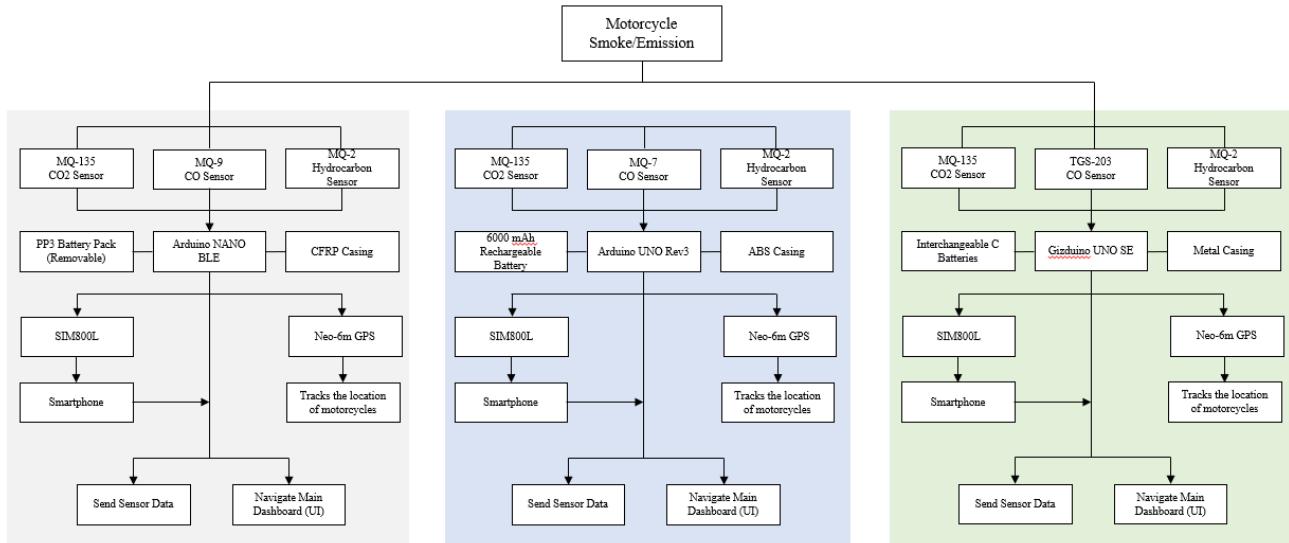


Figure 3-3. Design Hierarchy

3.4 Software Design

ThingSpeak

Thingspeak will be used to transfer data from the hardware system to the Application and Website of the system via cloud. The data from the Arduino is stored locally. Thingspeak enables the Arduino to send data to the cloud where it will be stored in a public channel. Once the data is stored in the cloud, the data will be transferred to the database of the website.

Visual Studio

Creating the software application, Microsoft Visual Studio is used to develop computer programs, as well as websites, web services, web apps, mobile apps, etc. Including being a code editor that supports IntelliSense, Visual Studio is written in C# and C++ that offers an integrated debugger that works both as a source-level debugger and a machine-level debugger. Visual studio is a fast source code and is used by many people with the support of hundreds of languages. This tool handles instantly productivity from syntax highlighting, auto-indentation, bracket-auto matching, snippets and etc. By this, we can customize every feature we want to install and any number of third-party extensions to help us work faster.

MIT App Inventor

In computer programming Android studio provides the fastest tool for building application on every type of android phones. The IDE will be used to provide a unified environment where we can build apps for phones,

tablets and etc. With the help of structured modules, it will easily for us to divide projects that we can independently build, test, and debug.

MySQL

A Powerful language that supports an open-source database and a relational database management system (RDBMS) which keeps the data in the database organized and provides multi-user access to a database and uses Structured Query Language (SQL) to work with it at the same time.

Arduino Software

An open-source electronic platform with easy-to-use software and hardware combination for building electronic projects. Consisting of both a physical programmable circuit board and software or called IDE (Integrated Development Environment) that runs onto a computer, used write and upload to our physical board.

Mobile Application

Our first custom application is our mobile application that is part of a computer program or software designed to run on a mobile device. It delivers user-based functionality such as data analytics and reports

Web Application

The web application performs CRUD (Create, Read, Update, Delete) operation, handling of a big task such as the data, functions, customer reports, and feedbacks. These features are a big part of what make our product.

Fusion 360

Fusion 360 is a cloud-based 3D modeling, CAD, CAM, and PCB software platform for product design and manufacturing. The sketches of the prototypes in each design option are made in this software application.

Solidworks

Solidworks is a solid modeling computer-aided design and computer-aided engineering application which are used by designers to create authentic design experience. Simulations are present in this software application, of which the thermal conduction simulation is used for the system. Thermal conduction simulation refers to a static analysis that measures the heat conducted by the system in its environment.

Data Flow Diagram

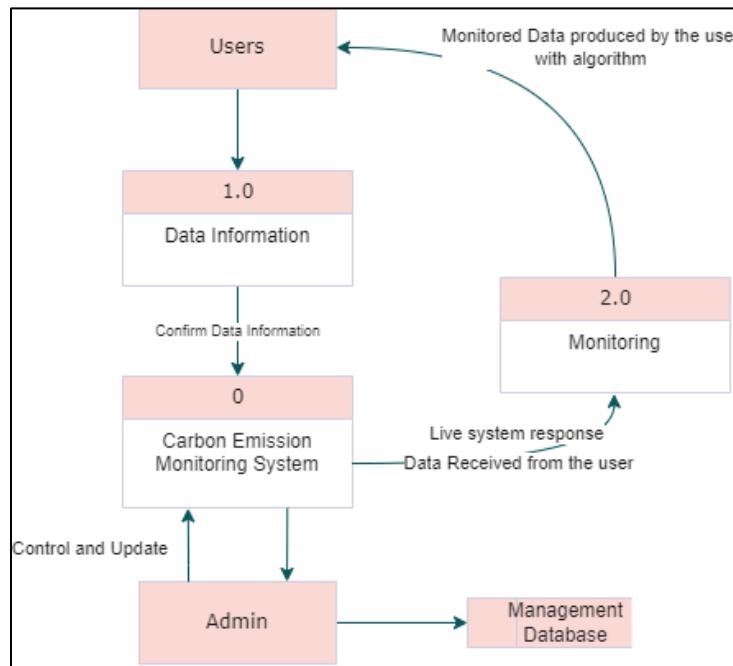


Figure 3-4. Level 0 DFD

Presented in the Level 0 Data Flow Diagram is how the data of our system will go through various phases and devices or components that is included. It is indicated that the data information of the user is a requirement in order to have a confirmation that a person is using the device. With this information, the carbon emission monitoring system will then give live system response from the data that is received from the user at which the monitoring of this data is then made. Externally, the admin of the system can control and update the system to further give the user a better and user-friendly experience.

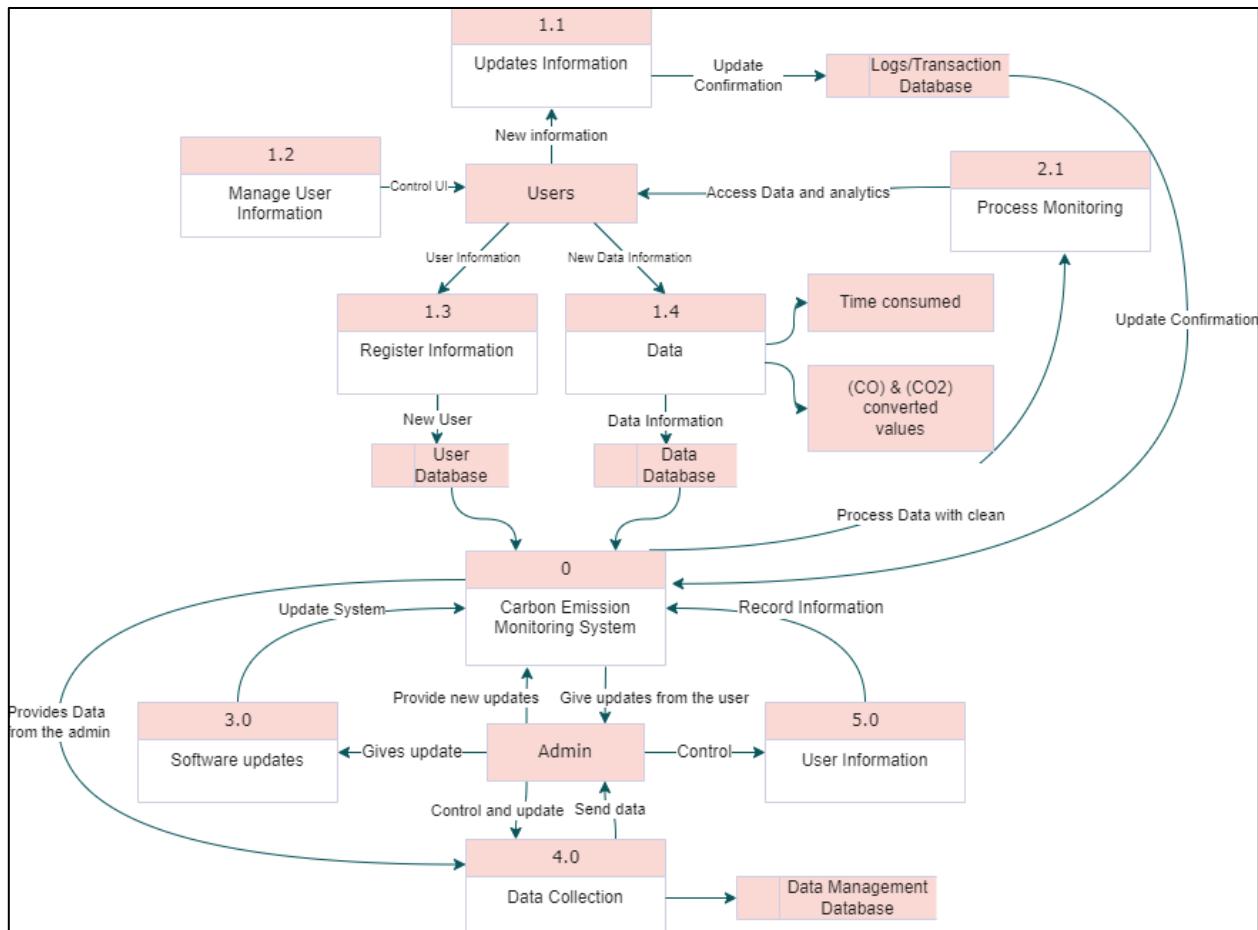


Figure 3-5. Level 1 DFD

Presented in the Level 1 Data Flow Diagram is the more specific, expansive, and elaborate explanation on how the data from the system would go from several components or devices. As instructed in the Level 0 DFD, the user's data is important in the system albeit the personal information (Name, Email, and etc.) or technical information (Sensor data, Usage data) all of which are stored in the database in order for the carbon emission monitoring system to work as intended. With these data and information, it is then given back to the user as a monitoring statistic or data in order for them to see the data and statistical analysis of their carbon emission data. Additionally, the admin of the monitoring system has full control on how the system will work through servers and databases. Administrators are mainly the one who manages and secures the data and information of the users as well as update the whole system's software for better usage and access.

Entity Relationship Diagram

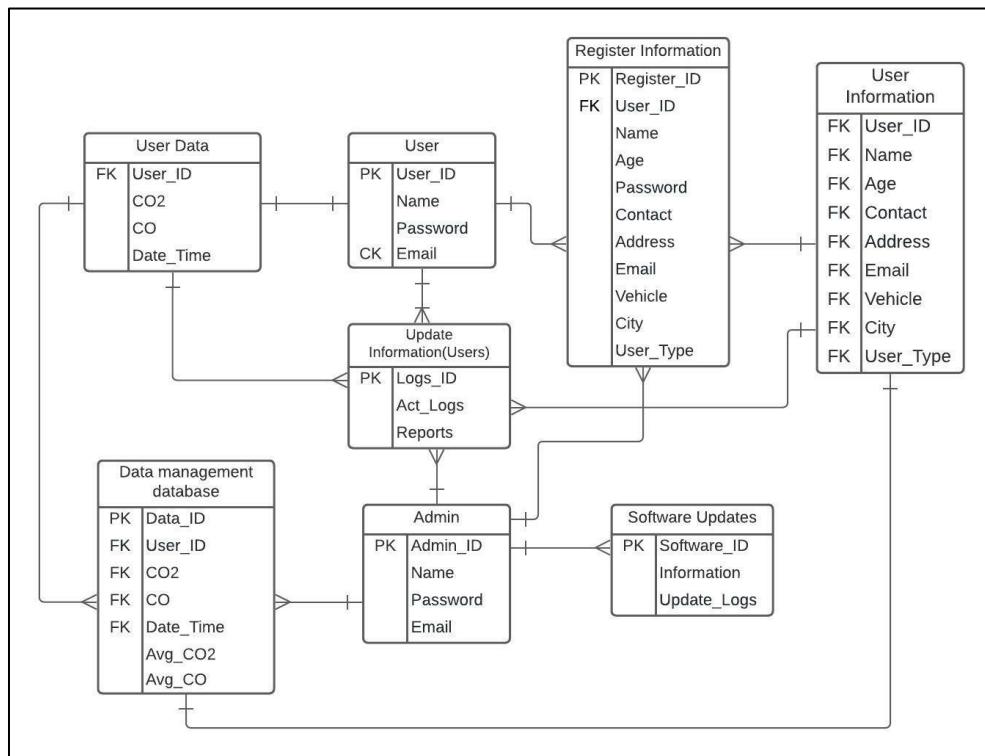


Figure 3-6. ERD Figure

Presented above is the Entity Relationship Diagram or the ERD of the design. This explains how the databases and tables are related to each other and to work as to what the data is intended to be worked on. It simple elaborates the specific values or strings that are needed in a specific table in order for the information to work in the system's software.

The design option has three (3) stages namely Pre-Processing, Feature Selection, Training of Dataset. In pre-processing, the data is normalized to make sure that all the features are in the same scale and will ensure a smooth training between the datasets. In feature selection, only the features significant in obtaining the statistics of emission are gathered to avoid redundant and irrelevant features due to the reason that it may negatively affect the performance of the model. In the last process, the data will be trained and fed into the algorithm. Moreover, the performance of these algorithms is evaluated by real-life condition simulations.

3.5 Summary of Design Options

In table 3-1, three (3) design options will be used in testing the accuracy of the design. All of the components are the same for each design option but the only factors that will vary are the use of sensors, the type of transmission of data, and the use of different algorithm models to test the accuracy of the sensor data that will be fed to the software for analysis and visualization.

The selection of sensors are based on its popularity in the market; and the selection of algorithms are also based on its popularity.

Table 3-1. Summary of Design Options

	Design Option 1	Design Option 2	Design Option 3
Consistency	MQ-9 CO Sensor	MQ-7 CO Sensor	TGS-203 CO Sensor
Cost	Arduino Nano BLE	Arduino Uno Rev3	Gizduino Uno-SE
Durability	CFRP Casing	ABS Plastic Casing	Metal Casing
Power Source	PP3 Removable Battery	Rechargeable Battery Pack (6000 mAh)	C Removable Batteries

3.6 Design Option 1

The main focus of this specific design is that the small ergonomic of the Arduino Nano BLE could benefit on the overall size of the device. Having the capability to communicate, its module only includes the SMS SIM800L and NEO-6M GPS. Having the material of the casing to be plastic, in comparison to other Design Options, this is relatively weaker but rather a cheaper material to adjust in costs. The battery that will be operating in this device is a removable pp3 battery.

3.6.1 Design Option 1 System Architecture

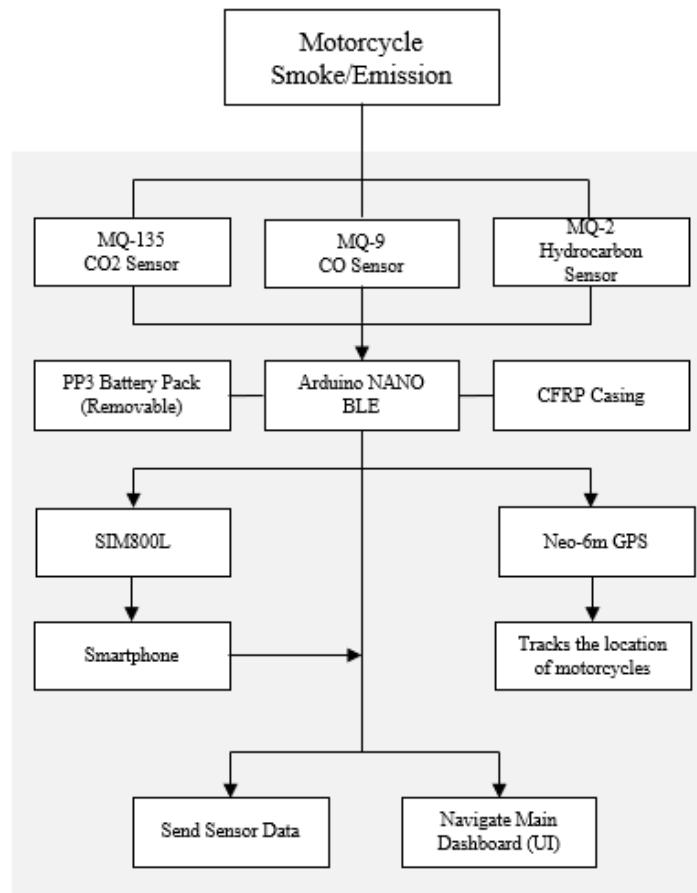


Figure 3-7. Design Option 1 System Architecture

The first design option has three (3) sensors which are the MQ-135 CO2 Sensor, MQ-9 CO Sensor, and MQ-2 Sensor HC. All of which are connected to the main board which is the Arduino Nano BLE. The main board has several modules in order to operate its functions and these modules are the SIM800L and NEO-6M GPS.

3.6.2 System and Layout / Drawings

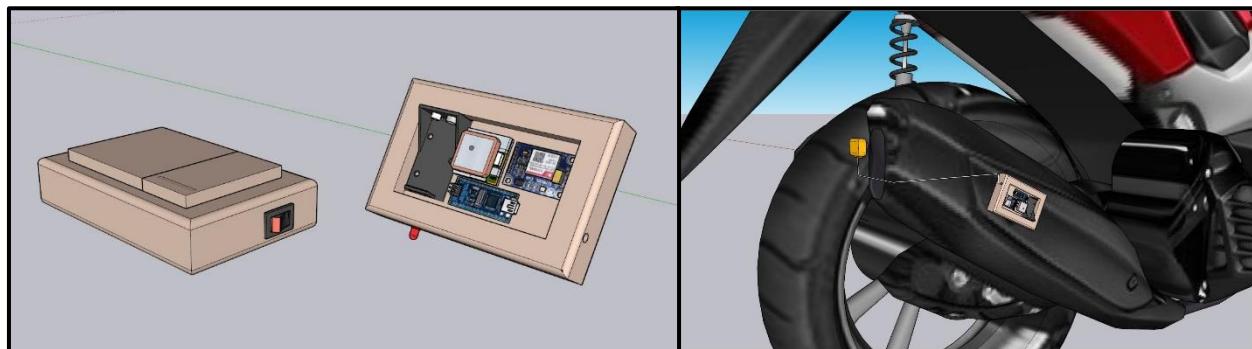


Figure 3-8. Design Option 1 Device Sketchup

Components Used:

- Arduino Nano BLE
- MQ-135 CO2 Gas Sensor
- MQ-9 CO Gas Sensor
- MQ-2 Gas Sensor
- Carbon Fiber-Reinforced Polymer
- LED
- SIM800L SMS Module
- NEO-6M GPS Module

3.6.3. Hardware Design

Arduino Nano BLE

The Arduino Nano 33 BLE is a completely new board on a well-known form factor. It comes with an embedded 9 axis inertial sensor which makes this board ideal for wearable devices, but also for a large range of scientific experiments in the need of short-distance wireless communication.

Carbon Dioxide Gas Sensor MQ-135

The first sensor that is used in the design project is the MQ-135 sensor. Its features include a wide range of detecting scope in the environment, its fast response and high sensitivity to the gases involved in detecting the amount of emission, its stable and long life, and its non-complex drive circuit. The resistance value of this sensor depends on the variation of concentration gases. So, this sensor needs to adjust its sensitivity by calibrating the detector. In table 3-2, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-2. MQ-135 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
VC	Circuit voltage	5V	AC or DC
VH	Heating voltage	5V	AC or DC
RL	Load resistance	Can adjust	
RH	Heater resistance	33 ohms	Room Temperature
PH	Heating consumption	Less than 800mw	

Carbon Monoxide Gas Sensor MQ-9

This sensor is good for sensing the concentration of Carbon Monoxide. It has a high sensitivity to Methane, Propane, and Carbon Monoxide. The structure of this sensor includes AL2O3 ceramic tube, Tin Dioxide (SnO₂) sensitive layer, measuring electrode and heater are included in the crust and plastic and stainless steel. In table 3-3, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-3. MQ-9 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
V _C	Circuit voltage	5V	AC or DC
V _H	Heating voltage	5V	AC or DC
R _L	Load resistance	Can adjust	
R _H	Heater resistance	33 ohms	Room Temperature
P _S	Heating consumption	Less than 800mw	

Hydrocarbon Gas Sensor MQ-2

This sensor has a wide detecting scope, stable and long life, with fast response and high sensitivity, and a simple drive circuit. Its applications consist of gas leakage detection, LPG, smoke, i-butane, propane, methane alcohol, Hydrogen, and smoke. In table 3-4, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-4. MQ-2 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
V _C	Circuit voltage	5V	AC or DC
V _H	Heating voltage	5V	AC or DC
R _L	Load resistance	Can adjust	
R _H	Heater resistance	33 ohms	Room Temperature
P _H	Heating consumption	Less than 800mw	

Carbon Fiber Reinforced Polymer

Carbon Fiber Reinforced Polymer (CFRP) is a type of durable and strong material that is composed of carbon atoms of polymer resin. CFRPs have the best strength -to-weight ration for construction materials. They are

commonly used in aerospace, automotive, civil engineering, and sporting goods. However, CFRPs are negative at high temperature of at least 200 degree Celsius.

LEDs

A semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light).

NEO-6M GPS

The NEO-6M module belongs to the family of stand-alone GPS receivers with high performance u-blox 6 positioning engine. Its compact architecture and power and memory options make NEO-6M modules ideal for battery operated mobile devices with very strict cost and space constraints. This module can handle a voltage supply of 2.7V to 3.6V with interfaces of UART, USB, SPI, and DDC. Its features contain TCXO, RTC crystal, and external interrupt.

SIM800L SMS

This module is a quad-band GSM/GPRS module that is functional on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class and supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. This module works on a power of 3.4V to 4.4V.

3.6.4 Design Standards

The following are the standards in the conceptualization of the prototype design. Some modules of the proposed design require using a standardized protocol in order to communicate with other components of the devices. This includes but is not limited to the following: wireless communication, and voltage or power ratings.

- IEEE Std 1012-1986 Documentation of the essential requirements (functions, performance, design constraints, and attributes) of the software and its external interfaces.
- IEEE Std 1818-2017 Guide for the Design of low-voltage auxiliary systems

3.6.5. Testing, Validation, and Result

For each design options, the testing will be based on the constraints presented by the client requirements. The following are the summary of the testing, validation, and the expected result of the system.

Table 3-5. Design Option 1 Testing, Validation, and Result

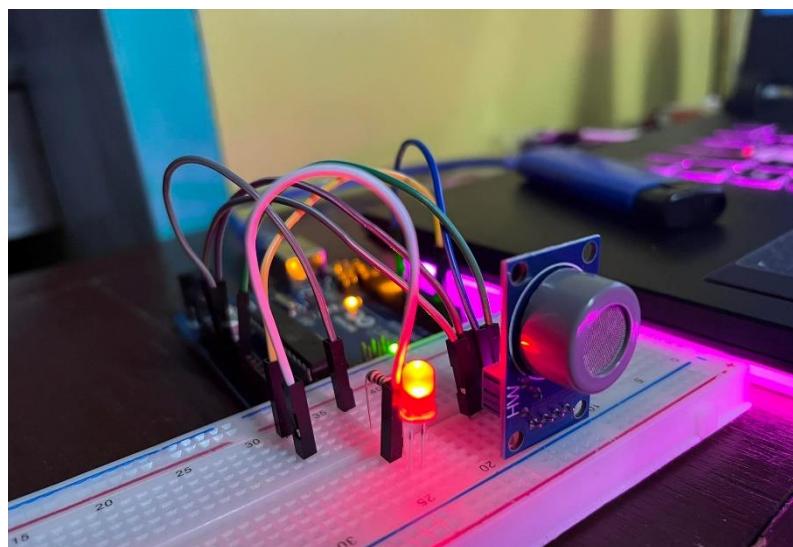
Constraints	Description
Consistency	Pearson R will be tested for calculating the Consistency of the sensor. The linear correlation relative to the actual gas analyzer values will be compared and verified if it has a strong positive correlation. For it to produce good results, the rating must be between 0.70-0.99.
Economic	The budget of the system will be dependent on the microcontroller that will be used in the device. Aside from that, the overall budget will be calculated in order to determine the total amount budget this device has to incur. Based from the client requirements, the overall budget is around 5,000 PHP so the total budget should be less than 5,000 PHP.
Durability	The device should be able to withstand the heat coming from the exhaust in order to maintain the quality of the device. The durability test will be tested

	using the thermal conduction simulator. The device should be able to obtain a conducting temperature of less than 120 degrees Celsius.
Power Usage	The device should be working and operating for at least 8 hours of work.

3.6.5.1. Accuracy and Functionality (from Functionality Simulations or Testing, and Performance Computations)

Design Option 1 uses the MQ-9 gas sensor for detecting and measuring the Carbon Monoxide levels of the motorcycle. For the testing, only the gas sensor, arduino board, and LED light are used to test the functionality of the device in getting the values of the emitted gas.

Figure 3.9 Prototype of the Device



The test was conducted in one hour where the garnered data consisted of 70 values where each value are all represented in parts per million (ppm). The standard value or the threshold limit of the emission should not be greater than 800 ppm based on the DENR standards that the gas emission tester stated.

Table 3-6. Functionality Testing for MQ-9

	MQ-9 Value	Gas Analyzer
Average	315.81428	213.82857
Accuracy	0.677070	100%
Accuracy	67.070%	100%

For the data gathering, the table above shows the values of the data collected from the MQ-9 sensor where each value was compared to the values obtained by the actual gas analyzer. In its result, the MQ-9 gas sensor obtained an accuracy reading of 67.070% which indicates that it is relatively close or good as compared to the actual value.

3.6.5.2. Constraints Computations

The constraints that are used in the design option 1 are the Consistency constraints, economic constraints, durability constraints, and the power usage constraints. These constraints are tested in order to calculate the best and optimal design for each design option in dependent to the components that are used in each constraint.

Consistency Constraint

The project focuses on the performance of the MQ-9 as the main component that is used in detecting the levels of Carbon Monoxide in the system. The sensor was placed in the exhaust for one hour and the result of the data was compared to the result of the actual gas analyzer for one hour of operation. The computation in getting the Consistency of the sensor was tested using the Pearson Product-Moment Correlation. This formula measures the strength of a linear correlation between two variables. The consistency of the device in terms of acquiring the data can be computed by using the following:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.1)$$

Table 3-7. Table for Computation

Carbon Monoxide (MQ-9)	Gas Analyzer	X Squared	Y Squared	XY
71	78	5041	6084	5538
72	79	5184	6241	5688
71	75	5041	5625	5325
71	79	5041	6241	5609
72	85	5184	7225	6120
71	83	5041	6889	5893
71	86	5041	7396	6106
72	79	5184	6241	5688
71	84	5041	7056	5964
72	85	5184	7225	6120
72	86	5184	7396	6192
72	112	5184	12544	8064
105	114	11025	12996	11970
190	126	36100	15876	23940
224	143	50176	20449	32032
424	153	179776	23409	64872
434	163	188356	26569	70742
402	165	161604	27225	66330
401	176	160801	30976	70576
414	178	171396	31684	73692
401	187	160801	34969	74987
415	189	172225	35721	78435
385	194	148225	37636	74690

385	197	148225	38809	75845
465	204	216225	41616	94860
428	206	183184	42436	88168
390	207	152100	42849	80730
443	211	196249	44521	93473
402	218	161604	47524	87636
393	224	154449	50176	88032
1023	231	1046529	53361	236313
1005	244	1010025	59536	245220
908	256	824464	65536	232448
763	269	582169	72361	205247
687	274	471969	75076	188238
629	279	395641	77841	175491
583	285	339889	81225	166155
540	293	291600	85849	158220
503	303	253009	91809	152409
469	311	219961	96721	145859
439	318	192721	101124	139602
412	327	169744	106929	134724
387	334	149769	111556	129258
364	341	132496	116281	124124
341	349	116281	121801	119009
323	351	104329	123201	113373
317	354	100489	125316	112218
305	334	93025	111556	101870
281	325	78961	105625	91325
272	311	73984	96721	84592
255	303	65025	91809	77265
246	296	60516	87616	72816
236	291	55696	84681	68676
220	286	48400	81796	62920
189	275	35721	75625	51975
190	271	36100	73441	51490
190	265	36100	70225	50350
193	254	37249	64516	49022
190	244	36100	59536	46360
190	231	36100	53361	43890
191	221	36481	48841	42211
190	213	36100	45369	40470
189	205	35721	42025	38745
190	197	36100	38809	37430
189	191	35721	36481	36099
191	187	36481	34969	35717
189	179	35721	32041	33831
191	172	36481	29584	32852

189	168	35721	28224	31752
189	164	35721	26896	30996
22107	14968	10168181	3676874	5313879
X	Y	X-SQUARED	Y-SQUARED	XY

The result of the table is shown below:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.2)$$

$$r = \frac{70 * 5313879 - (22107)(14968)}{\sqrt{[70\sum 10168181^2 - (\sum X 22107)^2][70\sum Y 3676874^2 - (\sum Y 14968)^2]}} \quad (3.3)$$

$$r = 0.4762$$

The MQ-9 gas sensor garnered a result of 0.4672 which has a moderate correlation between the two sets of data.

Economic Constraint

The design should be able to produce a design that cost-effective. In a business dictionary, cost is the amount of something that needs to get paid for a purchase. In business, the cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. For this design, the major factor that could affect the cost of the device is the microcontroller used and its overall budget. The total cost can be defined as:

$$\text{Cost} = \sum \text{cost of components (PHP)} \quad (3.4)$$

Table 3-8 Design Option 1 Price Breakdown

MATERIALS	PRICE
MQ-135	₱295.00
MQ-9	₱210.00
MQ-2	₱195.00
Arduino NANO BLE	₱626.00
SIM800L	₱577.00
NEO-6M GPS	₱609.00
CFRP	₱300.00
LED	₱20.00
PP3 Battery	₱300.00
Hose Clamp	₱100.00
SUM	₱3232.16

In table 3-8, the design garnered an overall budget of ₱3232.16 pesos which is less than the overall budget of the client requirements.

Durability Constraint

The design focuses on the ability of the device to withstand heat for a long time without becoming damaged by certain conditions like heat. The device will be placed near the exhaust of the motorcycle which will require it to be at least heat-free for it to not wear for longer period of time. This design will be using a plastic casing made with Carbon Fiber-Reinforced Polymer to test the capability of this material to withstand the conditions that it will be placed under. The result will be based on the datasheet to tell if the casing can withstand the heat produced by the exhaust where the device will be placed.

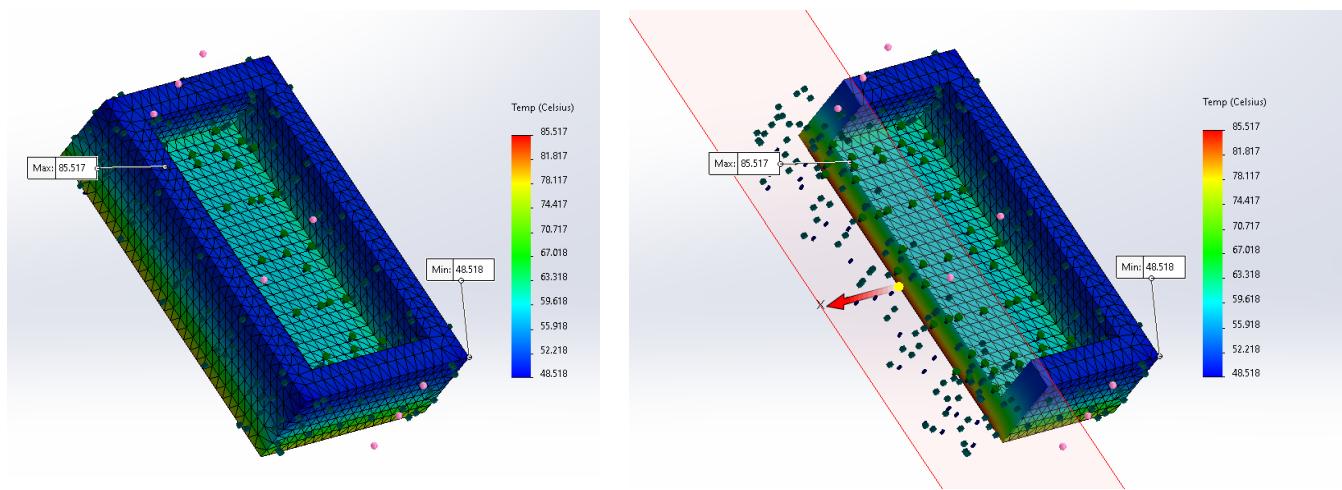


Figure 3-10. Design Option 1 Durability Simulation

In figure 3-10, thermal conduction is also tested in order to determine on how the heat will spread throughout the device. The thermal conduction simulation and analysis is done through SOLIDWORKS and has rendered a result of minimum heat index of 48.518 degrees Celsius and having the maximum heat index of 85.517 throughout the simulation. To summarize, the simulation garnered an average of 66.8335 heat index which is ideal because it is lower than the threshold of 120 degrees Celsius of thermal conduction.

Power Usage Constraint

The project focuses on the ability of the device to keep on working for a period of time. The computation of the power usage of each design option will be

$$\text{Operating Time} = \frac{\text{Battery Capacity} * \text{Battery Voltage}}{\text{Power Consumption}} \quad (3.5)$$

The total capacity of the design option 1 is seen in the table below.

Table 3-9. Design Option 1 Power Calculation

	Power (in hours)
MQ-135	1W
MQ-9	0.5W
SMS-SIM800L	1W
NEO 6M GPS	1W
LED	1.5W

By computing,

$$\text{Operating Time} = \frac{9V * 7.2A}{5W} \quad (3.6)$$

The total hours that the device can be used is around 12.96 hours.

DESIGN OPTION 1 SUMMARY

By calculating the constraints that are required for the design project, Design Option 1 come up with a summary that can be seen in the table below.

Table 3-10. Design Option 1 Summary

Constraint	Value	Remarks
Consistency	0.4762	It is lower than the ideal average result which is 0.77 to 0.99.
Economic	3232.16	It is cheaper and falls under the range of the cost required by the client which is 5,000 PHP
Durability	66.8335 degree Celsius	The device conducts less heat because it is lower than the muffler's temperature which is 120 degree Celsius.
Power Usage	12.96 hours	It surpasses the 8-hour operating time mark of the client requirement.

In table 3-10, design option 1 garnered a consistency value of 0.4762 which is lower than the ideal average result which falls from 0.70 to 0.99. Its economic value which equates to PHP3,232.16 is cheaper and it falls under the range of cost of the client which is 5,000 PHP. The device can handle high temperatures because of its ability of conducting less heat which is 66.833 degree Celsius which is lower than the mufflers temperature which is around 120 degree Celsius. The power usage of the batteries surpass which is around 12.6 hours surpass the 8-hour operating time mark of the client requirement.

3.7 Design Option 2

The difference of Design Option 2 compared to Design Option 1 is that the sensor for CO is different now, which is the MQ-7 this time around, and the main board has been replaced to Arduino Uno Rev3 which has several modules such as SIM800L for SMS, as well as the NEO-6M for GPS capability. The casing of this design option is now an Acrylonitrile Butadiene Styrene.

3.7.1 System Architecture

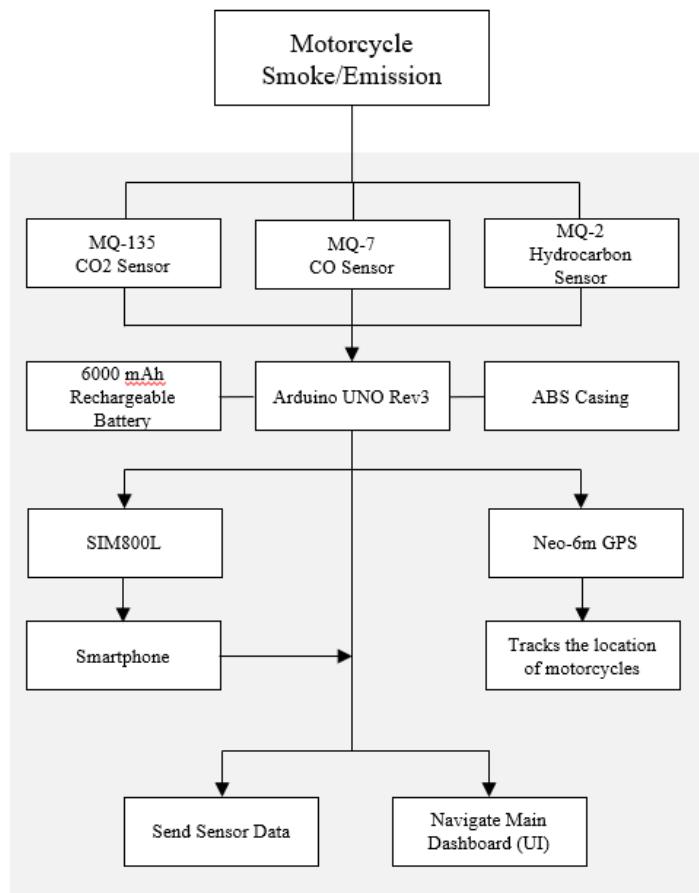


Figure 3-11. Hardware Architecture for Design Option 2

The second design option will use two sensors to record the emission statistics of the vehicle: MQ-137 for CO2 sensor, MQ-2 for Hydrocarbon, and MQ-7 sensor for Carbon Monoxide. This time around, the Arduino component used is the classic Arduino Uno R3 which will have several modules in order for it to function properly. The power source that will be used in this design option is a Rechargeable Battery Pack that has at least 6000 mAh capacity.

3.7.2. System and Layout /Drawings



Figure 3-12. Design Option 2 Hardware Sketchup

Components Used:

- Arduino Uno R3
- MQ-137 Sensor
- MQ-7 Sensor
- MQ-2 Gas Sensor
- Acrylonitrile Butadiene Styrene
- LED
- SIM800L SMS Module
- NEO-6M GPS Module

3.7.3. Hardware Design

Arduino Uno REV3

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it.

Carbon Dioxide Gas Sensor MQ-135

The first sensor that is used in the design project is the MQ-135 sensor. Its features include a wide range of detecting scope in the environment, its fast response and high sensitivity to the gases involved in detecting the amount of emission, its stable and long life, and its non-complex drive circuit. The resistance value of this sensor depends on the variation of concentration gases. So, this sensor needs to adjust its sensitivity by

calibrating the detector. In table 3-11, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-11. MQ-135 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
VC	Circuit voltage	5V	AC or DC
VH	Heating voltage	5V	AC or DC
RL	Load resistance	Can adjust	
RH	Heater resistance	33 ohms	Room Temperature
PH	Heating consumption	Less than 800mw	

Carbon Monoxide Gas Sensor MQ-7

This Carbon Monoxide (CO) gas sensor detects the concentrations of CO in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of 10 to 10,000 ppm. The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5 V. In table 3-12, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-12. MQ-7 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
VC	Circuit voltage	5V	AC or DC
VH	Heating voltage	5V	AC or DC
RL	Load resistance	Can adjust	
RH	Heater resistance	33 ohms	Room Temperature
PH	Heating consumption	Less than 800mw	

Hydrocarbon Gas Sensor MQ-2

This sensor has a wide detecting scope, stable and long life, with fast response and high sensitivity, and a simple drive circuit. Its applications consist of gas leakage detection, LPG, smoke, i-butane, propane, methane alcohol, Hydrogen, and smoke. In table 3-13, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-13. MQ-2 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
V _c	Circuit voltage	5V	AC or DC
V _H	Heating voltage	5V	AC or DC
R _L	Load resistance	Can adjust	
R _H	Heater resistance	33 ohms	Room Temperature
P _H	Heating consumption	Less than 800mw	

Acrylonitrile Butadiene Styrene

ABS (Acrylonitrile butadiene styrene) is a hard, tough, heat-resistant engineering plastic that is commonly used in applications like housings, luggage, pipe, fittings, and automotive interior parts. This common thermoplastic which has high impact resistance, heat resistance and toughness, and low thermal conductivity to be potentially applicable in civil engineering field.

LEDs

A semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light).

NEO-6M GPS

The NEO-6M module belongs to the family of stand-alone GPS receivers with high performance u-blox 6 positioning engine. Its compact architecture and power and memory options make NEO-6M modules ideal for battery operated mobile devices with very strict cost and space constraints. This module can handle a voltage supply of 2.7V to 3.6V with interfaces of UART, USB, SPI, and DDC. Its features contain TCXO, RTC crystal, and external interrupt.

SIM800L SMS

This module is a quad-band GSM/GPRS module that is functional on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class and supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. This module works on a power of 3.4V to 4.4V.

3.7.4. Design Standards

The following are the standards in the conceptualization of the prototype design. Some modules of the proposed design require using a standardized protocol in order to communicate with other components of the devices. This includes but is not limited to the following: wireless communication, and voltage or power ratings.

- IEEE Std 1012-1986 Documentation of the essential requirements (functions, performance, design constraints, and attributes) of the software and its external interfaces.
- IEEE Std 1818-2017 Guide for the Design of low-voltage auxiliary systems
- IEEE Std. 1609-2016 Standard for Wireless access in vehicular environments

3.7.5 Testing, Validation, and Result

For each design options, the testing will be based on the constraints presented by the client requirements. The following are the summary of the testing, validation, and the expected result of the system.

Table 3-14. Design Option 2 Testing, Validation, and Result

Constraints	Description
Consistency	Pearson R will be tested for calculating the consistency of the sensor. The linear correlation relative to the actual gas analyzer values will be compared and verified if it has a strong positive correlation. For it to produce good results, the rating must be between 0.70-0.99.
Economic	The budget of the system will be dependent on the microcontroller that will be used in the device. Aside from that, the overall budget will be calculated in

	order to determine the total amount budget this device has to incur. Based from the client requirements, the overall budget is around 5,000 PHP so the total budget should be less than 5,000 PHP.
Durability	The device should be able to withstand the heat coming from the exhaust in order to maintain the quality of the device. The durability test will be tested using the thermal conduction simulator. The device should be able to obtain a conducting temperature of less than 120 degrees Celsius.
Power Usage	The device should be working and operating for at least 8 hours of work.

3.7.5.1. Accuracy and Functionality (from Functionality Simulations or Testing, and Performance Computations)

Design Option 2 uses the MQ-7 gas sensor for detecting and measuring the Carbon Monoxide levels of the motorcycle. For the testing, only the gas sensor, arduino board, and LED light are used to test the functionality of the device in getting the values of the emitted gas.

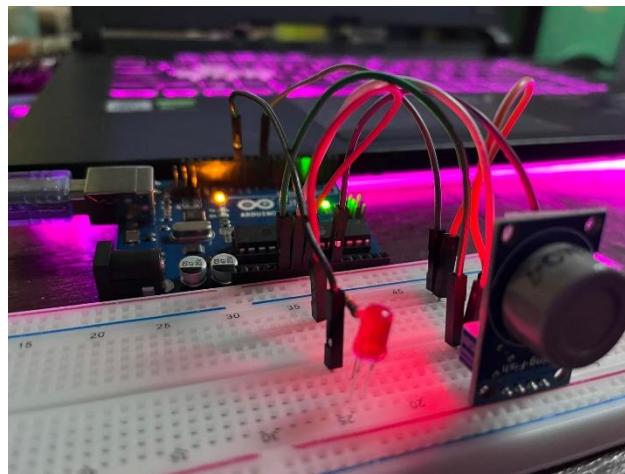


Figure 3-13. Prototype of the Device

The test was conducted in one hour where the garnered data consisted of 70 values where each value are all represented in parts per million (ppm). The standard value or the threshold limit of the emission should not be greater than 800 ppm based on the DENR standards that the gas emission tester stated.

Table 3-15. Functionality Testing for MQ-7

	MQ-7 Value	Gas Analyzer
Average	204	213.82857
Accuracy	0.9440	100%
Accuracy	94.40%	100%

For the data gathering, the table above shows the values of the data collected from the MQ-7 sensor where each value was compared to the values obtained by the actual gas analyzer. In its result, the MQ-7 gas sensor obtained an accuracy reading of 94.40% which indicates that it is really close as compared to the actual value.

3.7.5.2. Constraints Computations

The constraints that are used in the design option 1 are the consistency constraints, economic constraints, durability constraints, and the power usage constraints. These constraints are tested in order to calculate the best and optimal design for each design option in dependent to the components that are used in each constraint.

Consistency Constraint

The project focuses on the performance of the MQ-7 as the main component that is used in detecting the levels of Carbon Monoxide in the system. The sensor was placed in the exhaust for one hour and the result of the data was compared to the result of the actual gas analyzer for one hour of operation. The computation in getting the consistency of the sensor was tested using the Pearson Product-Moment Correlation. This formula measures the strength of a linear correlation between two variables. The consistency of the device in terms of acquiring the data can be computed by using the following:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.7)$$

Table 3-16. Table for Computation

Carbon Monoxide (MQ-9)	Gas Analyzer	X Squared	Y Squared	XY
78	78	6084	6084	6084
79	79	6241	6241	6241
80	75	6400	5625	6000
79	79	6241	6241	6241
81	85	6561	7225	6885
80	83	6400	6889	6640
79	86	6241	7396	6794
81	79	6561	6241	6399
81	84	6561	7056	6804
82	85	6724	7225	6970
82	86	6724	7396	7052
101	112	10201	12544	11312
124	114	15376	12996	14136
144	126	20736	15876	18144
156	143	24336	20449	22308
165	153	27225	23409	25245
170	163	28900	26569	27710
176	165	30976	27225	29040
181	176	32761	30976	31856
184	178	33856	31684	32752
191	187	36481	34969	35717
194	189	37636	35721	36666
201	194	40401	37636	38994
205	197	42025	38809	40385

208	204	43264	41616	42432
210	206	44100	42436	43260
215	207	46225	42849	44505
213	211	45369	44521	44943
221	218	48841	47524	48178
232	224	53824	50176	51968
244	231	59536	53361	56364
263	244	69169	59536	64172
286	256	81796	65536	73216
291	269	84681	72361	78279
300	274	90000	75076	82200
304	279	92416	77841	84816
308	285	94864	81225	87780
309	293	95481	85849	90537
309	303	95481	91809	93627
310	311	96100	96721	96410
311	318	96721	101124	98898
327	327	106929	106929	106929
315	334	99225	111556	105210
327	341	106929	116281	111507
332	349	110224	121801	115868
306	351	93636	123201	107406
295	354	87025	125316	104430
309	334	95481	111556	103206
290	325	84100	105625	94250
285	311	81225	96721	88635
299	303	89401	91809	90597
286	296	81796	87616	84656
258	291	66564	84681	75078
249	286	62001	81796	71214
241	275	58081	75625	66275
433	271	187489	73441	117343
225	265	50625	70225	59625
220	254	48400	64516	55880
214	244	45796	59536	52216
209	231	43681	53361	48279
204	221	41616	48841	45084
200	213	40000	45369	42600
197	205	38809	42025	40385
192	197	36864	38809	37824
188	191	35344	36481	35908
185	187	34225	34969	34595
183	179	33489	32041	32757
180	172	32400	29584	30960
177	168	31329	28224	29736

176	164	30976	26896	28864
14910	14968	3643176	3676874	3635277
X	Y	X-SQUARED	Y-SQUARED	XY

The result of the table is shown below:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.8)$$

$$r = \frac{70*3635277 - (14910)(14968)}{\sqrt{[70\sum 3643176 - (\sum 14910)^2][N\sum 3676874^2 - (\sum 14968)^2]}} \quad (3.9)$$

$$r = 0.947640933$$

The MQ-7 gas sensor garnered a result of 0.4672 which has a strong positive correlation between the two sets of data.

Economic Constraint

The design should be able to produce a design that cost-effective. In a business dictionary, cost is the amount of something that needs to get paid for a purchase. In business, the cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. For this design, the major factor that could affect the cost of the device is the microcontroller used and its overall budget. The total cost can be defined as:

$$\text{Cost} = \sum \text{cost of components (PHP)}$$

Table 3-17. Design Option 2 Price Breakdown

MATERIALS	PRICE
MQ-135	₱295.00
MQ-7	₱210.00
MQ-2	₱195.00
Arduino UNO Rev3	₱500.00
SIM800L	₱577.00
NEO-6M GPS	₱609.00
ABS	₱2000.00
LED	₱20.00
Lithium Ion Battery	₱80.00
Hose Clamp	₱100.00
SUM	₱4586.00

The design garnered an overall budget of 4586.00 pesos which is less than the overall budget of the client requirements.

Durability Constraint

The design focuses on the ability of the device to withstand heat for a long time without becoming damaged by certain conditions like heat. The device will be placed near the exhaust of the motorcycle which will require it to be at least heat-free for it to not wear for longer period of time. This design will be using a plastic casing made with Acrylonitrile Butadiene Styrene to test the capability of this material to withstand the conditions that it will be placed under. The result will be based on the datasheet to tell if the casing can withstand the heat produced by the exhaust where the device will be placed.

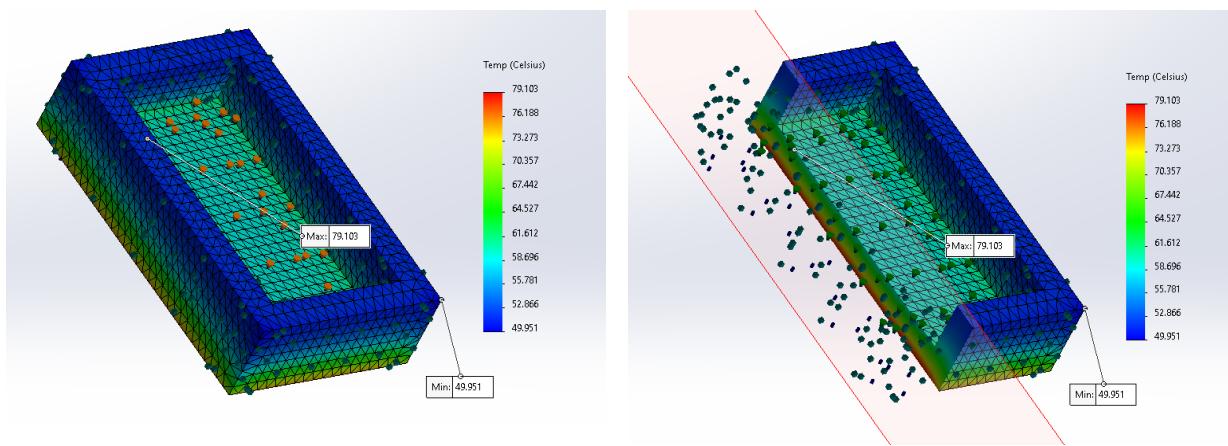


Figure 3-14. Design Option 2 Thermal Conduction Simulation

Thermal conduction is also tested in order to determine on how the heat will spread throughout the device. The thermal conduction simulation and analysis is done through SOLIDWORKS and has rendered a result of minimum heat index of 49.951 degrees Celsius and having the maximum heat index of 79.103 throughout the simulation. To summarize, the simulation garnered an average of 64.527 heat index which is ideal because it is lower than the threshold of 80 degrees Celsius of thermal conduction.

Power Usage Constraint

The project focuses on the ability of the device to keep on working for a period of time. The computation of the power usage of each design option will be

$$\text{Operating Time} = \frac{\text{Battery Capacity} * \text{Battery Voltage}}{\text{Power Consumption}} \quad (3.10)$$

The total capacity of the design option 2 is seen in the table below.

Table 3-18. Design Option 2 Power Breakdown

	Power (in hours)
MQ-135	1W
MQ-9	0.5W
SMS-SIM800L	1W
NEO 6M GPS	1W
LED	1.5W

By computing,

$$\text{Operating Time} = \frac{7.2V * 6A}{5} \quad (3.11)$$

The total hours that the device can be used is around 8.64 hours.

DESIGN OPTION 2 SUMMARY

By calculating the constraints that are required for the design project, Design Option 2 come up with a summary that can be seen in the table below.

Table 3-19. Design Option 2 Summary

Constraint	Value	Remarks
Consistency	0.947640933	It falls within the range of ideal average result which is 0.77 to 0.99.
Economic	4586.00	It falls under the range of the cost required by the client which is 5,000 PHP
Durability	64.527 degree Celsius	The device conducts less heat because it is lower than the muffler's temperature which is 120 degree Celsius.
Power Usage	8.64 hours	It surpasses the 8-hour operating time mark of the client requirement.

In table 3-19, design option 2 garnered a consistency value of 0.9476 which falls under the ideal average result which falls from 0.70 to 0.99. Its economic value which equates to PHP4,586.00 is cheap and it falls under the range of cost of the client which is 5,000 PHP. The device can handle high temperatures because of its ability of conducting less heat which is 64.527 degree Celsius which is lower than the mufflers temperature which is around 120 degree Celsius. The power usage of the batteries surpass which is around 8.64 hours surpass the 8-hour operating time mark of the client requirement.

3.8 Design Option 3

The main distinction of this Design Option compared to the other two (2) is the replacement of the CO sensor and the replacement of the mainboard into a cheaper, yet functions the same, Gizduino Uno-SE that is provided here in the Philippines. This board is the local version of the Arduino Uno Rev3 for the use of students who are taking ECE or CpE. Another main difference of this design option is that the material of the casing is now metal which is in theory, the most durable among the three (3). Another difference is the power source is another removable battery but this time, it is 4x AA batteries.

3.8.1 Design Option 3 System Architecture

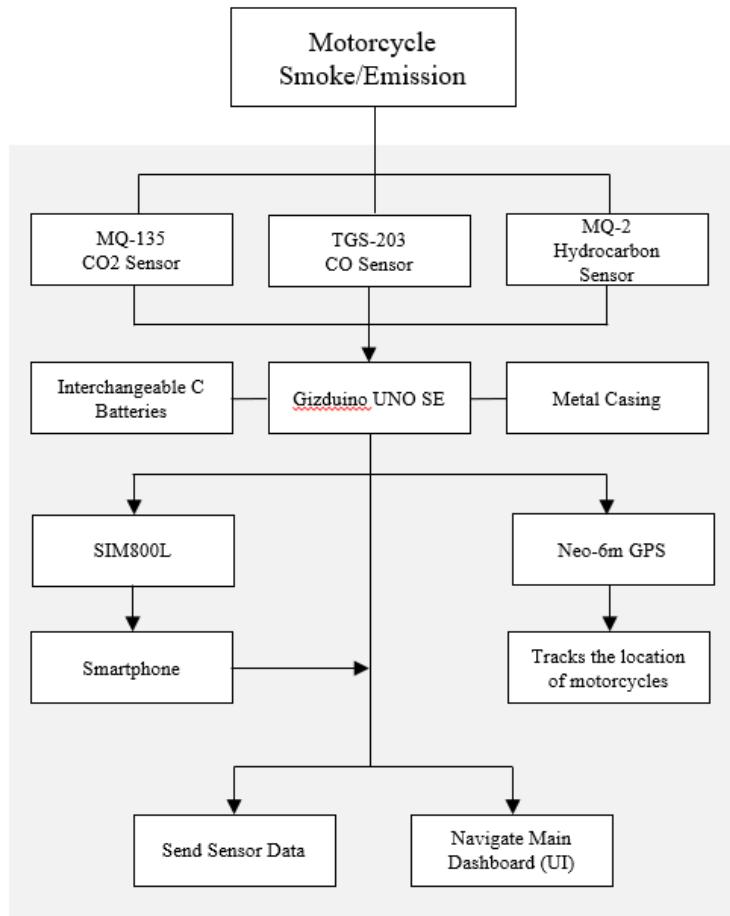


Figure 3-15. Hardware Architecture for Design Option 3

The third design option will use two sensors to capture the emission statistics of the vehicle: MQ-135 for CO2 sensor, MQ-2 for Hydrocarbon, and TGS-203 sensor for Carbon Monoxide. The communication from both sensors will come from the Gizduino UNO-SE that has several modules for it to function properly. The modules that is connected to the main board are the SIM800L SMS module and the NEO-6M GPS module. The power source that will be used in this design option is 4 AA Batteries

3.8.2. System and Layout /Drawings

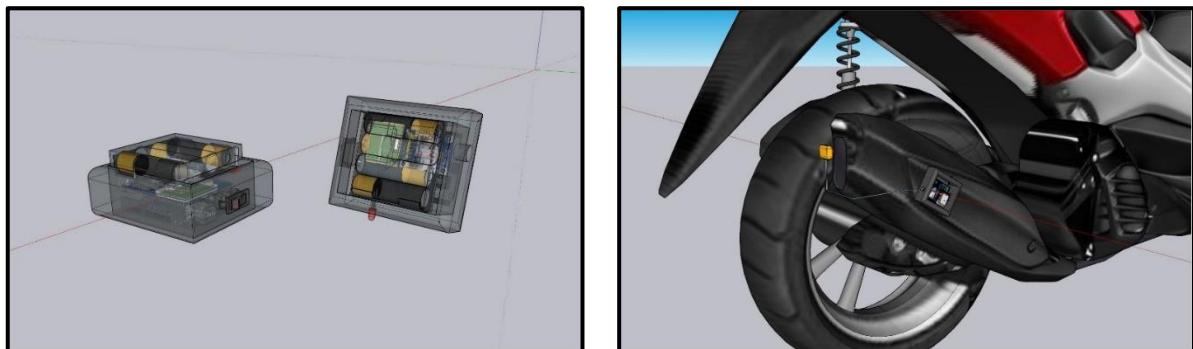


Figure 3-16. Design Option 3 Sketchup

Components Used:

- Gizduino UNO-SE
- MQ-135 CO₂ Gas Sensor
- TGS-203 CO Sensor
- MQ-2 HC Sensor
- Metal Casing
- LED
- SIM800L SMS Module
- NEO-6M GPS Module

3.8.3. Hardware Design

Gizduino Uno-SE

Gizduino UNO-SE (Student's Edition) is 100% code compatible with Arduino Uno. It is built for the budget but with the best possible quality. To obtain to most competitive price, we used the same USB bridge CH340 universally used by China UNO compatible manufacturers. Hence, if you are already user of these boards, you can switch to the gizDuino UNO-SE and not notice a difference in usage.

Carbon Dioxide Gas Sensor MQ-135

The first sensor that is used in the design project is the MQ-135 sensor. Its features include a wide range of detecting scope in the environment, its fast response and high sensitivity to the gases involved in detecting the amount of emission, its stable and long life, and its non-complex drive circuit. The resistance value of this sensor depends on the variation of concentration gases. So, this sensor needs to adjust its sensitivity by calibrating the detector. In table 3-20, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-20. MQ-13 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
VC	Circuit voltage	5V	AC or DC

VH	Heating voltage	5V	AC or DC
RL	Load resistance	Can adjust	
RH	Heater resistance	33 ohms	Room Temperature
PH	Heating consumption	Less than 800mw	

Carbon Monoxide Gas Sensor TGS-203

Tin dioxide (SnO_2) is used as the main material of the sensor element. A pair of wire electrodes are embedded in the sintered material. A 90-micron diameter iridium-palladium alloy wire with resistance of approximately 2Ω is spot welded to nickel pins. The sensor base is made of polyethylene terephthalate reinforced with glass fiber. The internal cover is a double layer of 100 mesh stainless steel gauze (SUS316) and the cover is fastened to the sensor base by a nickel-plated brass ring. The external housing material consists of reinforced polyamide resin (UL94V-0) and a layer of 60 mesh stainless steel gauze (SUS304) is used for the outside cover. In table 3-21, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-21. TGS-203 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
VC	Circuit voltage	5V	AC or DC
VH	Heating voltage	5V	AC or DC
RL	Load resistance	Can adjust	
RH	Heater resistance	33 ohms	Room Temperature
PH	Heating consumption	Less than 800mw	

Hydrocarbon Gas Sensor MQ-2

This sensor has a wide detecting scope, stable and long life, with fast response and high sensitivity, and a simple drive circuit. Its applications consist of gas leakage detection, LPG, smoke, i-butane, propane, methane alcohol, Hydrogen, and smoke. In table 3-22, the sensor works well under a voltage of 5 volts, and its load resistance can adjust meaning it is flexible in terms of the power that it can handle, and the power consumption of the sensor is at less than 800 mw.

Table 3-22. MQ-2 Data Sheet

Symbol	Parameter Name	Technical Condition	Remarks
V_c	Circuit voltage	5V	AC or DC
V_H	Heating voltage	5V	AC or DC
R_L	Load resistance	Can adjust	
R_H	Heater resistance	33 ohms	Room Temperature
P_H	Heating consumption	Less than 800mw	

Metal Casing

Steel casing is widely used in industrial workplaces due to its capability of protecting underground utilities from damage due to nature or human activity.

LEDs

A semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light).

NEO-6M GPS

The NEO-6M module belongs to the family of stand-alone GPS receivers with high performance u-blox 6 positioning engine. Its compact architecture and power and memory options make NEO-6M modules ideal for battery operated mobile devices with very strict cost and space constraints. This module can handle a voltage supply of 2.7V to 3.6V with interfaces of UART, USB, SPI, and DDC. Its features contain TCXO, RTC crystal, and external interrupt.

SIM800L SMS

This module is a quad-band GSM/GPRS module that is functional on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class and supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. This module works on a power of 3.4V to 4.4V.

3.8.4 Design Standards

The following are the standards in the conceptualization of the prototype design. Some modules of the proposed design require using a standardized protocol in order to communicate with other components of the devices. This includes but is not limited to the following: wireless communication, and voltage or power ratings.

- IEEE Std 1012-1986 Documentation of the essential requirements (functions, performance, design constraints, and attributes) of the software and its external interfaces.
- IEEE Std 1818-2017 Guide for the Design of low-voltage auxiliary systems
- IEEE Std. 1609-2016 Standard for Wireless access in vehicular environments

3.8.5 Testing, Validation, and Result

For each design options, the testing will be based on the constraints presented by the client requirements. The following are the summary of the testing, validation, and the expected result of the system.

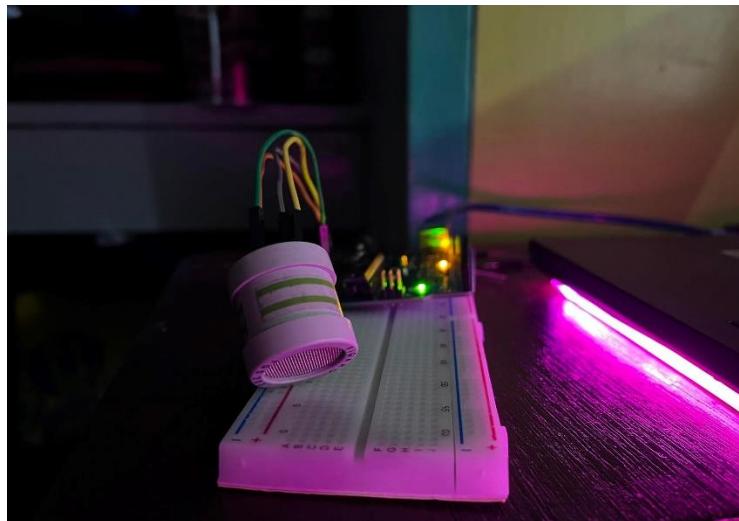
Table 3-23. Design Option 2 Testing, Validation, and Result

Constraints	Description
Consistency	Pearson R will be tested for calculating the Consistency of the sensor. The linear correlation relative to the actual gas analyzer values will be compared and verified if it has a strong positive correlation. For it to produce good results, the rating must be between 0.70-0.99.
Economic	The budget of the system will be dependent on the microcontroller that will be used in the device. Aside from that, the overall budget will be calculated in order to determine the total amount budget this device has to incur. Based from the client requirements, the overall budget is around 5,000 PHP so the total budget should be less than 5,000 PHP.
Durability	The device should be able to withstand the heat coming from the exhaust in order to maintain the quality of the device. The durability test will be tested using the thermal conduction simulator. The device should be able to obtain a conducting temperature of less than 120 degrees Celsius.
Power Usage	The device should be working and operating for at least 8 hours of work.

3.8.5.1. Accuracy and Functionality (from Functionality Simulations or Testing, and Performance Computations)

Design Option 3 uses the TGS-203 gas sensor for detecting and measuring the Carbon Monoxide levels of the motorcycle. For the testing, only the gas sensor, arduino board, and LED light are used to test the functionality of the device in getting the values of the emitted gas.

Figure 3-17. Prototype of the Device



The test was conducted in one hour where the garnered data consisted of 70 values where each value are all represented in parts per million (ppm). The standard value or the threshold limit of the emission should not be greater than 800 ppm based on the DENR standards that the gas emission tester stated.

Table 3-24. Functionality Testing for TGS-203

	TGS-203 Value	Gas Analyzer
Average	467	213.82857
Accuracy	0.45787	100%
Accuracy	45.787%	100%

For the data gathering, the table above shows the values of the data collected from the TGS-203 sensor where each value was compared to the values obtained by the actual gas analyzer. In its result, the TGS-203 gas sensor obtained an accuracy reading of 45.787% which indicates that it is not close as compared to the actual value.

3.8.5.2. Constraints Computations

The constraints that are used in the design option 3 are the Consistency constraints, economic constraints, durability constraints, and the power usage constraints. These constraints are tested in order to calculate the best and optimal design for each design option in dependent to the components that are used in each constraint.

Consistency Constraint

The project focuses on the performance of the TGS-203 as the main component that is used in detecting the levels of Carbon Monoxide in the system. The sensor was placed in the exhaust for one hour and the result of the data was compared to the result of the actual gas analyzer for one hour of operation. The computation in getting the consistency of the sensor was tested using the Pearson Product-Moment Correlation. This formula measures the strength of a linear correlation between two variables. The consistency of the device in terms of acquiring the data can be computed by using the following:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.12)$$

Table 3-25. Table for Computation

Carbon Monoxide (TGS-203)	Gas Analyzer	X Squared	Y Squared	XY
131	78	17161	6084	10218
211	79	44521	6241	16669
231	75	53361	5625	17325
423	79	178929	6241	33417
231	85	53361	7225	19635
546	83	298116	6889	45318
243	86	59049	7396	20898
265	79	70225	6241	20935
342	84	116964	7056	28728
432	85	186624	7225	36720
125	86	15625	7396	10750
643	112	413449	12544	72016
243	114	59049	12996	27702
526	126	276676	15876	66276
351	143	123201	20449	50193
243	153	59049	23409	37179
237	163	56169	26569	38631
531	165	281961	27225	87615
1032	176	1065024	30976	181632
647	178	418609	31684	115166
867	187	751689	34969	162129
578	189	334084	35721	109242
897	194	804609	37636	174018
745	197	555025	38809	146765
465	204	216225	41616	94860
645	206	416025	42436	132870
867	207	751689	42849	179469
354	211	125316	44521	74694
453	218	205209	47524	98754
645	224	416025	50176	144480
756	231	571536	53361	174636

685	244	469225	59536	167140
476	256	226576	65536	121856
845	269	714025	72361	227305
477	274	227529	75076	130698
645	279	416025	77841	179955
543	285	294849	81225	154755
346	293	119716	85849	101378
432	303	186624	91809	130896
443	311	196249	96721	137773
387	318	149769	101124	123066
356	327	126736	106929	116412
378	334	142884	111556	126252
423	341	178929	116281	144243
421	349	177241	121801	146929
408	351	166464	123201	143208
375	354	140625	125316	132750
354	334	125316	111556	118236
415	325	172225	105625	134875
395	311	156025	96721	122845
453	303	205209	91809	137259
490	296	240100	87616	145040
503	291	253009	84681	146373
543	286	294849	81796	155298
458	275	209764	75625	125950
365	271	133225	73441	98915
453	265	205209	70225	120045
345	254	119025	64516	87630
365	244	133225	59536	89060
325	231	105625	53361	75075
376	221	141376	48841	83096
425	213	180625	45369	90525
433	205	187489	42025	88765
476	197	226576	38809	93772
523	191	273529	36481	99893
576	187	331776	34969	107712
521	179	271441	32041	93259
476	172	226576	29584	81872
454	168	206116	28224	76272
421	164	177241	26896	69044
32690	14968	17503572	3676874	7154367
X	Y	X-SQUARED	Y-SQUARED	XY

The result of the table is shown below:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (3.13)$$

$$r = \frac{70*7154367 - (32690)(14968)}{\sqrt{[70\sum 17503572 - (\sum 32690)^2][N\sum 3676874 - (\sum 14968)^2]}} \quad (3.14)$$

$$r = 0.1591$$

The TGS-203 gas sensor garnered a result of 0.1591 which has a poor correlation between the two sets of data.

Economic Constraint

The design should be able to produce a design that cost-effective. In a business dictionary, cost is the amount of something that needs to get paid for a purchase. In business, the cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. For this design, the major factor that could affect the cost of the device is the microcontroller used and its overall budget. The total cost can be defined as:

$$\text{Cost} = \sum \text{cost of components (PHP)} \quad (3.15)$$

Table 3-26. Design Option 3 Price Breakdown

MATERIALS	PRICE
MQ-135	₱295.00
TGS-203	₱700.00
MQ-2	₱195.00
Gizduino UNO	₱500.00
SIM800L	₱577.00
NEO-6M GPS	₱609.00
Steel Case	₱3500.00
LED	₱20.00
AA Batteries 4x	₱300.00
Hose Clamp	₱100.00
SUM	₱6796.00

The design garnered an overall budget of 6796.00 pesos which is greater than the overall budget of the client requirements.

Durability Constraint

The design focuses on the ability of the device to withstand heat for a long time without becoming damaged by certain conditions like heat. The device will be placed near the exhaust of the motorcycle which will require it to be at least heat-free for it to not wear for longer period of time. This design will be using a metal casing to test the capability of this material to withstand the conditions that it will be placed under. The result will be based on the datasheet to tell if the casing can withstand the heat produced by the exhaust where the device will be placed.

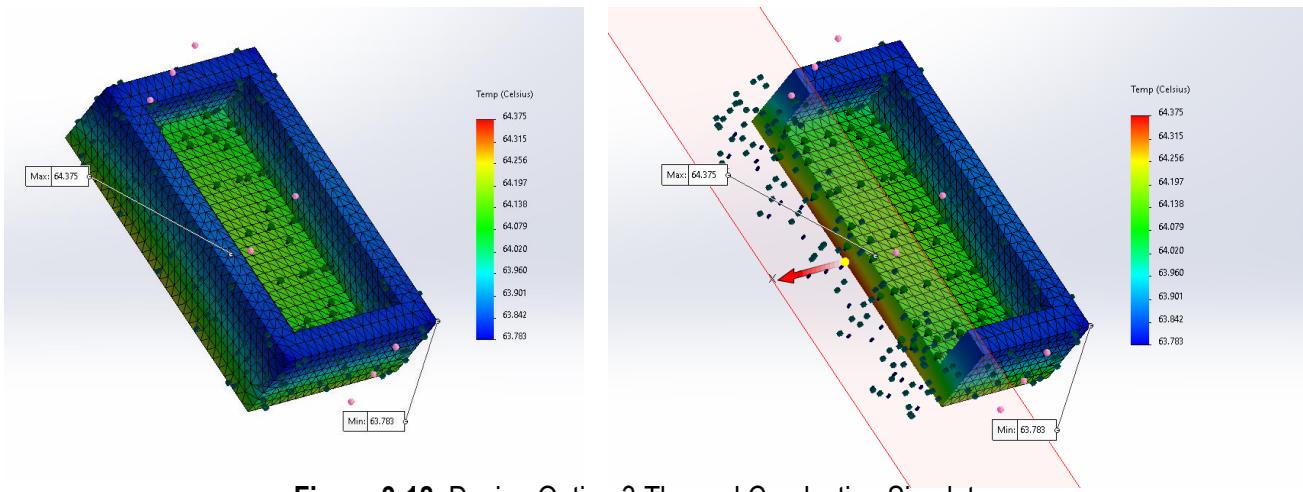


Figure 3-18. Design Option 3 Thermal Conduction Simulator

Thermal conduction is also tested in order to determine on how the heat will spread throughout the device. The thermal conduction simulation and analysis is done through SOLIDWORKS and has rendered a result of minimum heat index of 63.783 degrees Celsius and having the maximum heat index of 64.375 throughout the simulation. To summarize, the simulation garnered an average of 64.079 heat index which is ideal because it is lower than the threshold of 80 degrees Celsius of thermal conduction.

Power Usage Constraint

The project focuses on the ability of the device to keep on working for a period of time. The computation of the power usage of each design option will be

$$\text{Operating Time} = \frac{\text{Battery Capacity} * \text{Battery Voltage}}{\text{Power Consumption}} \quad (3.16)$$

The total capacity of the design option 2 is seen in the table below.

Table 3-27. Design Option 3 Power Breakdown

	Power (in hours)
MQ-135	1W
MQ-9	0.5W
SMS-SIM800L	1W
NEO 6M GPS	1W
LED	1.5W

By computing,

$$\text{Operating Time} = \frac{3.6V * 8.5A}{5W} \quad (3.17)$$

The total hours that the device can be used is around 6.12 hours.

DESIGN OPTION 3 SUMMARY

By calculating the constraints that are required for the design project, Design Option 3 come up with a summary that can be seen in the table below.

Table 3-28. Design Option 3 Summary

Constraint	Value	Remarks
Consistency	0.1591	It is lower than the ideal average result which is 0.77 to 0.99. It corresponds to having a POOR correlation. Meaning, it is the least consistent among the design options.
Economic	6796.00	It is expensive and falls above the range of the cost required by the client which is 5,000 PHP
Durability	64.079 degree Celsius	The device conducts less heat because it is lower than the muffler's temperature which is 120 degree Celsius.
Power Usage	6.12 hours	It did not surpass the 8-hour operating time mark of the client requirement.

In table 3-10, design option 1 garnered a consistency value of 0.1591 which is lower than the ideal average result which falls from 0.70 to 0.99. Its economic value which equates to PHP6796.00 is more expensive and it is greater than the given range of cost of the client which is 5,000 PHP. The device can handle high temperatures because of its ability of conducting less heat which is 64.079 degree Celsius which is lower

than the mufflers temperature which is around 120 degree Celsius. The power usage of the batteries which is around 6.12 hours did not surpass the 8-hour operating time mark of the client requirement.

CHAPTER 4:

CONSTRAINTS, TRADE-OFFS, AND STANDARDS

This chapter focuses on the constraints considered in the design option of the Carbon Sense system. This chapter also includes the design trade-offs and sensitivity analysis for each design option, considering the design constraints.

4.1 Design Constraints

Economical Constraint

The project should be able to produce a design that cost-effective. In a business dictionary, cost is the amount of something that needs to get paid for a purchase. In business, the cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. For this project, the materials should fall under the range set by the client which is 5,000 pesos. To compute the cost of the design, the cost of each material will be considered and calculate as its overall cost. The lesser the overall cost of the design, the better it is.

Consistency Constraint

The project focuses on the performance of the main device of the system in terms of getting the data that is needed for measurement. The device will be tested based on how consistent the sensors are especially when placed under the condition like heat for a period of time. The computation in getting the consistency of the device can be tested using the Pearson Product-Moment Correlation. This formula measures the strength of a linear correlation between two variables. To compute the consistency of the device in terms of acquiring the data needed for analysis, the data will be obtained from each of the design options and it will be compared to the gas analyzer that will be considered as the true value of the emission.

Durability Constraint

The project focuses on the ability of the device to withstand heat for a long time without becoming damaged by certain conditions like heat. The device will be placed near the exhaust of the motorcycle which will require it to be at least heat-free for it to not wear for longer period of time. The computation will be based on the datasheet whether which device in each design option can withstand the heat of the muffler from the motorcycle. This will be tested by using the heat conduction simulator in SOLIDWORKS.

Power Usage Constraint

The project focuses on the ability of the device to keep on working for a period of time. This is considered to be one of the constraints because this is a vital factor as to how long the power can make the device working and running.

Table 4-1. Considerations of constraints and possible solutions

Constraints	Criterion of Importance
Consistency Constraint	0.5
Economical Constraint	0.2
Durability Constraint	0.15
Power Usage Constraint	0.15

4.2 Design Trade-Offs

Design trade-off is a condition or situation that involves losing one quality, factor, or aspect to give way to which constraint should be chosen in the design. The trade-off is a concept where the proponents needs to choose the best design depending on the given objective and constraint, In selecting the most feasible design, trade-off analysis is performed on the design and criteria to determine which among of them is best suited for final design implementation.

Trade-Off Development Flowchart

In figure 4-1, the given design options were subjected to trade-off analysis to determine which is most likely suitable for the objectives given in this project. After that, a sensitivity analysis was implemented on the constraints by tweaking the important factors to determine how different variables affect a particular dependent variable under a given set of assumptions.

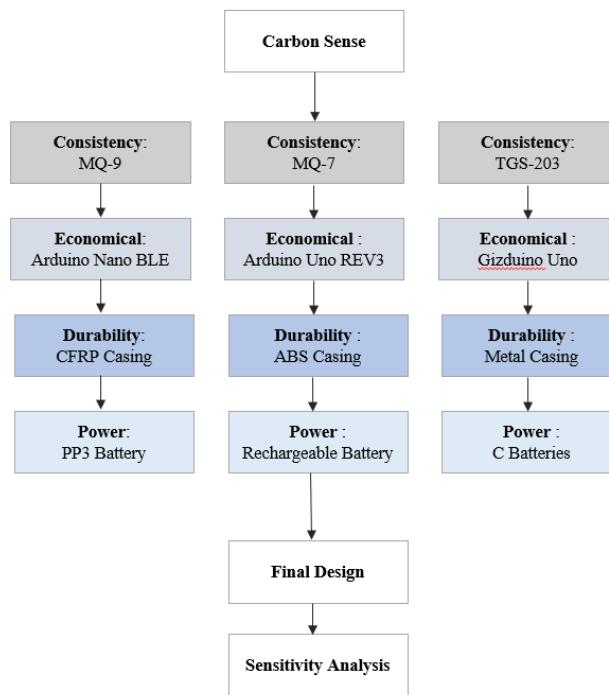


Figure 4-1. Constraints System Flow

4.2.1 Trade-Offs Analysis

For trade-off analysis, we will be using Kirkwood and Anton Son Method to evaluate each design option. The formula is given below:

$$\text{Ranking} = \left(1 - \frac{MV - RV}{RV}\right) * 5 \quad (4.1)$$

Where:

MV = Value to be ranked

RV = Reference value

HV = Highest Value

LV = Lowest Value

4.2.1.1 Constraint 1 – Consistency Constraint

The constraint is tested by using the Pearson R formula in determining which among the design options had the most consistent data after being run for over a period of one hour. In table 4-2, design option 1 garnered a result of 0.4762, while design option 2 garnered a result of 0.9476, and design option 3 garnered a result of 0.1591. With the highest rank of all the design options, design option 2 is the best option.

Table 4-2. Computation for the Consistency Constraint

Design Options	Value	Ranking Score
1	0.4762	2.5126
2	0.9476	5
3	0.1591	0.8394

4.2.1.2 Constraint 2 – Economical Constraint

The constraint is tested by using calculating the overall budget for each design options. The major factor that differs between the designs is the microcontroller used in the project. In table 4-3, design option 1 garnered a result of 3232.16, while design option 2 garnered a result of 4586.00, and design option 3 garnered a result of 6796.00. With the highest rank of all the design options, design option 1 is the best option.

Table 4.3. Computation for the Economic Constraint

Design Options	Value	Ranking Score
1	3232.16	5
2	4586.00	2.9056
3	6796.00	0.513

4.2.1.3 Constraint 3 – Durability Constraint

The constraint is tested by using calculating the heat resistance of each material in its datasheet. It is then compared in relation to the temperature produced by the vehicle in operation time. The temperature is in terms of degree Celsius. In table 4-4, design option 1 garnered a result of 66.8335, while design option 2 garnered a result of 64.527, and design option 3 garnered a result of 64.079. With the highest rank of all the design options, design option 3 is the best option.

Table 4-4 Computation for the Durability Constraint

Design Options	Value	Ranking Score
1	66.8335	4.78507
2	64.527	4.9650
3	64.079	5

4.2.1.4 Constraint 4 – Power Usage Constraint

The constraint is tested by using calculating the power that will be consumed in each design option. In table 4-, design option 1 garnered a result of 12.96, while design option 2 garnered a result of 8.64, and design option 3 garnered a result of 6.12. With the highest rank of all the design options, design option 1 is the best option.

Table 4-5. Computation for the Power Usage Constraint

Design Options	Value	Ranking Score
1	12.96	5
2	8.64	3.333
3	6.12	2.361

In the first constraint which is the Consistency constraint, the reference value of the data in the constraint is design option 2 because it has the highest value of the ranking which is defined to be the most stable among each design options. In the second constraint which is the economical constraint, the reference value of the data in this constraint is design option 1 because it has the cheapest overall amount of components. As a result, design option 1 produced the highest result among the three. In the third constraint which is the durability constraint, the design options are ranked based on their maximum heat capacity. Design option 3 holds the highest ranking among the three because it can sustain itself for over a significantly high temperature among the two because of its lower heat conduction. In the fourth constraint which is the power usage constraint, The reference value of the data in this constraint is design option 1 because it has the longest battery life among the three.

4.2.2 Overall Ranking

The overall ranking from the different constraints tested will be calculated in the table below. Each design will be ranked based don the overall ranking which gets the sum of calculated constraint in the tables above.

Table 4-6. Overall Ranking

Constraints	Criterion's Importance (i)	Design 1 Ranking	Design 2 Ranking	Design 3 Ranking
Constraint 1	0.5	2.5126	5	0.8394
Constraint 2	0.2	5	2.9056	0.513
Constraint 3	0.15	4.78507	4.9650	5
Constraint 4	0.15	5	3.33	2.361
Overall = $\sum(i * \text{Ranking})$		3.724061	4.32537	1.62645

In the overall ranking, the best design option that can be implement for this project is the Design Option 2. Between the three design options, the design option 2 yielded a result of **4.32537** which is relatively high as compared to the other design options.

4.3 Design Standards

A standard is a document that defines the characteristics of a product, process, or services, such as dimensions, safety aspects, and performance requirements. At this part, the best possible solutions selected on the considerations of multiple constraints in table 4.1 are tabulated with the considerations of applicable standards.

Table 4-7. Design Standards

Applicable Standards	Description
Consistency	The design will be using the MQ-7 sensor data for Carbon Monoxide since it has a Consistency reading of 94% when exposed to the operating conditions for an hour.
Cost	The cost of the design is estimated to be at least 4586.00. This is less than the budget required by the client which makes it an ideal design for the project.
Durability	The casing that will be used in implementing the design is the carbon-fiber reinforced casing. This casing can resist the temperature of the vehicle and has a lower heat conduction of 64.527.
Power	The power that will be used for the design is the 6000 mAh rechargeable battery pack since it can handle work for more than the average use of motorcycles. The rechargeable batteries can last up to 8.64 which is greater than the desired 8 hours of operating time.

IEEE STANDARDS

The following are the standards in the conceptualization of the prototype design. Some modules of the proposed design require using a standardized protocol in order to communicate with other components of the devices. This includes but is not limited to the following: wireless communication, and voltage or power ratings.

- IEEE Std 1012-1986 Documentation of the essential requirements (functions, performance, design constraints, and attributes) of the software and its external interfaces.

Verification and validation (V&V) processes are used to determine whether the development products of a given activity conform to the requirements of that activity and whether the product satisfies its intended use and user needs. V&V life cycle process requirements are specified for different integrity levels. The scope of V&V processes encompasses systems, software, and hardware, and it includes their interfaces. This standard applies to systems, software, and hardware being developed, maintained, or reused (legacy, commercial off-the-shelf [COTS], non-developmental items).

- 610.12-1990 IEEE standard glossary of software engineering terminology

This glossary defines terms in the field of Software Engineering. Topics covered include addressing; assembling, compiling, linking, loading; computer performance evaluation; configuration management; data types; errors, faults, and failures; evaluation techniques; instruction types; language types; libraries; microprogramming; operating systems; quality attributes; software documentation; software and system testing; software architecture; software development process;

software development techniques; and software tools. Every effort has been made to include all terms that meet these criteria. Terms were excluded if they were considered to be parochial to one group or organization; company proprietary or trademarked; multi-word terms whose meaning could be inferred from the definitions of the component words; or terms whose meaning in the computer field could be directly inferred from their standard English meaning. This glossary is an update and expansion of IEEE Std 729-1983, IEEE Standard Glossary of Software Engineering Terminology (ANSI) L31.¹ It increases the number of terms from approximately 500 to 1300, and updates or refines the definitions of many terms included in the initial glossary. A few terms that were included in the initial glossary have been moved to other glossaries in the 610 series. Some definitions have been recast in a system, rather than software, context. Every effort has been made to preserve the fine work that went into the initial glossary.

- IEEE Std 1818-2017 Guide for the Design of low-voltage auxiliary systems

Considered in this guide are the components of both the ac and dc systems and the provided guidelines and recommendations for designing the appropriate systems for the substation under consideration. This guide includes the low-voltage auxiliary systems from the source(s) to the distribution point(s). Reliability requirements and load characteristics are discussed and distribution methods are recommended.

Table 4-8. Design Option 1 Sensitivity Analysis

	Criterions Importance (i)				Cons1 (2.5126)	Cons2 (5)	Cons3 (4.78507)	Cons4 (5)	Total
Base Value	0.5	0.2	0.15	0.15	1.2563	1	0.717761	0.75	3.724061
SA1	0.15	0.5	0.2	0.15	0.37689	2.5	0.957014	0.75	4.583904
SA2	0.2	0.5	0.15	0.15	0.50252	2.5	0.717761	0.75	4.470281
SA3	0.15	0.15	0.5	0.2	0.37689	0.75	2.392535	1	4.519425
SA4	0.25	0.25	0.25	0.25	0.62815	1.25	1.196268	1.25	4.324418

When Consistency constraint has a value of 0.15 importance, cost constraint with 0.5 importance, durability constraint with 0.2 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 1 results to 4.583904. When Consistency constraint has a value of 0.2 importance, cost constraint with 0.5 importance, durability constraint with 0.15 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 1 results to 4.470281. When Consistency constraint has a value of 0.15 importance, cost constraint with 0.15 importance, durability constraint with 0.5 importance, and power usage with 0.2 importance, the sensitivity analysis for Design Option 1 results to 4.519425. In the fourth sensitivity analysis, each constraint has equal criterion of importance value, and it shows that the Design Option 1 has a ranking score of 4.324418.

Table 4-9. Design Option 2 Sensitivity Analysis

	Criterions Importance (i)				Cons1 (5)	Cons2 (2.9056)	Cons3 (4.9650)	Cons4 (3.33)	Total
Base Value	0.5	0.2	0.15	0.15	2.5	0.58112	0.74475	0.4995	4.32537

SA1	0.15	0.5	0.2	0.15	0.75	1.4528	0.993	0.4995	3.6953
SA2	0.2	0.5	0.15	0.15	1	1.4528	0.74475	0.4995	3.69705
SA3	0.15	0.15	0.5	0.2	0.75	0.43584	2.4825	0.666	4.33434
SA4	0.25	0.25	0.25	0.25	1.25	0.7264	1.24125	0.8325	4.05015

When consistency constraint has a value of 0.15 importance, cost constraint with 0.5 importance, durability constraint with 0.2 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 2 results to 3.6953. When Consistency constraint has a value of 0.2 importance, cost constraint with 0.5 importance, durability constraint with 0.15 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 2 results to 3.69705. When Consistency constraint has a value of 0.15 importance, cost constraint with 0.15 importance, durability constraint with 0.5 importance, and power usage with 0.2 importance, the sensitivity analysis for Design Option 2 results to 4.33434. In the fourth sensitivity analysis, each constraint has equal criterion of importance value, and it shows that the Design Option 2 has a ranking score of 4.05015.

Table 4-10. Design Option 3 Sensitivity Analysis

	Criterions Importance (i)				Cons1 (0.8394)	Cons2 (0.513)	Cons3 (5)	Cons4 (2.361)	Total
Base Value	0.5	0.2	0.15	0.15	0.4197	0.1026	0.75	0.35415	1.62645
SA1	0.15	0.5	0.2	0.15	0.12591	0.2565	1	0.35415	1.73656
SA2	0.2	0.5	0.15	0.15	0.16788	0.2565	0.75	0.35415	1.52853
SA3	0.15	0.15	0.5	0.2	0.12591	0.07695	2.5	0.4722	3.17506
SA4	0.25	0.25	0.25	0.25	0.20985	0.12825	1.25	0.59025	2.17835

When Consistency constraint has a value of 0.15 importance, cost constraint with 0.5 importance, durability constraint with 0.2 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 3 results to 1.73656. When Consistency constraint has a value of 0.2 importance, cost constraint with 0.5 importance, durability constraint with 0.15 importance, and power usage with 0.15 importance, the sensitivity analysis for Design Option 3 results to 1.52853. When Consistency constraint has a value of 0.15 importance, cost constraint with 0.15 importance, durability constraint with 0.5 importance, and power usage with 0.2 importance, the sensitivity analysis for Design Option 3 results to 3.17506. In the fourth sensitivity analysis, each constraint has equal criterion of importance value, and it shows that the Design Option 3 has a ranking score of 2.17835.

CHAPTER 5:

FINAL DESIGN

This chapter presents the culminating stage of this engineering design project. In this section, the selected design from the previous chapter is implemented and tested. The implementation is comprehensively discussed in terms of its architecture, parameters, and layout. Afterward, the final design is subjected to thorough testing to assess if the project's criteria and objectives were attained. Using thematic analysis, the results obtained from the testing are further examined. Lastly, all acquired findings are wrapped up for the conclusion, and recommendations are put together for future inquiry.

5.1 Architectural Design

5.1.1 Components

Arduino Uno Rev3 is the most critical part in the Carbon Sense system because its primary function is to be the main processing unit. Arduino Uno Rev3 was chosen compared to other models because it meets the system requirements while still satisfying the cost constraint. As compared to the other microcontrollers, it has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

Table 5-1. Arduino UNO Rev3 Data Sheet

Board	Name	Arduino UNO R3
	SKU	A000066
Microcontroller	ATmega328P	
USB connector	USB-B	
Pins	Built-in LED Pin	13
	Digital I/O Pins	14
	Analog input pins	6
	PWM pins	6
Communication	UART	Yes
	I2C	Yes
	SPI	Yes
Power	I/O Voltage	5V
	Input voltage (nominal)	7-12V
	DC Current per I/O Pin	20 mA
	Power Supply Connector	Barrel Plug
Clock speed	Main Processor	ATmega328P 16 MHz
	USB-Serial Processor	ATmega16U2 16 MHz
Memory	ATmega328P	2KB SRAM, 32KB FLASH, 1KB EEPROM
Dimensions	Weight	25 g
	Width	53.4 mm
	Length	68.6 mm

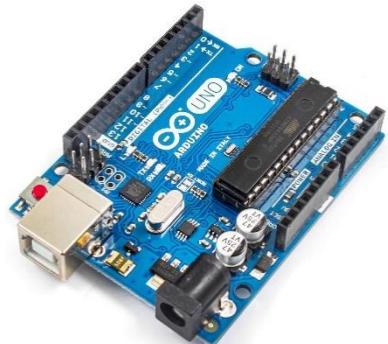


Figure 5-1. Arduino Uno Rev3

MQ-135 is used in the design project for the Carbon Monoxide Gas. Its features include a wide range of detecting scope in the environment, its fast response and high sensitivity to the gases involved in detecting the amount of emission, its stable and long life, and its non-complex drive circuit. The resistance value of this sensor depends on the variation of concentration gases. So, this sensor needs to adjust its sensitivity by calibrating the detector. The sensor can measure concentrations of 10 to 10,000 ppm. The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5 V. The table below shows the standard work condition of MQ-135. In the market, this is the only sensor for the measuring Carbon Monoxide's rate levels.

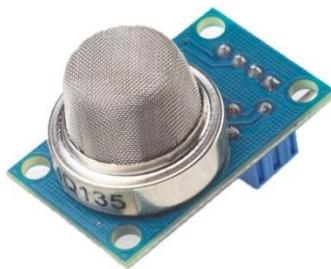


Figure 5-2. MQ-135

MQ-7 Carbon Dioxide (CO₂) gas sensor detects the concentrations of CO₂ in the air and outputs its reading as an analog voltage. This sensor is highly sensitive to Carbon Monoxide. Unlike other sensors for carbon dioxide, this sensor produces an accurate result of data, low cost, and is suitable for different applications.



Figure 5-3. MQ-7

This sensor has a wide detecting scope, stable and long life, with fast response and high sensitivity, and a simple drive circuit. Its applications consist of gas leakage detection, LPG, smoke, i-butane, propane, methane alcohol, Hydrogen, and smoke. MQ-2 is highly useful in detecting the anomalies inside a vehicle engine. Just by analyzing the smoke emitted by the motorcycle, it can be determined that there is an anomaly in the vehicle which will require sudden repairs to avoid further damage.



Figure 5-4. MQ-2

ABS (Acrylonitrile butadiene styrene) is a hard, tough, heat-resistant engineering plastic that is commonly used in applications like housings, luggage, pipe, fittings, and automotive interior parts. This common thermoplastic which has high impact resistance, heat resistance and toughness, and low thermal conductivity to be potentially applicable in civil engineering field. In the device, the ABS plastic was an ideal material for the system's external architecture because it is less conductive of heat, meaning the material will last even when in contact with extreme temperatures ranging from 50 to 120 degree Celsius.



Figure 5-5. Acrylonitrile Butadiene Styrene

A semiconductor diode that emits light when a voltage is applied to it and that is used especially in electronic devices (as for an indicator light). The LED will be the indicator that the device is up and running and ready to be tested.



Figure 5-6. LED

The NEO-6M module belongs to the family of stand-alone GPS receivers with high performance u-blox 6 positioning engine. Its compact architecture and power and memory options make NEO-6M modules ideal for battery operated mobile devices with very strict cost and space constraints. This module can handle a voltage supply of 2.7V to 3.6V with interfaces of UART, USB, SPI, and DDC. Its features contain TCXO, RTC crystal, and external interrupt. This GPS was used to determine the location of the driver once his emission levels are constantly rising.



Figure 5-7. NEO-6M GPS Module

Unlike other GPS modules, it can do up to 5 location updates a second with 2.5m Horizontal position accuracy. The u-blox 6 positioning engine also boasts a Time-To-First-Fix (TTFF) of under 1 second. One of the best features the chip provides is Power Save Mode(PSM). It allows a reduction in system power consumption by selectively switching parts of the receiver ON and OFF. This dramatically reduces power consumption of the module to just 11mA making it suitable for power sensitive applications like GPS wristwatch. The necessary data pins of NEO-6M GPS chip are broken out to a 0.1" pitch headers. This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 4800bps to 230400bps with default baud of 9600.

Table 5-2. Neo-6M GPS Module Specifications

Receiver Type	50 channels, GPS L1(1575.42Mhz)
Horizontal Position Accuracy	2.5m
Navigation Update Rate	1HZ (5Hz maximum)
Capture Time	Cool start: 27s Hot start: 1s
Navigation Sensitivity	-161dBm
Communication Protocol	NMEA, UBX Binary, RTCM
Serial Baud Rate	4800-230400 (default 9600)
Operating Temperature	-40°C ~ 85°C
Operating Voltage	2.7V ~ 3.6V
Operating Current	45mA
TXD/RXD Impedance	510Ω

This module is a quad-band GSM/GPRS module that is functional on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class and supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. This module works on a power of 3.4V to 4.4V. This module is used in the implementation of the project to send data from Arduino to cloud, specifically ThingSpeak where it will serve as the conduit between the Arduino and the web server.

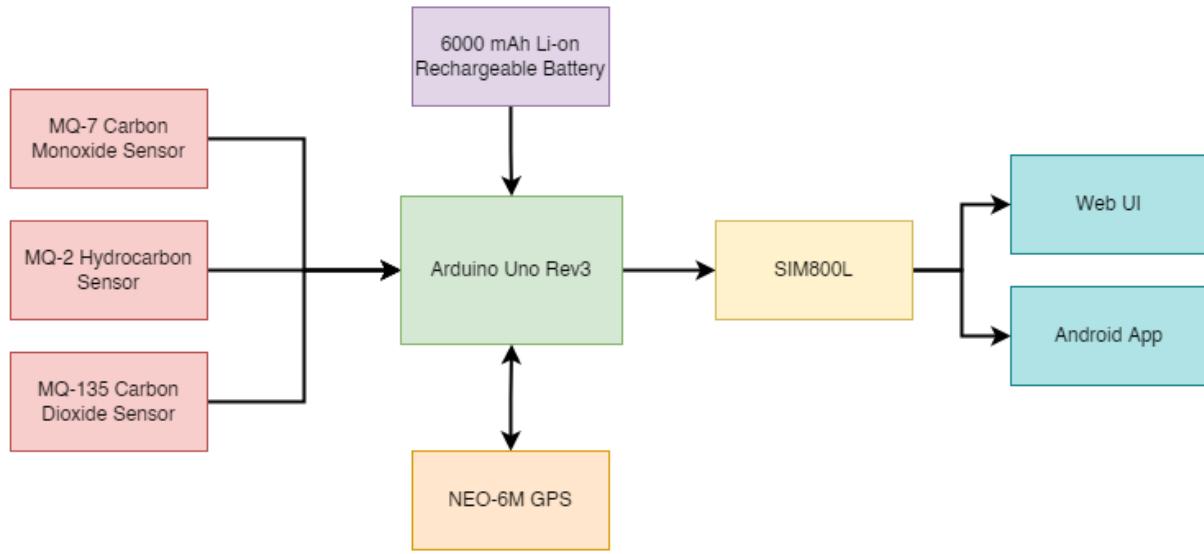


Figure 5-8. SIM800L

5.1.2 Block Diagram

The figure below is the Block Diagram of the project. It is shown that the Arduino Uno Rev3 as the main microcontroller of the device which has several components and/or modules that are attached to it. The main sensing modules are the carbon sensors namely the MQ-7 sensor for Carbon Monoxide, MQ-2 sensor for Hydrocarbon, and MQ-135 sensor for Carbon Dioxide. To power up the whole device, a 6000 mAh Li-on rechargeable battery is provided. For GPS geo-tracking, UBlox's NEO-6M GPS provides an accurate reading of the actual longitude and latitude on where the module is placed. In order to send all the collected data (carbon data, gps data), SIM800L acts as the wireless communication device in order to send the data to the Web UI and Android App which is named Cense: COmon app.

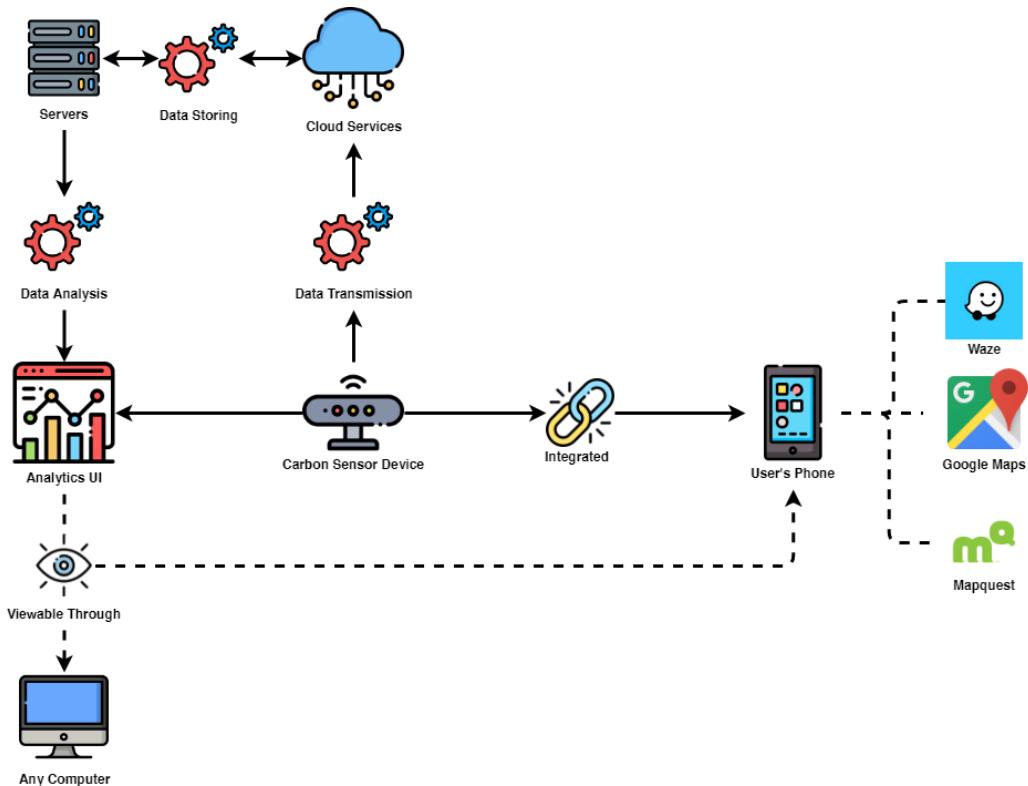
Figure 5-9. Block Diagram



5.1.3 System Architecture

The proposed solution of this project is visualized in the figure above. The system is composed of four major processes:

Figure 5-10. General System Architecture

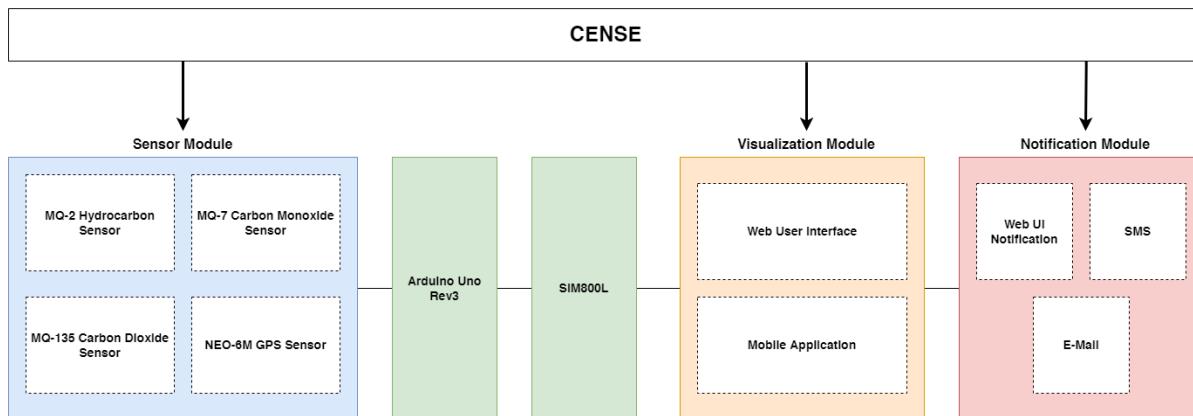


1. Carbon emission sensing process: This process includes the installation of hardware modules in the motorcycle that will be used in collecting sensor data that corresponds to the vehicle's carbon emissions.
2. Data collection process: The data from the sensor will be sent to the database for further visualization and analysis.
3. Sensor Analysis Notification: An alert notification will be sent to the user if the carbon emission levels (CO CO₂, HC) exceed the number of expected levels. If there will still be an increase in the following days, an alert notification will also be sent to the authorities to notify them that a certain user has reached the threshold limit of carbon emission. In this way, they will be able to track the carbon emission of the drivers.
4. Results process: The results from the analysis will be sent to the cloud for monitoring purposes. The data regarding the user's total carbon emission for a day and the areas in which he emitted the gases will be visualized in the application in his device. These sets of data will also be visible to the authorities in order for them to monitor the emission of each vehicle. The system will also provide feedbacks and suggestions that could help drivers reduce their carbon emission once the levels of their carbon emission exceeds the threshold limit.

5.1.4 Modules

Cense has several modules in order to determine whether the system is functional or not. The identified modules are as follows: Sensor Module, Visualization Module, and Notification Module.

Figure 5-11. Modules

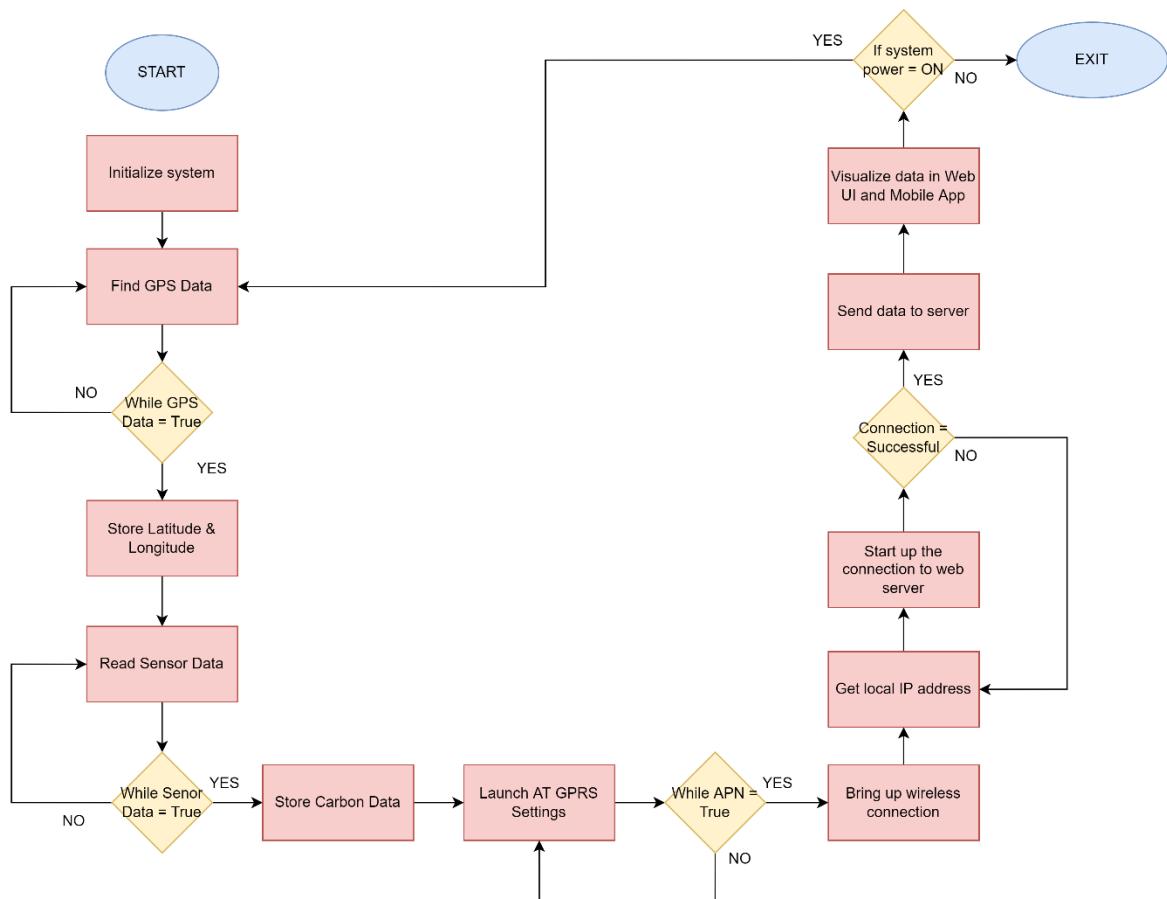


The sensor module functions as the main components in determining the raw data that is needed to be stored, sent and evaluated further on. Having this module is vital because it is essential to the entirety and functionality of the system. This module focuses on gathering the data in order to be determined digitally. The Visualization Module focuses on visualizing the data that is sent to the server database. Both the Web UI and Mobile Application shows the data that is gathered from the Sensor Module. Not only that, it is also evaluated and analyzed to further give emphasis on what the user/driver really needs in order to monitor his carbon data such as getting the average as well as comparing the history of the data that is collected. Lastly, the Notification Module focuses on notifying the user/driver when the pre-determined threshold is reached or exceeded. A Web UI Notification shows the potential solutions to the problem presented in the notification. Other alert systems such as SMS and E-mail are also sent to the user for further visibility on the anomaly or issue.

5.1.5 Flow Charts

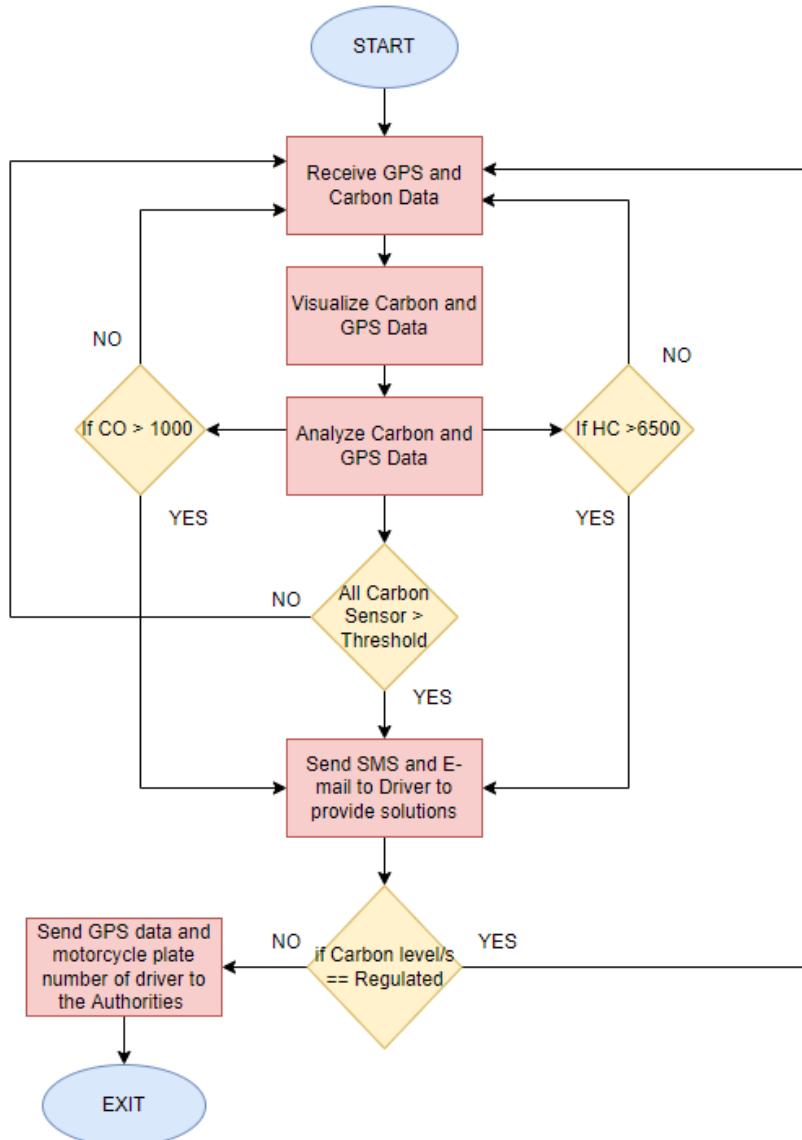
The entire process of the system can be divided into two: Data Collection Process, and Results Process. To initiate the system, the hardware module must first collect and read data from the sensors. The data that the hardware module received (MQ2 sensor for Hydrocarbon, MQ-7 sensor for Carbon Monoxide, and MQ-135 sensor for Carbon Dioxide, and GPS Data) will be sent to the server. The data will be visualized through the Web UI and Mobile Application. The Web UI will be used for monitoring the carbon levels of the motorcycle as well as sending notifications, and storing and analyzing the levels day by day, week by week, and month by month. Both the motorcycle drivers and the authorities are the users of this features. The mobile application, on the other hand, only be used for the real-time transfer of data from the system to phone. It does not consist of notification features. The visual presentation of the flowchart is shows in the figure below:

Figure 5-12. Flow Charts



When the data is received from the system, all the carbon levels are analyzed if they met the required levels for the motorcycle. If the Hydrocarbon level, Carbon Monoxide, and Carbon Dioxide levels are high and exceed the normal threshold, the system will send an alert message to the driver via SMS or E-mail. The content of the message is the notification that the driver's carbon levels are high, it also includes the possible causes regarding its high emission levels, and ways or tips on how to regulate and stop the continuous rising of the emission levels. After a week, if the driver fails to regulate his emission levels and the carbon is still high, an SMS or e-mail notification will be sent to the authorities regarding the driver's location and his plate number. The visualization of the flow chart is presented below:

Figure 5-13. Flow Chart



The threshold limit set is based on the LTO's emission standard for in-use vehicles, particularly those vehicle registered after January 1, 2003.

Table 5-3. LTO Emission Standard

Vehicle Registration Date	CO (ppm)	HC (ppm)	White smoke (% opacity)
Registered for the first time from January 1, 2003, and up to December 31, 2011	1000 ppm	6500	30

In terms of the notification system, the causes of emission rising and its ways on how to regulate it is different based on the specific carbon.

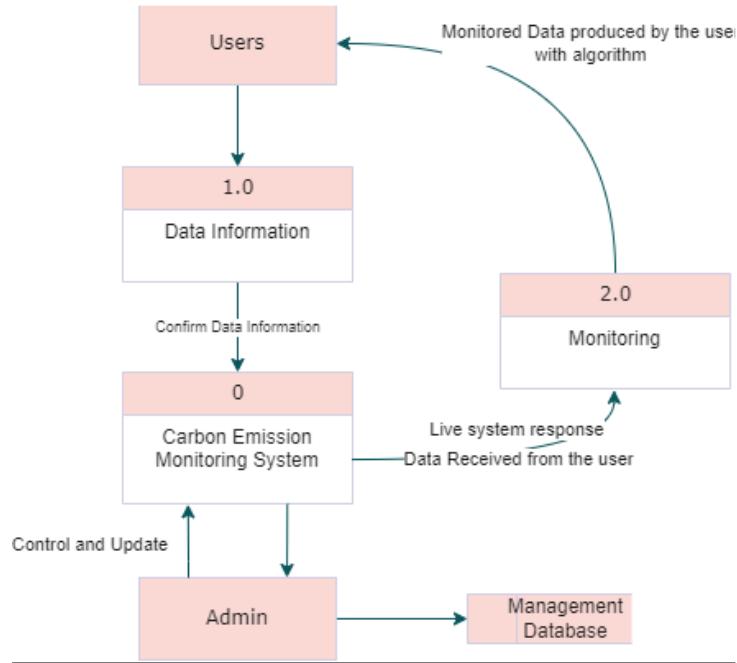
Table 5-4. Possible Causes and Solutions

Carbon Level	Possible Cause	Solution
Hydrocarbon = 6500+	<ul style="list-style-type: none"> • Dirty piston • Clogged fuel pump 	<ul style="list-style-type: none"> • Clean the exhaust or muffler for potential build-up of dirt or residue
Carbon Monoxide = 1000+	<ul style="list-style-type: none"> • Engine failure • Defective sparks plug or wires 	<ul style="list-style-type: none"> • Check for engine failures, dirt, etc. • Make sure the carburetor is clean.
All carbons are high	<ul style="list-style-type: none"> • Dirty piston • Clogged fuel pump • Engine failure • Defective sparks plug or wires 	<ul style="list-style-type: none"> • Clean the exhaust or muffler for potential build-up of dirt or residue • Check for engine failures, dirt, etc. • Make sure the carburetor is clean.

5.1.6 Data Flow Diagram

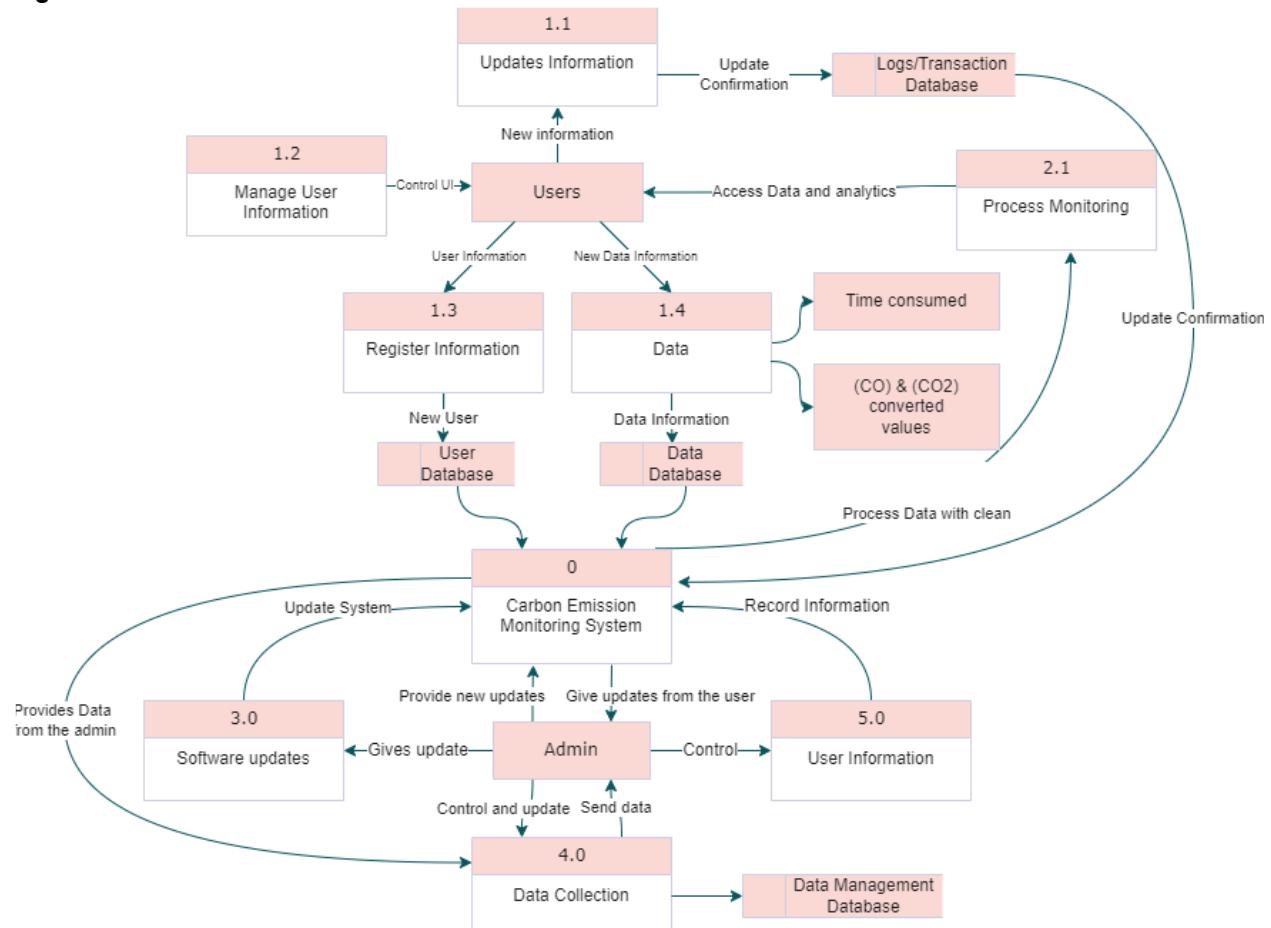
The data flow diagram of the application is mapped out to describe the flow of information for the processes involved. Both Level 0 and Level 1 DFDs were used to map out the given data. DFD Level 0 is a more generalized information on the main functions and processes or the data. On the other hand, DFD Level 1 is used to provide more details on the breakdown of main functions into sub processes.

Figure 5-14. Level 0 DFD



Presented in the Level 0 Data Flow Diagram is how the data of our system will go through various phases and devices or components that is included. It is indicated that the data information of the user is a requirement in order to have a confirmation that a person is using the device. With this information, the carbon emission monitoring system will then give live system response from the data that is received from the user at which the monitoring of this data is then made. Externally, the admin of the system can control and update the system to further give the user a better and user-friendly experience

Figure 5-15. Level 1 DFD



Presented in the Level 1 Data Flow Diagram is the more specific, expansive, and elaborate explanation on how the data from the system would go from several components or devices. As instructed in the Level 0 DFD, the user's data is important in the system albeit the personal information (Name, Email, and etc.) or technical information (Sensor data, Usage data) all of which are stored in the database in order for the carbon emission monitoring system to work as intended. With these data and information, it is then given back to the user as a monitoring statistic or data in order for them to see the data and statistical analysis of their carbon emission data. Additionally, the admin of the monitoring system has full control on how the system will work through servers and databases. Administrators are mainly the one who manages and secures the data and information of the users as well as update the whole system's software for better usage and access.

5.2 Parametric Design

Parametric design can be defined as a process based on an algorithmic approach that expresses parameters and rules that, together, can define, encode, and clarify the relationship between designer's intent and design response (Caetano et al., 2020; Touloupaiki and Theodosiou, 2017). This method consists mainly in an efficient way of flexibly describing and creating geometry through scripting, linking decision variables and constraints (parameters) to geometry, establishing interdependencies between objects, and defining transformational behavior of these objects. Such an approach offers dynamic control over geometry and components, allowing the designer to seek appropriate solutions for complex problems with the assessment of multiple variants at the same time.

The parametric design of Cense primarily focuses on the design of the cases. Analysis of these design are needed in order to determine whether the design meets the standard of the project such as integrity of the design, durability, and such. It is also taken into consideration that the cost of the design is considered and evaluated.

The material that is used in order to create the cases is Carbon-Fiber-Reinforced Polymer (CFRP). As elaborated in Design Option 2, CFRP is the chosen material to be made because of its capability to absorb heat with a minimum temperature of 49.951°C and a maximum temperature of 79.103 °C from a collective thermal load of at least 100 °C.

Figure 5-16. Acrylonitrile butadiene styrene (ABS) Plastic for 3D Printing



Talking about the cost, a 300cm, 3K quality, 200gsm, 0.2mm CFRP costs only around 399 PHP. Comparing it to other materials such as metal, alloys, and sheet metals, it is relatively lightweight but does the job (thermal load durability) almost equally as well as the materials mentioned. By using CFRP as the main material, given that it's plastic, it is relatively lightweight compared to other materials that are mentioned earlier.

Two (2) kinds of cases were made in order to suffice the needs of all the modules of the project. The first case is the main case which contains the main modules and microcontrollers such as the Arduino Uno Rev3, the SIM800L as well as the NEO-6M. Inside the main case is the battery or the power supply of the whole device. The other case, on the other hand, is a sensor case which is a case that has a smaller form factor compared to the main case because this case is particularly for the carbon sensor modules such as the MQ-7, MQ-2 and MQ-135 which are the Carbon Monoxide, Hydrocarbon, and Carbon Dioxide sensors respectively.

The conceptualization of the cases are made through SketchUp which predetermines the size of the case relative to where it should be placed on the motorcycle. The actual size of the case is present in this software but the other specific variables such as the snap fit locks, pillar handle locks, and the ridge around the cases are not present. With this, we used Autodesk's Fusion 360 to further elaborate the design, form factor, as well as variables that aren't present on the previous software.

The figure below shows the exterior design of Cense's main case. Having a measurement of 165 mm x 85 mm x 30 mm, all of the components inside the case are exactly fit and made as compact as possible for it not to be a hindrance when attached on the motorcycle.

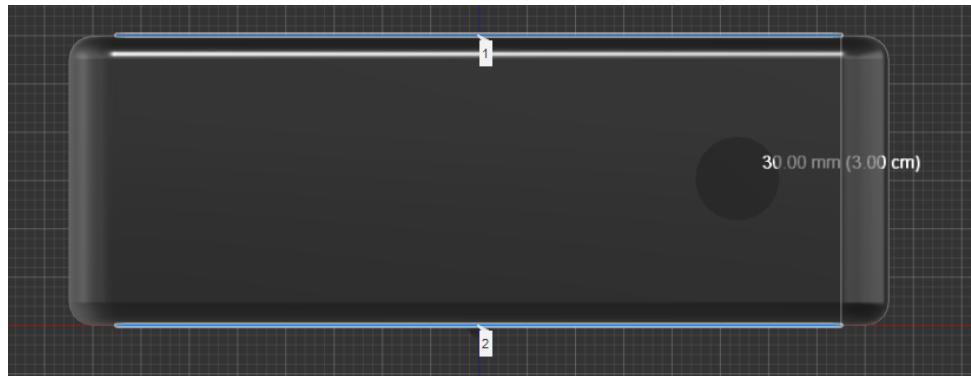


Figure 5-17. Width of Cense's Main Case

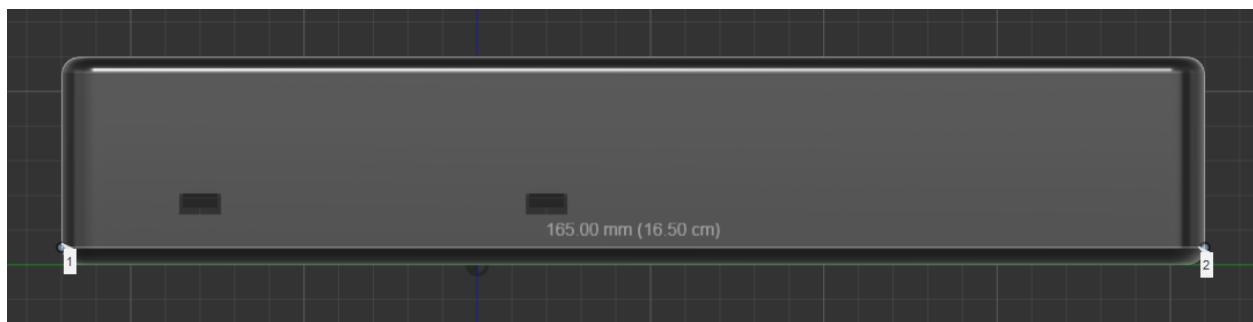


Figure 5-18. Length of Cense's Main Case

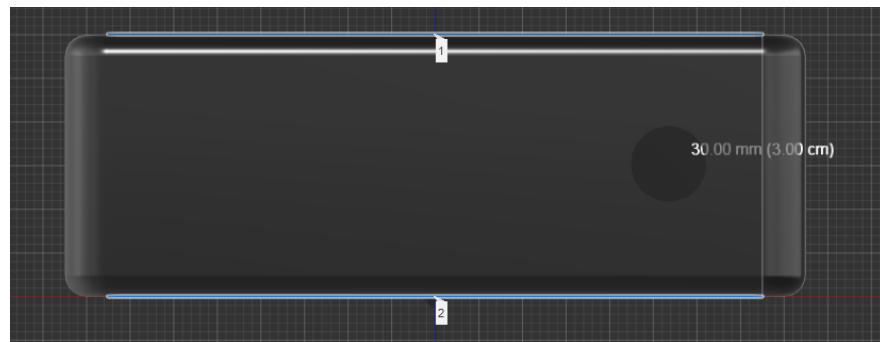


Figure 5-19. Height of Cense's Main Case

The following figure shows the actual and 3D rendered version of the main case of the device. It features the snap fit locks, the punch hole design for the sensor wires and mount, as well as a segment divider for the placement of the battery, with a punch whole design for the wires of the battery.

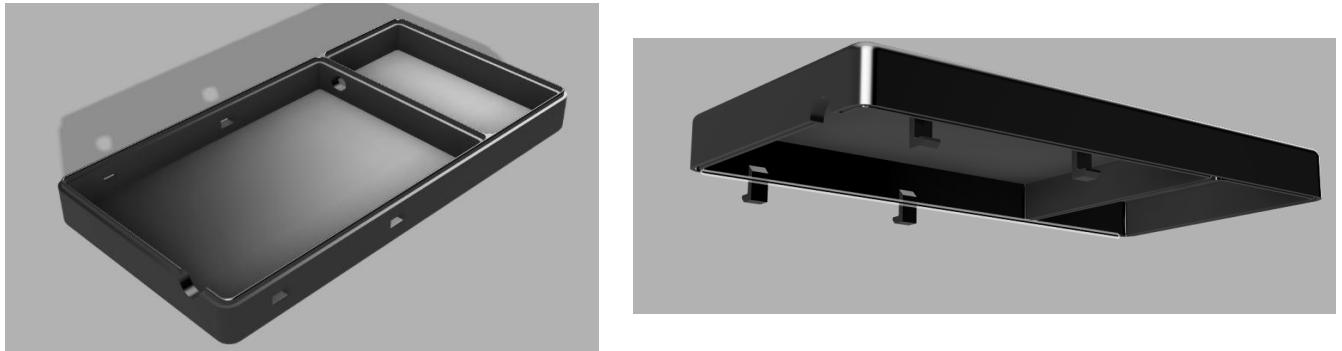


Figure 5-20. 3D Rendering of Cense's main case – Bottom design (left), Top design (right)



Figure 5-21. Cense's Main Case – 3D Rendering (left). Actual (right)

The other case that is made for this project is the sensor case which has a dimension of 92.40 mm x 37.47 mm x 14.00 mm. This case is also made out of CFRP which is reliable in handling several thermal loads.

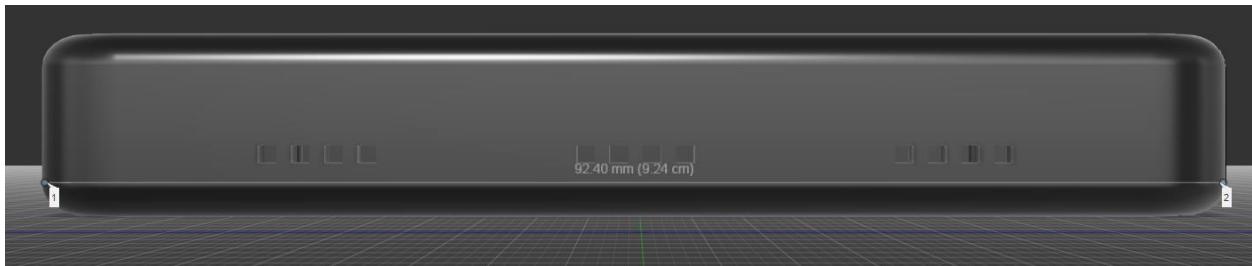


Figure 5-21. Length of Cense's Sensor Case

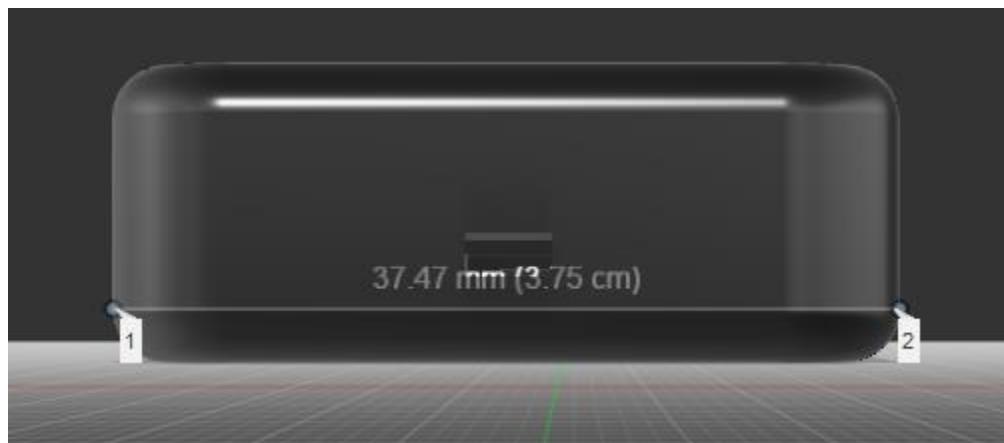


Figure 5-22. Width of Cense's Sensor Case

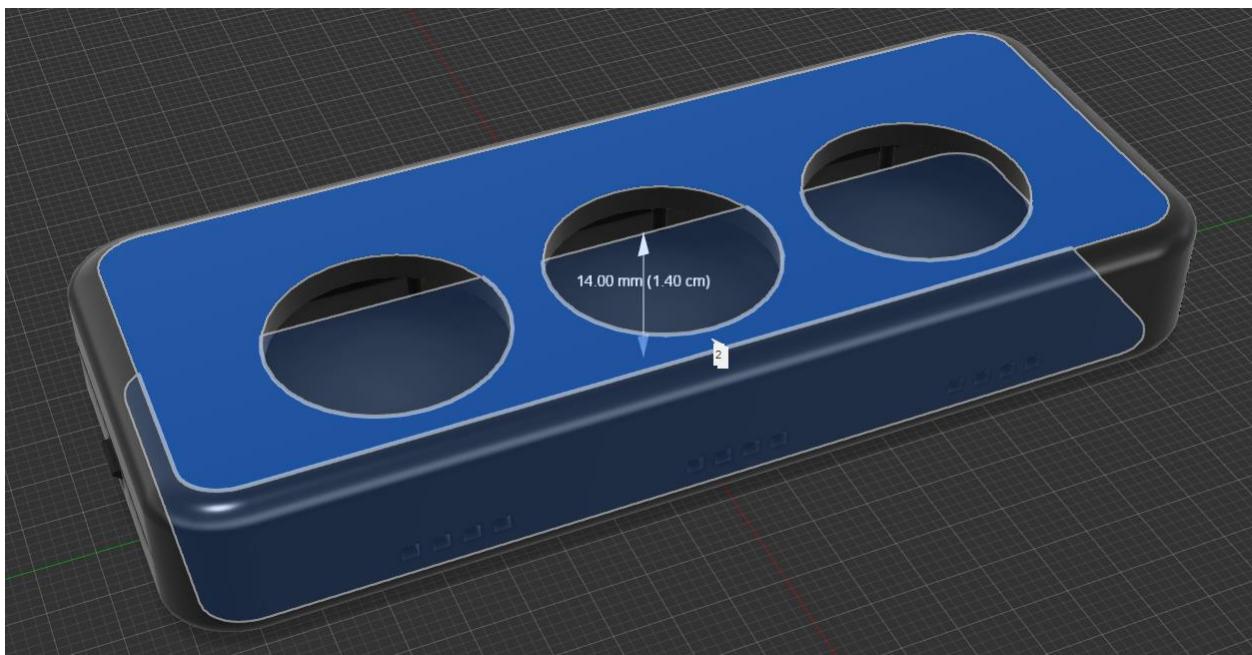


Figure 5-23. Height of Cense's Sensor Case

The following figure is the actual and 3D rendered complete version of the sensor with the actual sensor containing it. It features snap fit locks, pillars, holes for the sensor pins as well as a holes for the actual sensing component of the sensor.

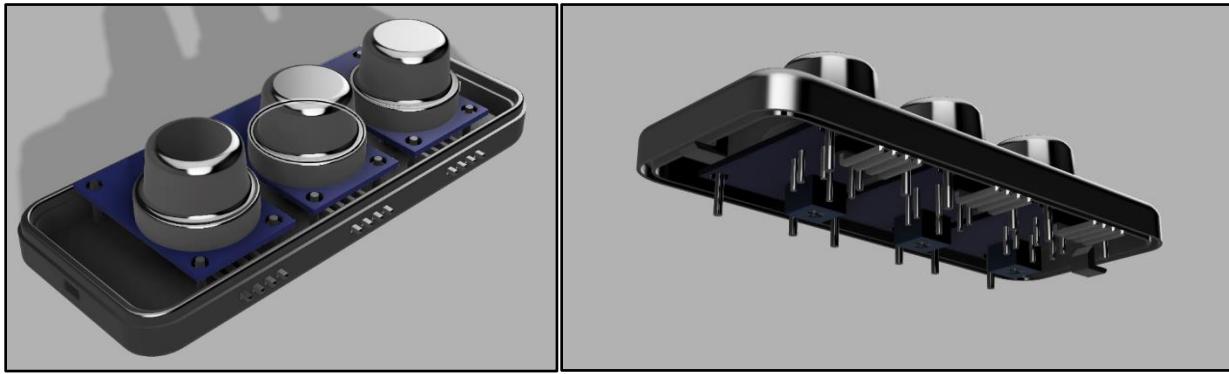


Figure 5-24. 3D Rendered Models of Cense's Sensor Case – Bottom design (left), Top design (right)



Figure 5-25. Cense's Sensor Case – Complete render (left), Actual (right)

Bill of materials is crucial in setting up the parameters of the design. BOM is essential because this acts as the centralized source of information used for the completion of the prototype. The following information is included in the bill of materials.

- *Item number*
- *Quantity*
- *Name of the component*
- *Source of the component*
- *Total amount of the component*

Table 5-5. Bill

Quantity	Component Name	Source	Amount
1	MQ-135	E-Gizmo	₱295.00
1	MQ-7	E-Gizmo	₱210.00
1	MQ-2	E-Gizmo	₱195.00
1	Arduino UNO Rev3	Deeco	₱500.00
1	SIM800L	E-Gizmo	₱577.00
1	Neo-6M GPS	Deeco	₱609.00

1	ABS Case	Makercarl	₱2000.00
1	LED	E-Gizmo	₱20.00
2	Lithium Ion Battery	E-Gizmo	₱80.00
1	Hose clamp	Ace Hardware	₱100.00
TOTAL			₱4586.00

The overall design of the CENSE device costs ₱45486.00 which is within the criterion set by the client of this project. It is worth noting that the material cost is only considered. Intangible costs such as overhead costs and labor costs are not included in the computation. In addition to that, CENSE weighs

Table 5-6. Weight of Components

Quantity	Component Name	Net Weight
1	MQ-135	11 g
1	MQ-7	10
1	MQ-2	11 g
1	Arduino UNO Rev3	25 g
1	SIM800L	15 g
1	Neo-6M GPS	12 g
1	ABS Case	100 g
1	LED	0.25 g
2	Lithium Ion Battery	46 g
1	Hose clamp	117 g
TOTAL		347.25 g

The table shows the weight of each component chosen for the final design of the CENSE system, the total weight is 349 g. as shown in the computation below:

$$\text{Total Weight} = W_1 + W_2 + W_3 + W_4 + \dots + W_n$$

$$\text{Total Weight} = 11g + 10g + 11g + 25g + 15g + 12g + 100g + 0.25g + 46g + 117g$$

$$\text{Total Weight} = 347.25g$$

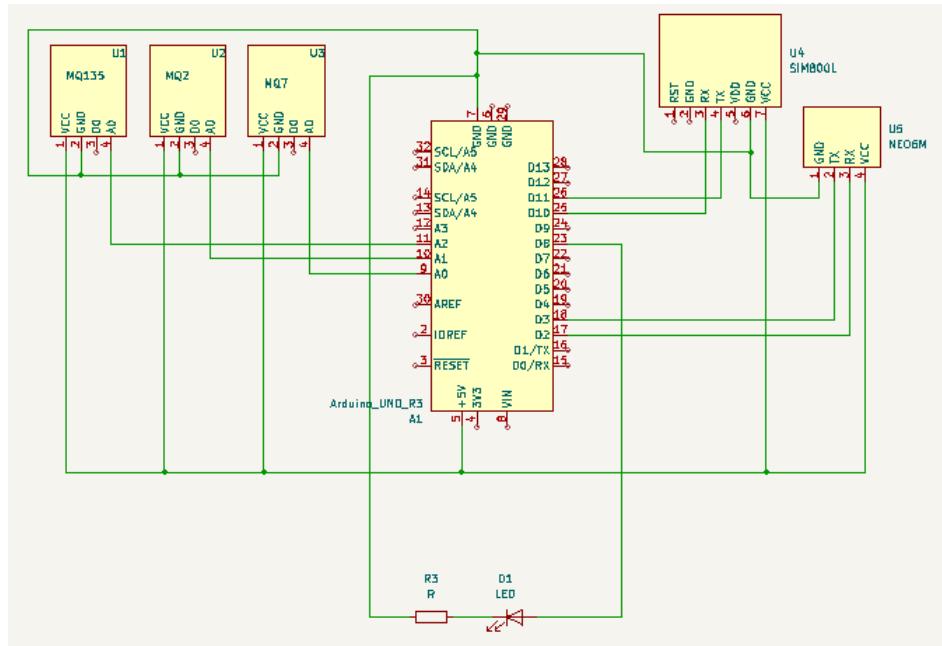
5.3 Detailed Design

The final step of the engineering design process is determining the detailed design of the said project. Elaborated in this section of the paper is the Schematic Diagram of cense which gives explanation to the circuitry and wirings of the device that are present. The PCB is also included to visualize the actual board that is needed to be used for actual manufacturing of the device. The UI of Cense comes in two (2) different types. One of which is the Web UI which gives of relevant information of your motorcycle, the average ppm of the carbon data that is collected, a history of GPS data on which it will determine where the driver was, a notification system which alerts the driver whether a certain threshold is reached, and lastly, a feedback page to determine whether if our system is doing good for them, giving them benefit, and to criticize how we are doing for them. On the other hand, there is an Android application, which is named the COmon app, which shows the real-time carbon data reading when the device is active on the palm of the driver's hand. It also features a live-tracing map to determine where the driver's location is at at the current timeframe.

5.3.1 Schematic Diagram

In the making of the schematic of the system, the functional specifications served as the guideline in selecting the components to be used. Also, the block diagram guided the designers in interfacing the components with each other. The schematic diagram is sketched using Kicad. The illustration of the schematic diagram is shown below.

Figure 5-26. Schematic Diagram



The modules are presented in the schematic as well as the quantity of each component. Its PCB layout is shown in the figure below.

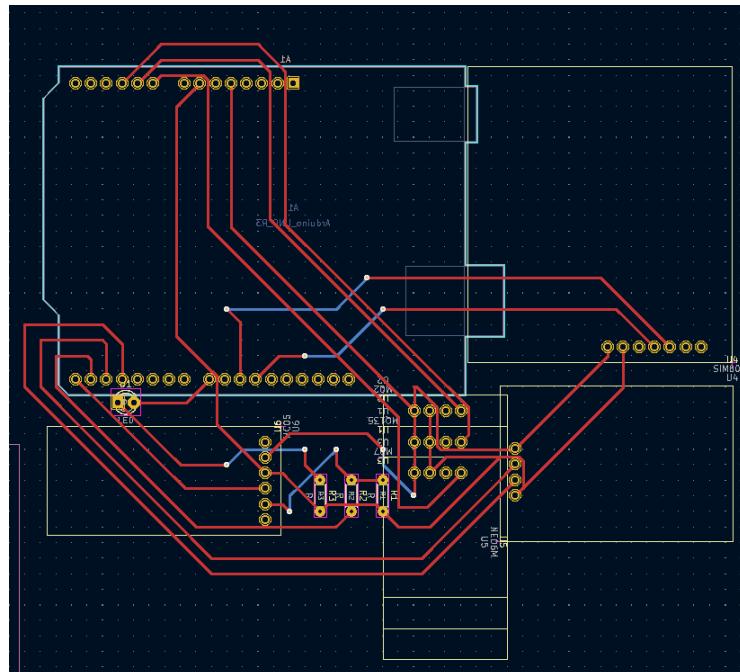


Figure 5-27. PCB Design

5.3.2 User Interface

This section presents the information about the objective of the applications by UI design that bridge between a system and users. Presented are two types of User Interface that Cense has in order to provide the maximum ease-of-access to the users, which are the Website User Interface which focuses on giving the full information of the evaluated and analyzed data, history of collected carbon data, a map that determines the location of the driver and its history, profile page that can be customized by the user, and a feedback page that gives a voice to the user to criticize the project for further improvements. Another User Interface is the Mobile Application which focuses on giving off the collected data from the device on-the-fly by clicking a few buttons on the user's smartphone. It also features a map that shows the real-time location of the driver.

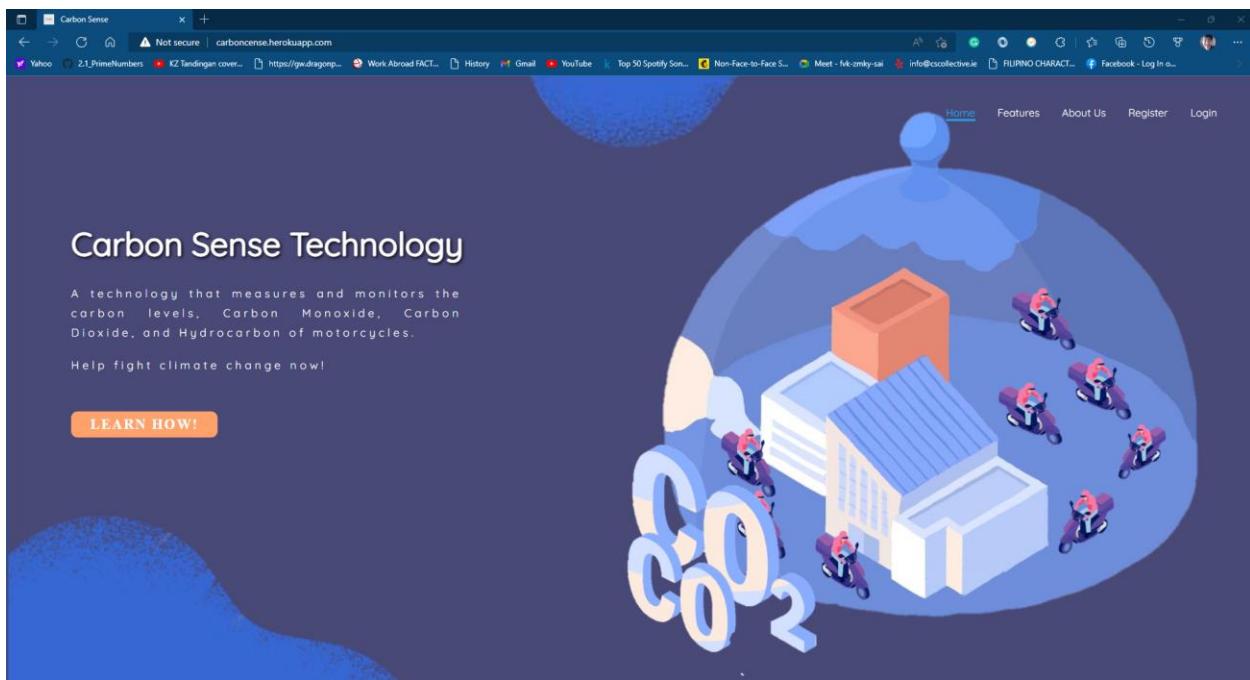


Figure 5-28. Home page of Cense Website

Home Page: the main page of the website where visitors can find viewable links to other pages on the site.

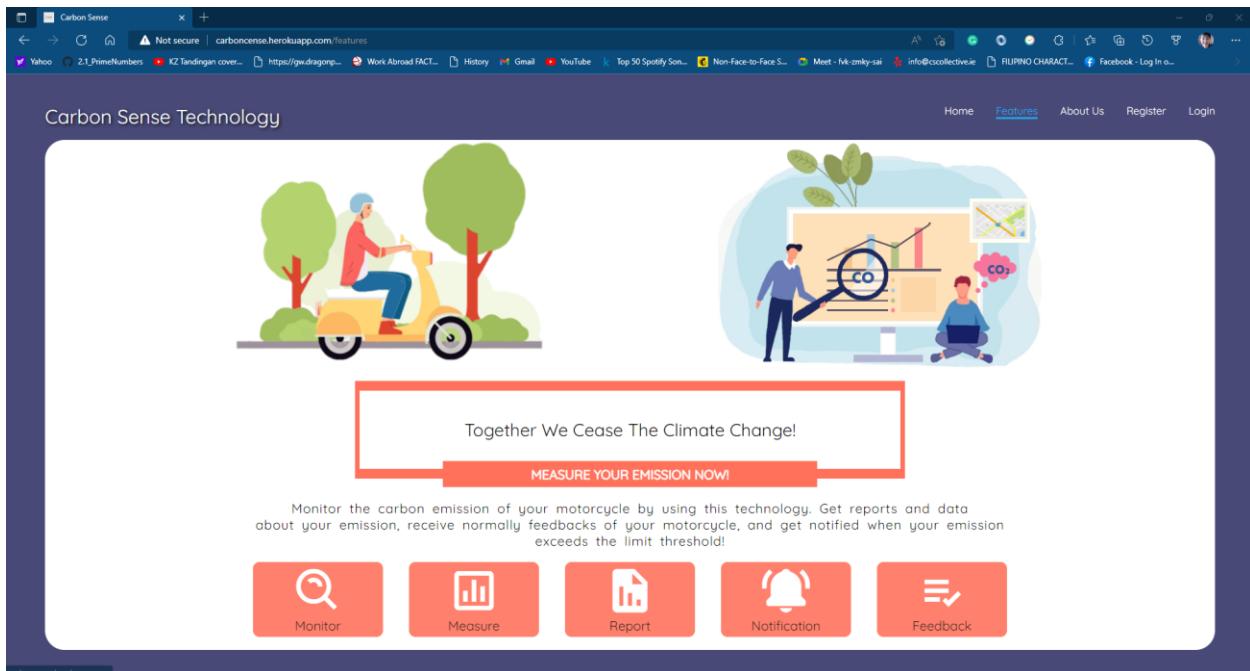


Figure 5-29. Feature page of Cense Website

Feature Page: to demonstrate and describe the features, product and software.

Carbon Sense Technology

About Us

We are the Carbon Sense Team. This website will use to record continous CO2 and CO of direct atmospheric measurements using high-precision instrument. DON'T BE A FOSSIL FOOL.



Introducing The GHG Emission Solutions For Motorcycles



CARBON SENSE

A Real-time Monitoring of Carbon Emission from Motorcycle Vehicles using IoT. The IoT provides opportunity not only for creation of new businesses and investments, but for reduction of carbon emissions. It enables production of highly automated and connected vehicles that change the global automotive market.

Real Time Monitoring

Relays the active and ongoing status of your motorcycle. Display relevant data on our customizable dashboards.

Easy to use

Fast and easy to use software and hardware.

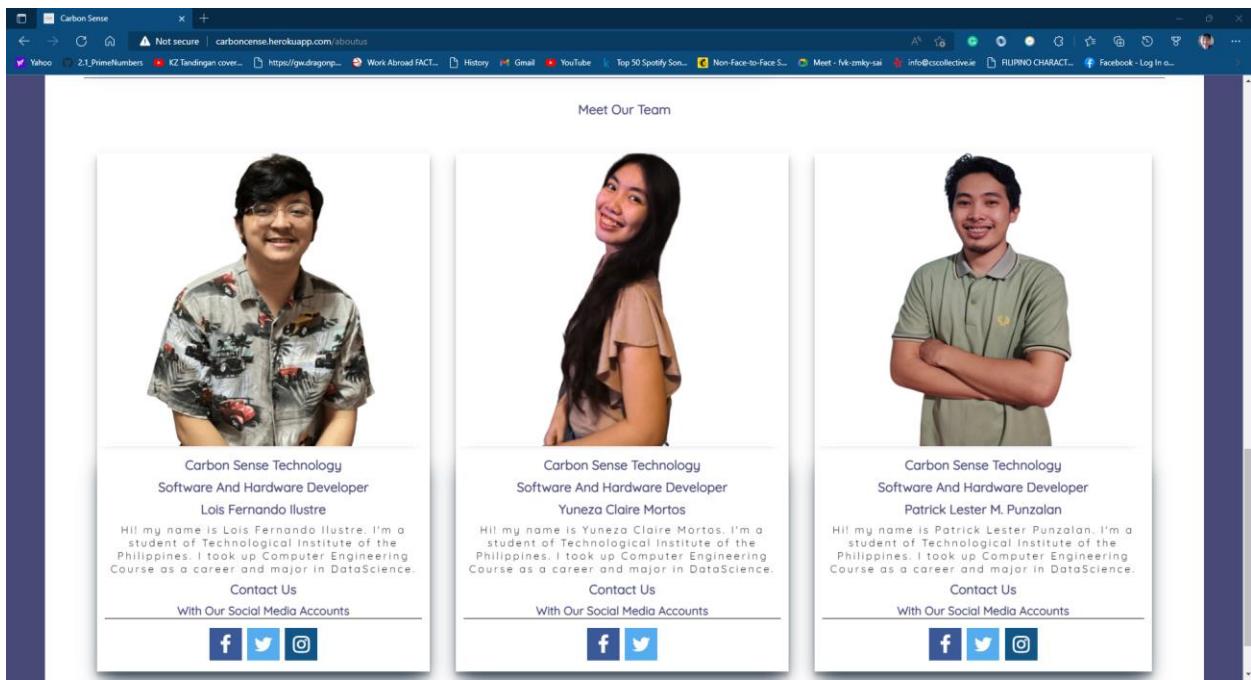


Figure 5-30. About Us Page of Cense Website

About Us Page: A source of information who what to know more about the company and showcase the design, written content, history, company's value, video elements, and the creators.

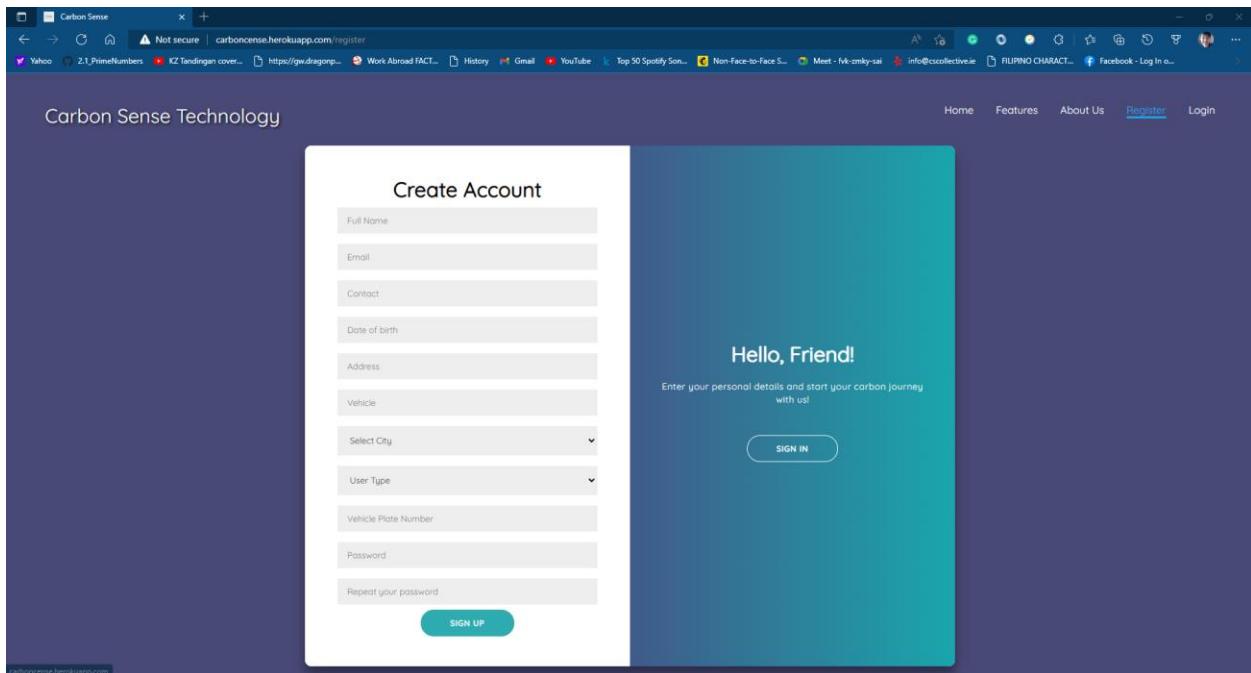


Figure 5-31. Register Page of Cense Website

Register Page: allowing the users to identify themselves, the users need to be able to register first to the system. Registration is having a profile account and gain access to the system.

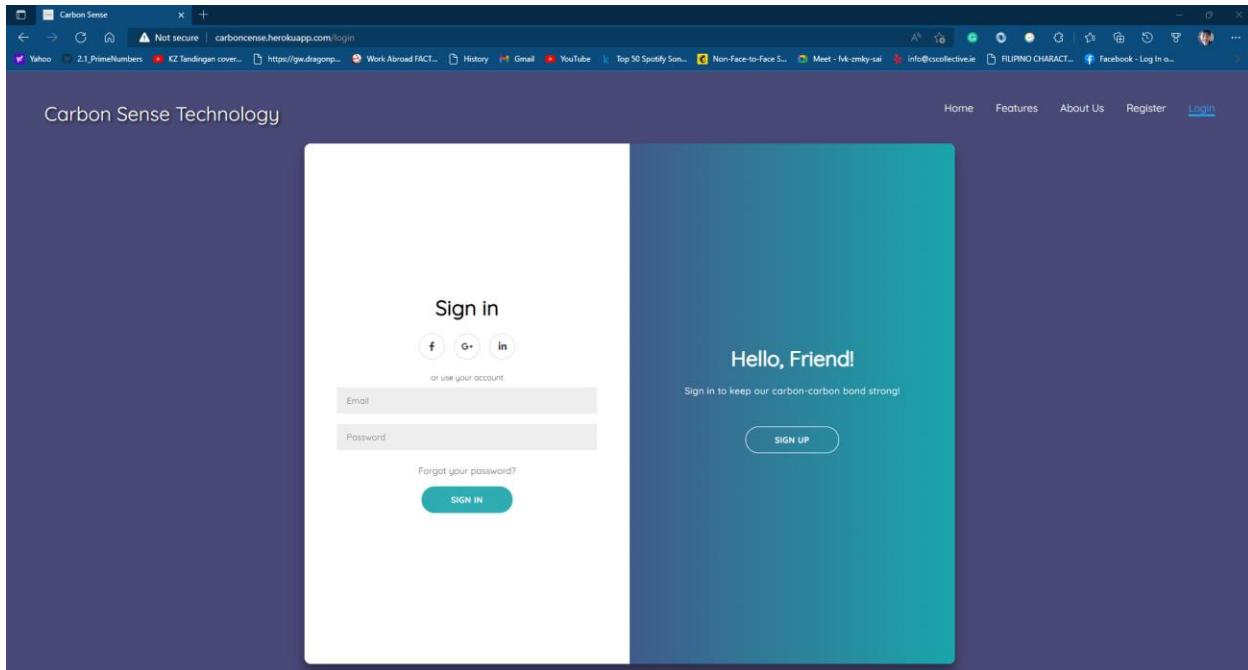


Figure 5-32. Login Page of Cense Website

Login Page: Create a user account to identify themselves when entering the systems to protect the system against nonmembers and to provide systems functionalities for known users.

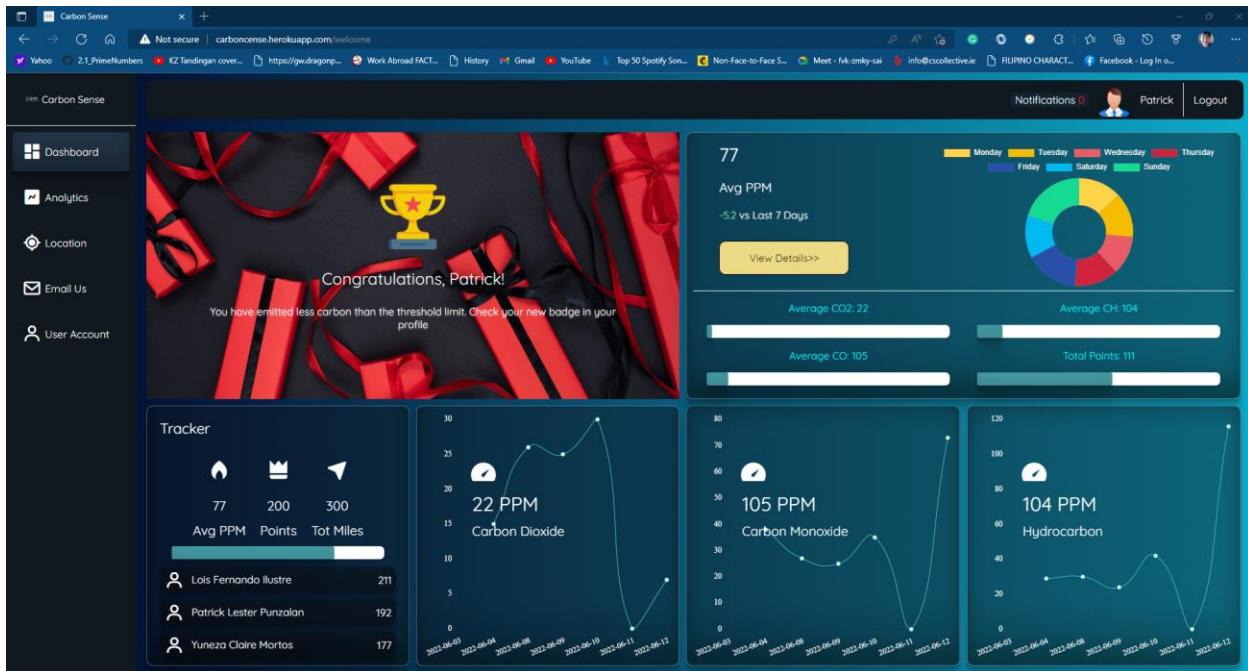


Figure 5-33. Dashboard of Cense Website

Dashboard Page: a limited visual display of data after login that shows the analysis of the application data, summaries, contents of projects, etc. The users can drill down to get more information about the particular piece of data by dynamically reports.



Figure 5-34. Analytics Page of Cense Website

Analytics Page: generates a real-time tracking, reviewing and reporting data.

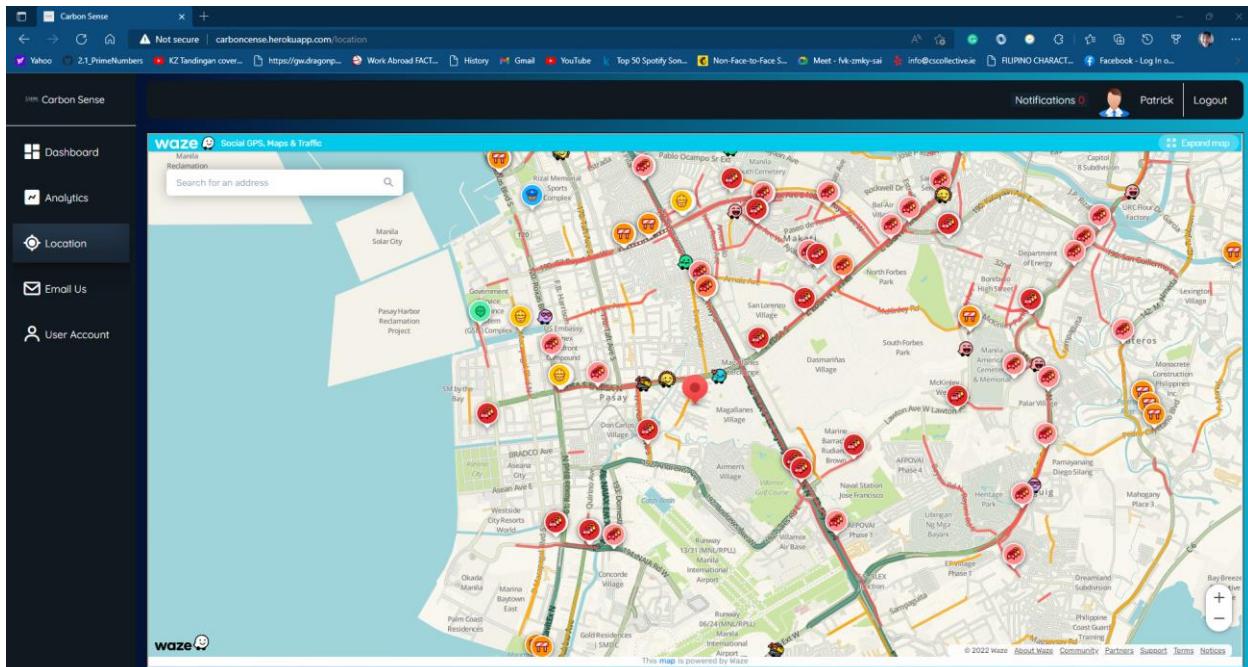


Figure 5-35. Location (Map) of Cense Website

Location Page: tracking the user's location by Geopositioning API by providing the ability to identify their location of our provided GPS tracking module.

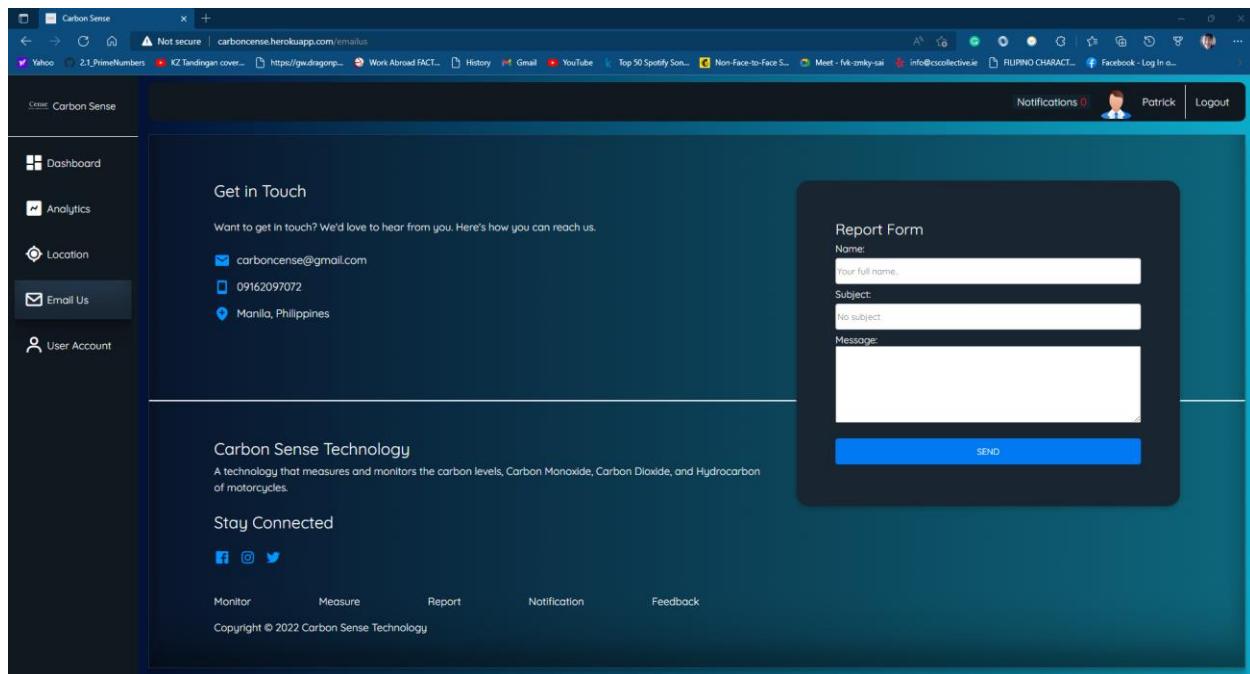


Figure 5-36. Feedback Page of Cense Website

Email Us Page: this page contains guidance for existing customers to access a communication between the user and the company by becoming even more accessible.

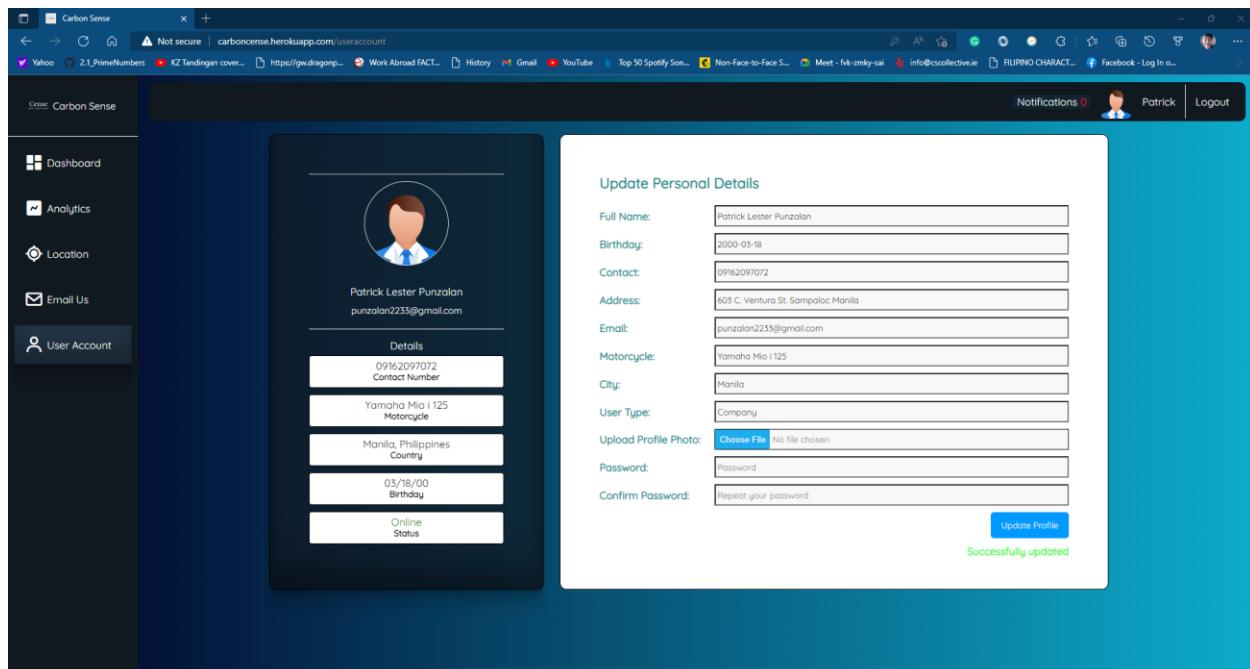


Figure 5-37. Profile (User) Page of Cense Website

User Account Page: contains a collection of information associated with a user, wherein they can set a profile image and personal information with the ability to edit all their profile. Also, gives critical information that is used to identify an individual.

Figures below will show the Mobile Application of Cense which is named the COmon app, the companion app of the system for the driver's benefit.



Figure 5-38. Home screen of CENSE:COmon App

This is the landing screen if the user clicked the application. It shows two (2) buttons which indicates the "Sensor Stats" as well as the "Map"

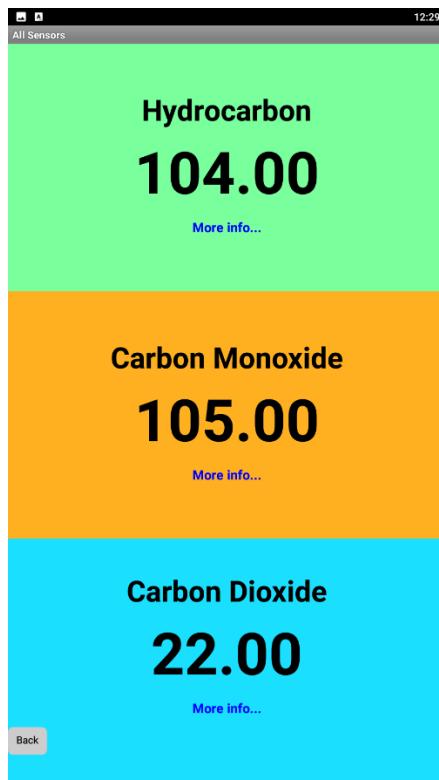


Figure 5-39. Sensor Stats Screen of Cense:COmon App

Upon clicking the Sensor Stats button on the home screen, it shows three (3) kinds of carbon data that is seen by the user. The carbon data presented is real-time as the driver uses the device. In order to present more information with regards on the specific carbon data, More Info button is provided.

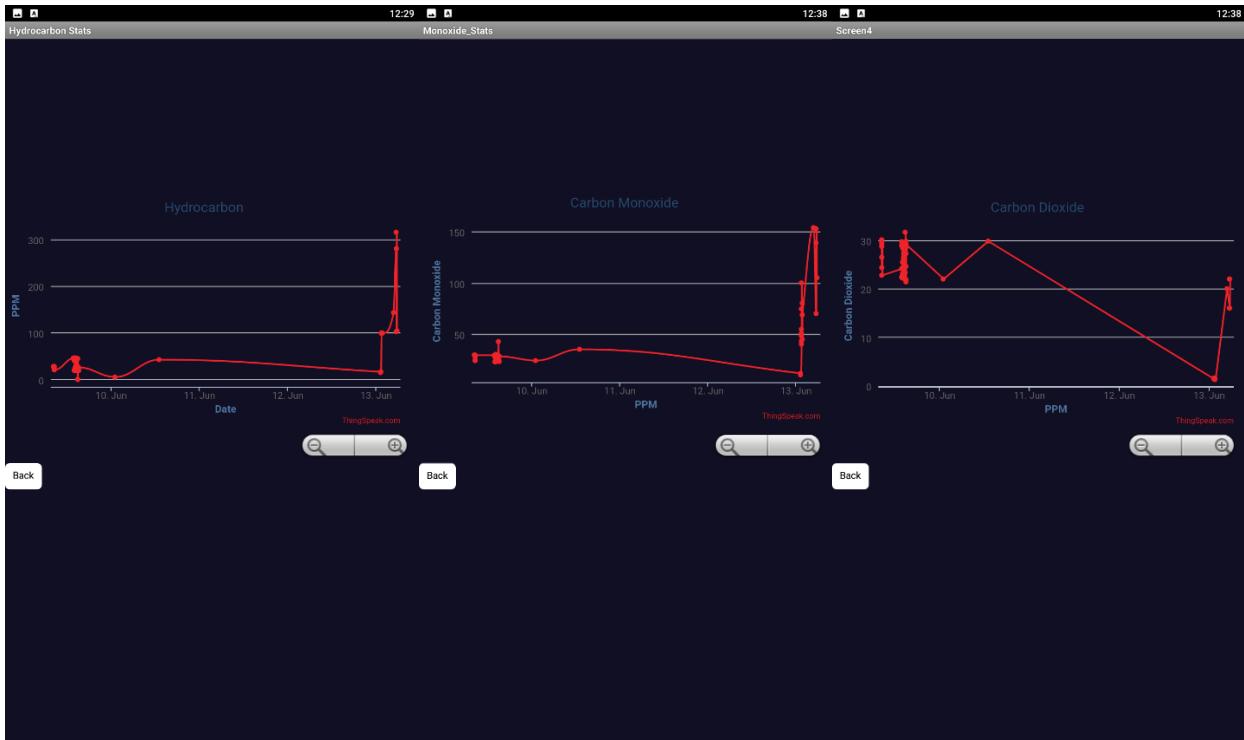


Figure 5-40. More Information Screen of the 3 Carbon Data of Cense:COmon App

When the more info button is clicked, line graphs are shown to see more information of the selected carbon data. It shows a history of readings throughout the day.



Figure 5-41. Map Screen of Cense:COmon App

When the Map button is clicked on the homescreen of Cense:COmon App, it shows a real-time location of the driver as he/she uses the device.

5.3.3 Code

The code of this project is divided into three (3) types: Code for Arduino, Code for Web UI, and Code for Mobile Application. These types of code are essential to the functionality of the system and holistically for the UI that is used by the user/driver.

The Code for Arduino is the main internal function or sets of command in order for the microcontroller to perform the said actions that is relevant to the project. Code is provided as follows.

Figure 5-42. Source Code for Arduino

```
#include <SoftwareSerial.h>
#include <AltSoftSerial.h>
SoftwareSerial gprsSerial(2,3);
#include <TinyGPSPlus.h>
#include <String.h>
TinyGPSPlus gps;
AltSoftSerial neogps;

#define mq2_sensor A0
#define mq7_sensor A1
#define mq135_sensor A2

void setup()
{
    gprsSerial.begin(9600);           // the GPRS baud rate
    Serial.begin(9600);             // the GPRS baud rate
    neogps.begin(9600);
    delay(1000);
    Serial.print("Initializing..");
}

void loop()
{
    //Can take up to 60 seconds
    boolean newData = false;
    for (unsigned long start = millis(); millis() - start < 2000;){
        while (neogps.available()){
            if (gps.encode(neogps.read())){
                newData = true;
                break;
            }
        }
    }

    //If newData is true
    if(true){
        newData = false;

        String latitude, longitude;
        float altitude;
```

```

latitude = String(gps.location.lat(), 6); // Latitude in degrees (double)
longitude = String(gps.location.lng(), 6); // Longitude in degrees (double)
altitude = gps.altitude.meters(); // Altitude in meters (double)

Serial.print("Latitude= ");
Serial.print(latitude);
Serial.print(" Longitude= ");
Serial.println(longitude);

float mq2_val = analogRead(mq2_sensor);
if (isnan(mq2_val)){
    Serial.println("Failed to read from MQ-2 sensor!");
    return;
}
mq2_val = mq2_val/1023*100;
Serial.println("MQ-2 Data: " + String(mq2_val));
delay(2000);

float mq7_val = analogRead(mq7_sensor);
if (isnan(mq7_val)){
    Serial.println("Failed to read from MQ-7 sensor!");
    return;
}
mq7_val = mq7_val/1023*100;
Serial.println("MQ-7 Data: " + String(mq7_val));
delay(2000);

float mql35_val = analogRead(mql35_sensor);
if (isnan(mql35_val)){
    Serial.println("Failed to read from MQ-135 sensor!");
    return;
}
mql35_val = mql35_val/1023*100;
Serial.println("MQ-135 Data: " + String(mql35_val));
delay(2000);
if (gprsSerial.available())
    Serial.write(gprsSerial.read());

```

```

gprsSerial.println("AT");
delay(1000);

gprsSerial.println("AT+CPIN?");
delay(1000);

gprsSerial.println("AT+CREG?");
delay(1000);

gprsSerial.println("AT+CGATT?");
delay(1000);

gprsSerial.println("AT+CIPSHUT");
delay(1000);

gprsSerial.println("AT+CIPSTATUS");
delay(2000);

gprsSerial.println("AT+CIPMUX=0");
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CSTT=\"internet.globe.com.ph\"");//start task and setting the APN,
delay(1000);

ShowSerialData();

gprsSerial.println("AT+CIICR");//bring up wireless connection
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CIFSR");//get local IP address
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CIPSPRT=0");

```

```

ShowSerialData();
gpsserial.println("AT+CIPSTART=\"TCP\",\"api.thingspeak.com\",\"80\");//start up the connection
delay(5000);

ShowSerialData();

gpsserial.println("AT+CIPSEND");//begin send data to remote server
delay(3000);
ShowSerialData();

String str="GET http://api.thingspeak.com/update?api_key=V1N1IANHAKGE538&field1=" + String(mq2_val) + "&field2=" + String(mq7_val) + "&field3=" + String(mq135_val) + "&field4=" + String(latitude) + "&field5=" + String(longitude);
Serial.println(str);
gpsserial.println(str);//begin send data to remote server

delay(4000);
ShowSerialData();

gpsserial.println((char)26);//sending
delay(4000)//waiting for reply, important! the time is base on the condition of internet
gpsserial.println();

ShowSerialData();

gpsserial.println("AT+CIPSHUT");//close the connection
delay(100);
ShowSerialData();
}

void ShowSerialData()
{
    while(gpsserial.available()!=0)
    Serial.write(gpsserial.read());
    delay(5000);
}

void GpsData()
{
    //Can take up to 60 seconds
    boolean newData = false;
    for (unsigned long start = millis(); millis() - start < 2000;){
        while (neogps.available()) {
            if (gps.encode(neogps.read())){
                newData = true;
                break;
            }
        }
    }

    //If newData is true
    if(true){
        newData = false;

        String latitude, longitude;
        float altitude;
        unsigned long date, time, speed, satellites;

        latitude = String(gps.location.lat(), 6); // Latitude in degrees (double)
        longitude = String(gps.location.lng(), 6); // Longitude in degrees (double)
        altitude = gps.altitude.meters(); // Altitude in meters (double)
        date = gps.date.value(); // Raw date in DDMMYY format (u32)
        time = gps.time.value(); // Raw time in HHMMSSCC format (u32)
        speed = gps.speed.kmph();

        Serial.print("Latitude= ");
        Serial.print(latitude);
        Serial.print(" Longitude= ");
        Serial.println(longitude);
    }
}
}

```

Figure 5-42. Source Code for Arduino

The code provided below is the code for the mobile application of Cense which is named Cense:COmon app. This provides the overall functionality of the app and its real-time data manner for the ease-of-access of the user/driver.

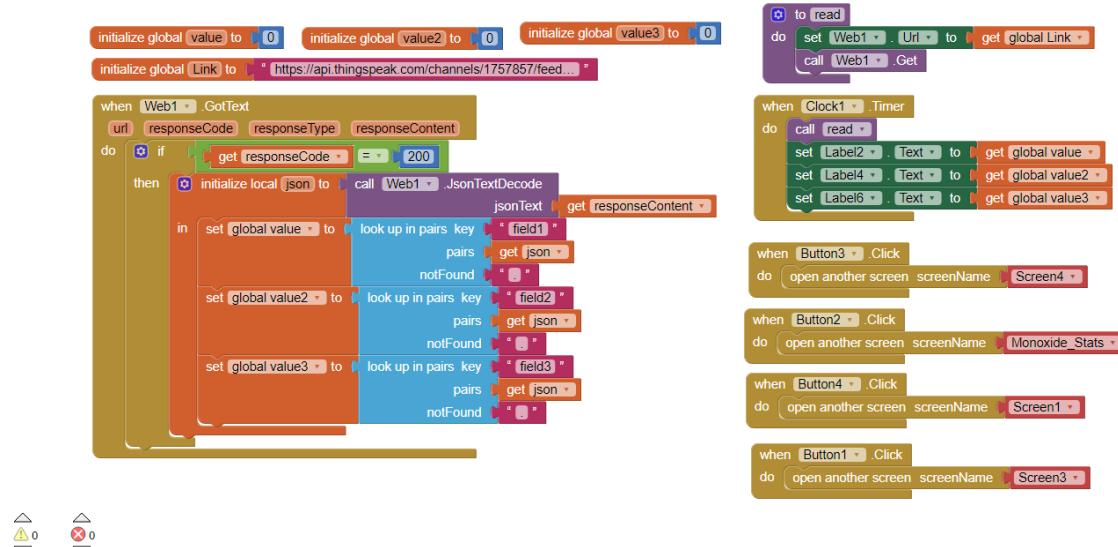


Figure 5-43. Code blocks for getting the real-time carbon data at Cense:COmon App

This section of the overall code is how the mobile application will get the real-time data from the cloud, specifically, the real-time database provided by ThingSpeak. It also features the changes in labels, and the linking of ThingSpeak API into the app.

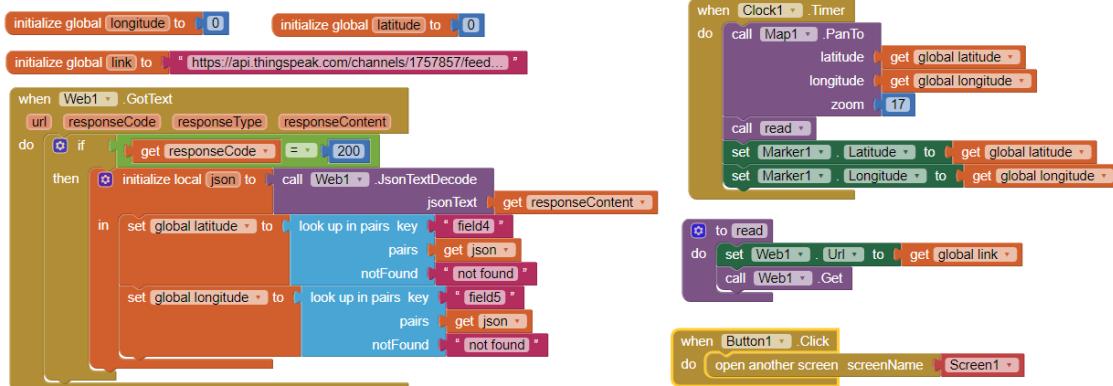


Figure 5-44. Code blocks for getting the geo-location (Longitude, Latitude) data of the device at Cense: COmon App

This section of the overall code is how the mobile application gathers the geo-location data of the device for geo-tracking. The source of the data is when the SIM800L data sends the data to the real-time database of ThingSpeak

Home.blade.php

A basic showcase of the home page using HTML components and CSS. The page was divided into 2 HTML elements Header and the Main section. The header section contains the logo, name of the website, and navigation bar, main section contains the body that everything you want to show on the homepage.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}>
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
        src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link
        href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>

<body class="home_img">
    <div class="navbar" id="navbar_home">
        <ul>
```

```

<li id="active"><a href="/">Home</a></li>
<li><a href="/features">Features</a></li>
<li><a href="/aboutus">About Us</a></li>
<li><a href="/register">Register</a></li>
<li><a href="/login">Login</a></li>
</ul>
</div>

<div class="title_align">

<div id="title">
    <span>Carbon Sense Technology</span>
</div>

<div id="title_info">
    <span>
        A technology that measures and monitors the carbon levels, Carbon Monoxide, Carbon Dioxide, and Hydrocarbon of motorcycles.
    </span>
    <br>
    <span id="title_info_help">Help fight climate change now!</span>
    </p>
</div>

<br>
<br>

<div class="learn_how">
    <a href="/features">LEARN HOW!</a>
</div>

</div>

</body>
</html>

```

Feature.blade.php

The feature blade page carries a collection of contents about our objective. The code contains HTML elements that are enhanced and modified by CSS to control the presentation, formatting, and layout.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}>
    <!-- Boxicons CDN Link -->
    <link href="https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css" rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">

</head>
<body class="features_body_color">
    <div class="navbar3">
        <ul>
            <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
            <div class="nav_hover">
                <li><a href="/">Home</a></li>
                <li><a href="/features">Features</a></li>
                <li><a href="/aboutus">About Us</a></li>
                <li><a href="/register">Register</a></li>
                <li><a href="/login">Login</a></li>
            </div>
        </ul>
    </div>
```

```

        </ul>
    </div>
<div class="features_content">
    <div class="align_content">
        <div class="box_img" id="margin_box">
            
        </div>
        <div class="box_img" id="margin_box1">
            
        </div>
    </div>
    <div class="title_fight">
        <span>Together we cease the climate change! </span>
    </div>
    <div class="title_measure">
        <span>MEASURE YOUR EMISSION NOW!</span>
    </div>
    <div class="title_monitor">
        <span>Monitor the carbon emission of your motorcycle by using
            this technology. Get reports and data </span>
        <span>about your emission, receive normally feedbacks of your
            motorcycle, and get notified when your emission</span>
        <span>exceeds the limit threshold!</span>
    </div>
    <div class="features_activity">
        <div class="monitor">
            <i class='bx bx-search-alt' ></i>
            <span>Monitor</span>
        </div>
        <div class="monitor">
            <i class='bx bx-bar-chart-square' ></i>
            <span>Measure</span>
        </div>
        <div class="monitor">
            <i class='bx bxs-report' ></i>
            <span>Report</span>
        </div>
        <div class="monitor">
            <i class='bx bxs-bell-ring'></i>
            <span>Notification</span>
        </div>
        <div class="monitor">
            <i class='bx bx-list-check' ></i>

```

```

        <span>Feedback</span>
    </div>
</div>
</div>
</body>
</html>

```

About us.blade.php

In creating a responsive attractive page with simple HTML and CSS. We didn't use any templates or pre-build design than can reduce the work and save time.

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}"/>
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
        src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js">
    </script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
        <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
        <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}"/>

```

</head>

```

<body class="features_body_color">
  <div class="navbar3">
    <ul>
      <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
      <div class="nav_hover">
        <li><a href="/">Home</a></li>
        <li><a href="/features">Features</a></li>
        <li id="about_us_active"><a href="/aboutus">About Us</a></li>
        <li><a href="/register">Register</a></li>
        <li><a href="/login">Login</a></li>
      </div>
    </ul>
  </div>

  <div class="about_us">
    <div class="about_us_title">
      <span id="margin_title" >About Us</span>
    <div class="meeting">
      <div class="meeting_content" id="meeting_content_description">
        <span style="text-align: justify; letter-spacing: 2px;">We are the Carbon Sense Team. This website will use to record continous CO2 and CO of direct atmospheric measurements using high-precision instrument. DON'T BE A FOSSIL FOOL.</span>
      </div>
      <div class="meeting_content">
        
      </div>
    </div>
  </div>
  <div class="auvideo_content">
    <div class="video_title">
      <span>Introducing The GHG Emission Solutions For Motorcycles</span>
    </div>
    <div class="video_content">
      <div class="video_file">
        <video width="600" height="100%" controls>
          <source src="{{asset('photos/project.mp4')}}" type="video/mp4">
        Your browser does not support HTML5 video.
      </video>
    </div>
    <div class="video_details">

```

```

<div class="video_details_title">
    <h2>CARBON SENSE</h2>
    <small style="text-align: center;">A Real-time Monitoring of
        Carbon Emission from Motorcycle Vehicles using IoT.</small>
</div>
<p style="text-indent: 20px;">The IoT provides opportunity not
only for creation of new businesses and investments, but for
reduction of carbon emissions. It enables production of highly
automated and connected vehicles that change the global
automotive market.

</p>
<h2>Real Time Monitoring</h2>
<p style="text-indent: 20px;">Relays the active and ongoing
status of your motorcycle. Display relevant data on our
customizable dashboards.</p>
<h2>Easy to use</h2>
<p style="text-align: center;">Fast and easy to use software and
hardware.</p>
</div>
</div>
</div>
<div class="team_content">
    <div class="meet_the_team">
        <span>Meet Our Team</span>
    </div>
    <div class="team_img">
        <div class="team_img_border" id="team_img_border1">
            
        <div class="team_img_content">
            <span id="title">carbon sense technology</span>
            <span id="focus">Software and Hardware
                Developer</span>
            <span id="team_img_name">Lois Fernando Ilustre</span>
            <span id="about_you" style="letter-spacing: 3px;">Hi! my name
                is Lois Fernando Ilustre. I'm a student of Technological Institute of
                the Philippines. I took up Computer Engineering Course as a career and
                major in DataScience.</span>
            <span id="team_img_name" >Contact Us </span>
            <span id="team_img_name" style="font-size: 18px; border-
                bottom: 1px solid black">With Our Social Media
                Accounts</span>
        
```

```

<a href="https://www.facebook.com/IamLoisBro" target="_blank"
    class="fa fa-facebook"></a>
<a href="https://twitter.com/ImLoisBro" target="_blank"
    class="fa fa-twitter"></a>
<a href="https://www.instagram.com/imloisbro/" target="_blank"
    class="fa fa-instagram"></a>
</div>
</div>
<div class="team_img_border" id="team_img_border2">
    
    <div class="team_img_content">
        <span id="title">carbon sense technology</span>
        <span id="focus">Software and Hardware
            Developer</span>
        <span id="team_img_name">Yuneza Claire Mortos</span>
        <span id="about_you" style="letter-spacing: 3px;">Hi! my name
            is Yuneza Claire Mortos. I'm a student of Technologic
            al Institute of the Philippines. I took up Computer
            Engineering Course as a career and major in
            DataScience.</span>
        <span id="team_img_name" >Contact Us </span>
        <span id="team_img_name" style="font-size: 18px; border-
            bottom: 1px solid black">With Our Social Media
            Accounts</span>
        <a href="https://www.facebook.com/wagyuneza" target="_blank"
            class="fa fa-facebook"></a>
        <a href="https://twitter.com/yonessaur" target="_blank"
            class="fa fa-twitter"></a>
    </div>
</div>
<div class="team_img_border" id="team_img_border3">
    
    <div class="team_img_content">
        <span id="title">carbon sense technology</span>
        <span id="focus">Software and Hardware
            Developer</span>
        <span id="team_img_name">Patrick Lester M. Punzalan</span>
        <span id="about_you" style="letter-spacing: 3px;">Hi! my name is Patrick
            Lester Punzalan. I'm a student of Technological Institute of the
            Philippines. I took up Computer Engineering Course as a career and
            major in DataScience.</span>
    </div>
</div>

```

```
<span id="team_img_name" >Contact Us</span>
<span id="team_img_name" style="font-size: 18px; border-
    bottom: 1px solid black">With Our Social Media
Accounts</span>
<a href="https://www.facebook.com/patwickku/" target="_blank"
    class="fa fa-facebook"></a>
<a href="https://twitter.com/patwickku" target="_blank"
    class="fa fa-twitter"></a>
<a href="https://www.instagram.com/patwickku/" target="_blank"
    class="fa fa-instagram"></a>
</div>
</div>
</div>
</div>

<div>
    <br>
</div>
<div>
    <br>
</div>

</div>
</body>
</html>
```

Register.blade.php

A simple sign-up and registration form for users powered by HTML, CSS, JAVASCRIPT, PHP, and MYSQL. The form needs to validate the incoming data before to save in the system. By default, the controller class uses a ValidateRequests that provides a convenient method to validate the HTTP Request with validation rules. Javascript and CSS make the form responsive.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
    <link rel="stylesheet" type="text/css" href="{{ asset('css/login.css') }}">
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <!-- Login -->
    <link href="https://fonts.googleapis.com/css?family=Montserrat&display=swap" rel="stylesheet">
    <link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.8.2/css/all.css" integrity="sha384-oS3vJWv+0UjzBfQzYUhtDYW+Pj2yciDJxpsK1OYPAYjqT085Qq/1cq5FLXAZQ7Ay" crossorigin="anonymous">
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>
```

```

<body class="features_body_color">
    <div class="navbar3">
        <ul>
            <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
            <div class="nav_hover">
                <li><a href="/">Home</a></li>
                <li><a href="/features">Features</a></li>
                <li><a href="/aboutus">About Us</a></li>
                <li id="active"><a href="/register">Register</a></li>
                <li><a href="/login">Login</a></li>
            </div>
        </ul>
    </div>
    <div class="login_content">
        <div class="login_margin">
            <div class="container" id="container">
                <div class="form-container sign-in-container">
                    <form action="/register" method="POST" class="login_form">
                        @csrf
                        <h1>Create Account</h1>
                        <input class="login_input" type="text" name="name" placeholder="Full Name" id="full_name" required />
                        @error('name')
                            <div class="form_error">
                                {{ $message }}
                            </div>
                        @enderror
                        <input class="login_input" type="text" name="email" placeholder="Email" id="email" required/>
                        @error('email')
                            <div class="form_error">
                                {{ $message }}
                            </div>
                        @enderror
                        <input class="login_input" type="text" name="contact" placeholder="Contact" id="contact" required/>
                        @error('contact')
                            <div class="form_error">
                                {{ $message }}
                            </div>
                        @enderror
                </div>
            </div>
        </div>
    </div>

```

```

<input class="login_input" type="text" name="birthday"
placeholder="Date of birth" onfocus="(this.type='date')" id="birthday" >
@error('birthday')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="address"
placeholder="Address" id="address" required/>
@error('address')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="vehicle"
placeholder="Vehicle" id="vehicle" required/>
@error('vehicle')
<div class="form_error">
{{ $message }}
</div>
@enderror
<select class="login_input" type="text" name="city"
placeholder="City" id="city" style="width: 100%; height: 45px; background-color: #eee; border: none; padding: 12px 15px; margin: 8px 0;" required >
<option value="">Select City</option>
<option value="Caloocan">Caloocan</option>
<option value="Calumpang">Calumpang</option>
<option value="Dasmariñas Village">Dasmariñas
Village</option>
<option value="Ermita">Ermita</option>
<option value="Intramuros">Intramuros</option>
<option value="Las Piñas">Las Piñas</option>
<option value="Makati">Makati</option>
<option value="Malabon">Malabon</option>
<option value="Malate">Malate</option>
<option value="Mandaluyong">Mandaluyong</option>
<option value="Manila">Manila</option>
<option value="Marikina">Marikina</option>
<option value="Muntinlupa">Muntinlupa</option>
<option value="National Capital Region">National
Capital Region</option>
<option value="Navotas">Navotas</option>
<option value="Niugan">Niugan</option>

```

```

        <option value="Paco">Paco</option>
        <option value="Pandacan">Pandacan</option>
        <option value="Parañaque">Parañaque</option>
        <option value="Pasay">Pasay</option>
        <option value="Pasig">Pasig</option>
        <option value="Pateros">Pateros</option>
        <option value="Port Area">Port Area</option>
        <option value="Quezon City">Quezon City</option>
        <option value="Quiapo">Quiapo</option>
        <option value="Sambayanihan People's
Village">Sambayanihan People's Village</option>
        <option value="San Juan">San Juan</option>
        <option value="San Miguel">San Miguel</option>
        <option value="Santa Ana">Santa Ana</option>
        <option value="Santa Cruz">Santa Cruz</option>
        <option value="Singkamas">Singkamas</option>
        <option value="Taguig">Taguig</option>
        <option value="Tanza">Tanza</option>
        <option value="Tanza">Tanza</option>
        <option value="Tondo">Tondo</option>
        <option value="Valenzuela">Valenzuela</option>
    </select>
    @error('city')
    <div class="form_error">
        {{ $message }}
    </div>
    @enderror
    <select class="login_input" type="text" name="usertype"
placeholder="User Type" id="usertype" style="width: 100%; height: 45px;
background-color: #eee; border: none; padding: 12px 15px; margin: 8px 0;" required>
        <option value="" style="color: green; font-weight: bold;">User
Type</option>
        <option value="Company">Company</option>
        <option value="Self">Self</option>
    </select>
    @error('usertype')
    <div class="form_error">
        {{ $message }}
    </div>
    @enderror
    <input class="login_input" type="text" name="platenumber"
placeholder="Vehicle Plate Number" id="platenumber" required/>

```

```

        @error('platenumber')
            <div class="add_errors">
                {{ $message }}
            </div>
        @enderror
        <input class="login_input" type="password"      name="password"
placeholder="Password" id="password" required/>
        <input class="login_input" type="password"
name="password_confirmation" placeholder="Repeat your password"
id="repeat_password" for="password_confirmation" required/>

        @error('password')
            <div style="margin-top: 10px; color: red; margin-
bottom:10px;">
                {{ $message }}
            </div>
        @enderror
        <button onclick="signup()">Sign Up</button>
        @error('repeat_password')
            <div style="margin-top: 10px; color: red;">
                {{ $message }}
            </div>
        @enderror
        @if(\Session::has('success'))
            <div class="register_success">
                {{ \Session::get('success') }}
            </div>
        @endif
    </form>
</div>
<div class="overlay-container">
    <div class="overlay">
        <div class="overlay-panel overlay-left">
            <h1>Welcome Back!</h1>
            <p>Enter your personal details and start your carbon journey
with us!</p>
            <button class="ghost" id="signIn">Sign In</button>
        </div>
        <div class="overlay-panel overlay-right">
            <h1>Hello, Friend!</h1>
            <p>Enter your personal details and start your carbo journey
with us!</p>
        <a href="/login"><button class="ghost">SignIn</button></a>
    
```

```

        </div>
    </div>
</div>
<script type="text/javascript" src="{{ asset('js/index.js') }}" >
</script>
</div>
</div>
</body>
</html>

```

Login.blade.php

The same use of line of codes of Register.blade.php. The Laravel built-in function makes login easier through their function authentication and model.

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
    <link rel="stylesheet" type="text/css" href="{{ asset('css/login.css') }}">
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
        src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <!-- Login -->
    <link href="https://fonts.googleapis.com/css?family=Montserrat&display=swap" rel="stylesheet">

```

```

<link rel="stylesheet"
      href="https://use.fontawesome.com/releases/v5.8.2/css/all.css" integrity="sha384-oS3vJWv+0UjzBfQzYUhtDYW+Pj2yciDJxpsK10YPAYjqT085Qq/1cq5FLXAZQ7Ay"
      crossorigin="anonymous">
<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>
<body class="features_body_color">
    <div class="navbar3">
        <ul>
            <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
                <div class="nav_hover">
                    <li><a href="/">Home</a></li>
                    <li><a href="/features">Features</a></li>
                    <li><a href="/aboutus">About Us</a></li>
                    <li><a href="/register">Register</a></li>
                    <li id="active"><a href="/login">Login</a></li>
                </div>
            </ul>
        </div>
        <div class="login_content">
            <div class="login_margin">
                <div class="container" id="container">
                    <div class="form-container sign-up-container">
                    </div>
                    <div class="form-container sign-in-container">
                        <form method="POST" action="/login">
                            @csrf
                            <h1>Sign in</h1>
                            <div class="social-container">
                                <a href="#" class="social"><i class="fab fa-facebook-f"></i></a>
                                <a href="#" class="social"><i class="fab fa-google-plus-g"></i></a>
                                <a href="#" class="social"><i class="fab fa-linkedin-in"></i></a>
                            </div>
                            <span>or use your account</span>
                            <input type="email" name="email" placeholder="Email" />
                            @error('email')
                                <div style="margin-top: 10px; color: red; margin-bottom: 10px;">

```

```

        {{ $message }}
    </div>
@enderror
<input type="password" name="password"
placeholder="Password"
id="password"/> @error('password')
<div style="margin-top: 10px; color: red;
margin-bottom: 10px;">
{{ $message }}
</div>
@enderror
<a href="#">Forgot your password?</a>
<button>Sign In</button>

@if (session('status'))
<div style="color: red; margin-top: 10px;">
{{ session('status') }}
</div>
@endif

</form>
</div>
<div class="overlay-container">
<div class="overlay">
<div class="overlay-panel overlay-left">
<h1>Welcome Back!</h1>
<p>To keep connected with us please login with
your personal info</p>
<button class="ghost" id="signIn">Sign
In</button>
</div>
<div class="overlay-panel overlay-right">
<h1>Hello, Friend!</h1>
<p>Sign in to keep our carbon-carbon bond
strong!</p>
<a href="/register"><button
class="ghost">Sign Up</button></a>
</div>
</div>
</div>
</div>
<script type="text/javascript" src="{{ asset('js/index.js') }}" >
</script>

```

```

        </div>
    </div>
</body>
</html>
```

Dashboard.blade.php

Javascript is used to create and run the visualization of chart.js. HTML and CSS for making the website look attractive, easy to use and responsive.

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
        src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <!-- JS Script -->
    <script src="{{ asset('js/index.js') }}></script>

    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>
@auth
<body id="dashboard_color">
```

```

<div class="sidebar">
    <div class="name_logo">
        <a href="/welcome" style="font-size: 15px; color: white;">
            
        </a>
        Carbon Sense
    </div>
    <a class="active" href="/welcome" id="sidebar_hover">
        <i class='bx bxs-dashboard'></i>
        Dashboard</a>
    <a href="/analytics" id="sidebar_hover">
        <i class='bx bxs-chart'></i>
        Analytics
    </a>
    <a href="/location" id="sidebar_hover">
        <i class='bx bx-current-location'></i>
        Location
    </a>
    <a href="/emailus" id="sidebar_hover">
        <i class='bx bx-envelope'></i>
        Email Us
    </a>
    <a href="/useraccount" id="sidebar_hover">
        <i class='bx bx-user'></i>
        User Account
    </a>
</div>

<div class="content">
    <div class="navbar">
        <div class="dropdown">
            <button onclick="myFunction()" class="dropbtn">Notifications
                <span style="color: red;">{{ auth() -> user() -> unreadNotifications -> count() }}</span>
            </button>
            <div id="myDropdown" class="dropdown-content">
                <div id="notificationDropdown" class="notification-content">
                    @foreach ($summary as $summary)
                        <div class="notification_css">
                            <table>
                                <td>
                                    <button id="myBtn" style = "background-color: white;">

```

```

        <p>{{ $summary->created_at }}</p>
        <p>{{ Auth::user()->name }}, Your Hydrocarbon sensor exceeds the
threshold limit.</p>
    </button>

    <!-- The Modal -->
<div id="myModal" class="modal">

    <!-- Modal content -->
<div class="modal-content">
    <div class="modal-header" style="text-align: center;">
        <span class="close">&times;</span>
        <h4 style="text-align: center; letter-spacing: 6px; color:
            rgba(16, 24, 32, 0.468)">Sensor Alert</h4>
    <h3>Sensor Problem</h3>
    <span style="display: block;">If Hydrocarbon - Check if Piston is
        clean It is recommended to clean the Exhaust or Muffler
        for potential build up of dirt or residue</span>
    <span style="display: block;">If Monoxide - Check if the sound of
        the engine is as clear as before.</span>
    <span style="display: block;">It is recommended to check for
        engine failures, dirt, and etc.</span>
    <span style="display: block;">Make sure the carburetor is
        clean.</span>
    <h3>Both</h3>
    <span style="display: block;">Make sure to clean the exhaust of
        the motorcycle and check for residue</span>
    <span style="display: block;">Check the sound of the engine if
        it's clear as before</span>
    <span style="display: block;">It is recommended to clean the
        engine</span>
    <span style="display: block;">Clean the carburetor to have better
        quality emitted air</span>
    <span style="display: block;">Check the valve for potential
        failures</span>
    <br>
    <br>
</div>
</div>

</div>
</td>

```

```

<!-- <td>
    <a href="{{ route('markasread', $summarys->id) }}">
        <div class="markasread">Markasread</div>
    </a>
</td> -->
</table>
</div>
<script>
    // Get the modal
    var modal = document.getElementById("myModal");

    // Get the button that opens the modal
    var btn = document.getElementById("myBtn");

    // Get the <span> element that closes the modal
    var span = document.getElementsByClassName("close")[0];

    // When the user clicks the button, open the modal
    btn.onclick = function() {
        modal.style.display = "block";
    }

    // When the user clicks on <span> (x), close the modal
    span.onclick = function() {
        modal.style.display = "none";
    }

    // When the user clicks anywhere outside of the modal, close it
    window.onclick = function(event) {
        if (event.target == modal) {
            modal.style.display = "none";
        }
    }
</script>
@endforeach
</div>
</div>

<script>
    /* When the user clicks on the button,
    toggle between hiding and showing the dropdown content */
    function myFunction() {

```

```

document.getElementById("myDropdown").classList.toggle("show");
}

// Close the dropdown if the user clicks outside of it
window.onclick = function(event) {
  if (!event.target.matches('.dropbtn')) {
    var dropdowns = document.getElementsByClassName("dropdown-content");
    var i;
    for (i = 0; i < dropdowns.length; i++) {
      var openDropdown = dropdowns[i];
      if (openDropdown.classList.contains('show')) {
        }
      }
    }
  }
</script>
<div class="user_img_name">
  
  <span>{{ strtok(Auth::user()->name, " ") }}</span>
</div>
<div class="user_img_logout">
  <a href="/logout">Logout</a>
</div>
</div>

<div class="analytics">
  <div class="dashboard-grid-container">
    <div class="dashboard-grid-item dashboard-grid-item-1" id="grid_color_first">
      <div id="align">
        <div class="slideshow-container">
          <div class="mySlides fade">
            <!-- <div class="numbertext">1 / 3</div> -->
            <div class="grid_image-1">
              <span>
              </span>
              <p style="font-size: 25px;">Congratulations, {{ strtok(Auth::user()->name, " ") }}!</p>
              <p style="color: #FFF; text-shadow: 0px 2px 2px rgba(255, 255, 255, 0.4); ">You have emitted less carbon than the threshold limit. Check your new badge in your profile</p>
            </div>
          </div>
        </div>
      </div>
    </div>
  </div>

```

```

<div class="mySlides fade">
<!-- <div class="numbertext">2 / 3</div> -->
<div class="grid_image-2">
<p>We continue to adapt and evolve our project model to ensure that we are meeting our customer's expectations. One example of this has been the use of modern technology and the introduction of the real-time tracking of GHG using sensors. It has the features that are useful to combat climate change in regards to technology.</p>
</div>
</div>

<div class="mySlides fade">
<!-- <div class="numbertext">3 / 3</div> -->
<div class="grid_image-3">
<p>Fact</p>
<span>To save most of humanity from extinction before it's impossible, at this 11th hour we must execute history's largest government-enforced mass mobilization of resources to get close to the 2025 targets. </p>
<span>If our governments fail to get us close to the 2025 targets, our focus must shift to minimizing fatalities for as long as possible as well as planning for a massive population loss and a sudden global decline.</p>
</div>
</div>

<div class="mySlides fade">
<!-- <div class="numbertext">3 / 3</div> -->
<div class="grid_image-4">
<p>Monitor the carbon emission of your vehicle by using this technology. Get reports and data about your emission, track your emission via GPS, and get notified when your emission exceeds the limit threshold!</p>

</div>
</div>
</div>
<br>

<div style="text-align:center">

```

```

<span class="dot"></span>
<span class="dot"></span>
<span class="dot"></span>
<span class="dot"></span>
</div>
</div>
<script>
let slideIndex = 0;
showSlides();

function showSlides() {
    let i;
    let slides = document.getElementsByClassName("mySlides");
    let dots = document.getElementsByClassName("dot");
    for (i = 0; i < slides.length; i++) {
        slides[i].style.display = "none";
    }
    slideIndex++;
    if (slideIndex > slides.length) {slideIndex = 1}
    for (i = 0; i < dots.length; i++) {
        dots[i].className = dots[i].className.replace(" active", "");
    }
    slides[slideIndex-1].style.display = "block";
    dots[slideIndex-1].className += " active";
    setTimeout(showSlides, 3000); // Change image every 2 seconds
}
</script>
</div>
<div class="dashboard-grid-item dashboard-grid-item-2" id="grid_color">
<div class="carbon_dioxide">
<i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
<span id="total">{{ Auth::user()->carbonmonoxide }} PPM</span>
<span id="title">Carbon Monoxide</span>
</div>
<div class="chart" style="height:380px; width: 100%;">
<canvas id="myChart1">
</canvas>
</div>
<script src="{{ asset('js/index.js') }}" onLoad="carbonMonoxide()">
</script>
</div>
<div class="dashboard-grid-item dashboard-grid-item-3" id="grid_color">

```

```

<div class="carbon_dioxide">
  <i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
  <span id="total">{{ Auth::user()->hydrocarbon }} PPM</span>
  <span id="title">Hydrocarbon</span>
</div>
<div class="chart" style="height:380px; width: 100%;">
  <canvas id="myChart5">
  </canvas>
</div>
<script src="{{ asset('js/index.js') }}" onLoad="hydroCarbon()">
</script>
</div>
<div class="dashboard-grid-item dashboard-grid-item-4" id="grid_color">
  <div class="whole_content">
    <div class="first_content">
      <div class="avg_ppm">
        <span id="total" style="font-size: 29px">{{ Auth::user()->avgppm }}</span>
        <p id="avg" style="font-size: 20px">Avg PPM</p>
        <p><span style="color: #90EE90;">-5.2 </span>vs Last 7 Days</p>
        <div class="details">
          <div class="box"><a href="">View Details</a></div>
        </div>
      </div>
      <div class="pie_chart">
        <div class="chart2" style="height:100%; width: 100%;">
          <canvas id="myChart2">
          </canvas>
        </div>
        <script src="{{ asset('js/index.js') }}" onLoad="averagePpm()">
        </script>
      </div>
    </div>
    <div class="second_content">
      <div id="first_column">
        <p>Average CO2: {{ Auth::user()->avgcarbondioxide }}</p>
        <progress value="{{ Auth::user()->avgcarbondioxide }}" max="1000"></progress>
        <p>Average CO: {{ Auth::user()->avgcarbonmonoxide }}</p>
        <progress value="{{ Auth::user()->avgcarbonmonoxide }}" max="1200"></progress>
      </div>
    </div>
  </div>

```

```

<div id="first_column">
    <p>Average CH: {{ Auth::user()->avghydrocarbon }}</p>
    <progress value="{{ Auth::user()->avghydrocarbon }}" max="1000"></progress>
    <p>Total Points: 111</p>
    <progress value="111" max="200"></progress>
</div>
</div>
</div>
<div class="dashboard-grid-item dashboard-grid-item-5" id="grid_color">
    <div class="dashboard-grid-item-2-wholecontent">
        <div class="dashboard-grid-item-2-firstcontent">
            <span> Tracker</span>
        </div>
        <div class="dashboard-grid-item-2-secondcontent">
            <table id=table>
                <tr>
                    <td><i class='bx bxs-flame'></i></td>
                    <td><i class='bx bxs-crown'></i></td>
                    <td><i class='bx bxs-navigation'></i></td>
                </tr>
                <tr id="points">
                    <td>{{ Auth::user()->avgppm }}</td>
                    <td>200</td>
                    <td>300</td>
                </tr>
                <tr id="title">
                    <td>Avg PPM</td>
                    <td>Points</td>
                    <td>Tot Miles</td>
                </tr>
            </table>
        </div>
    </div>
    <div class="dashboard-grid-item-2-thirdcontent">
        <div class="progress">
            <progress value="153" max="200"></progress>
        </div>
    </div>
    <div class="center_box">
        <div class="box">
            <i class='bx bx-user' style="font-size: 30px;"></i>
            <span id="name">Lois Fernando Ilustre</span>
        </div>
    </div>

```

```

        <span id="points">211</span>
    </div>
    <div class="box">
        <i class='bx bx-user' style="font-size: 30px;"></i>
        <span id="name">Patrick Lester Punzalan</span>
        <span id="points">192</span>
    </div>
    <div class="box">
        <i class='bx bx-user' style="font-size: 30px;"></i>
        <span id="name">Yuneza Claire Mortos</span>
        <span id="points">177</span>
    </div>
    </div>
</div>
<div class="dashboard-grid-item dashboard-grid-item-6" id="grid_color">
    <div class="carbon_dioxide">
        <i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
        <span id="total">{{ Auth::user()->carbondioxide }} PPM</span>
        <span id="title">Carbon Dioxide</span>
    </div>
    <div class="chart" style="height:380px; width: 100%;">
        <canvas id="myChart">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="carbonDioxide()">
    </script>
    </div>
    </div>
</div>
@endauth
@guest
<body id="dashboard_color">
    <div class="sidebar">
        <div class="name_logo">
            <a href="/welcome" style="font-size: 18.5px; color: white;">
                <i class="fa fa-motorcycle" style="font-size:20px;"></i>
                Carbon Sense
            </a>
        </div>
        <a href="" style="cursor: default; pointer-events: none;">

```

```

<i class='bx bxs-dashboard'></i>
Dashboard</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bxs-chart'></i>
Analytics
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-current-location' ></i>
Location
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-envelope' ></i>
Email Us
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-user' ></i>
User Account
</a>
</div>

<div class="content">
<div class="navbar">
<div class="guest">
<a href="/home">Home</a>
<a href="/register">Register</a>
<a href="/login">Login</a>
</div>
</div>
</content>
</body>
@endguest
</body>
</html>

```

Analytics Page

The JavaScript code references a JavaScript file that executes the tracking concept for our Analytics page. JavaScript controls the behavior of both HTML,CSS elements, users and web browsers. In addition, JS also helps with data collection.

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <script src="https://code.iconify.design/2/2.2.1/iconify.min.js"></script>
    <!-- JS script -->
    <script src="{{ asset('js/index.js') }}></script>
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">

</head>
@auth
<body id="dashboard_color">
    <div class="sidebar">
        <div class="name_logo">
            <a href="/welcome" style="font-size: 15px; color: white;">
                
            </a>
            Carbon Sense
        </div>
    </div>
</body>
```

```

</div>
<a href="/welcome" id="sidebar_hover">
    <i class='bx bxs-dashboard'></i>
    Dashboard</a>
<a class="active" href="/analytics" id="sidebar_hover">
    <i class='bx bxs-chart'></i>
    Analytics
</a>
<a href="/location" id="sidebar_hover">
    <i class='bx bx-current-location'></i>
    Location
</a>
<a href="/emailus" id="sidebar_hover">
    <i class='bx bx-envelope'></i>
    Email Us
</a>
<a href="/useraccount" id="sidebar_hover">
    <i class='bx bx-user'></i>
    User Account
</a>
</div>

<div class="content">
    <div class="navbar">
        <div class="dropdown">
            <button onclick="myFunction()" class="dropbtn">Notifications
                <span style="color: red;">{{ auth() -> user() -> unreadNotifications -> count() }}</span>
            </button>
            <div id="myDropdown" class="dropdown-content">
                <div id="notificationDropdown" class="notification-content">
                    @foreach ($summary as $summarys)
                        <div class="notification_css">
                            <table>
                                <td>
                                    <button id="myBtn" style = "background-color: white;">
                                        <p>{{ $summarys -> created_at }}</p>
                                        <p>{{ Auth::user() -> name }}>, Your Hydrocarbon exceeds to the threshold limit.</p>
                                    </button>
                                </td>
                            </table>
                        </div>
                    @endforeach
                </div>
            </div>
        </div>
    </div>
<!-- The Modal -->
<div id="myModal" class="modal">

```

```

<!-- Modal content -->
<div class="modal-content">
  <div class="modal-header" style="text-align: center;">
    <span class="close">&times;</span>
    <h4 style="text-align: center; letter-spacing: 6px; color: rgba(16, 24, 32, 0.468)">Sensor Alert</h4>
  <h3>Sensor Problem</h3>
  <span style="display: block;">If Hydrocarbon - Check if Piston is clean It is recommended to clean the Exhaust or Muffler for potential build up of dirt or residue</span>
  <span style="display: block;">If Monoxide - Check if the sound of the engine is as clear as before.</span>
  <span style="display: block;">It is recommended to check for engine failures, dirt, and etc.</span>
  <span style="display: block;">Make sure the carburetor is clean.</span>
  <h3>Both</h3>
  <span style="display: block;">Make sure to clean the exhaust of the motorcycle and check for residue</span>
  <span style="display: block;">Check the sound of the engine if it's clear as before</span>
  <span style="display: block;">It is recommended to clean the engine</span>
  <span style="display: block;">Clean the carburetor to have better quality emitted air</span>
  <span style="display: block;">Check the valve for potential failures</span>
  <br>
  <br>
</div>
</div>

</div>

</td>
</table>
</div>
<script>
// Get the modal
var modal = document.getElementById("myModal");

// Get the button that opens the modal

```

```

var btn = document.getElementById("myBtn");

// Get the <span> element that closes the modal
var span = document.getElementsByClassName("close")[0];

// When the user clicks the button, open the modal
btn.onclick = function() {
    modal.style.display = "block";
}

// When the user clicks on <span> (x), close the modal
span.onclick = function() {
    modal.style.display = "none";
}

// When the user clicks anywhere outside of the modal, close it
window.onclick = function(event) {
    if (event.target == modal) {
        modal.style.display = "none";
    }
}
</script>
@endforeach
</div>
</div>
</div>

<script>
/* When the user clicks on the button,
toggle between hiding and showing the dropdown content */
function myFunction() {
    document.getElementById("myDropdown").classList.toggle("show");
}

// Close the dropdown if the user clicks outside of it
window.onclick = function(event) {
    if (!event.target.matches('.dropbtn')) {
        var dropdowns = document.getElementsByClassName("dropdown-content");
        var i;
        for (i = 0; i < dropdowns.length; i++) {
            var openDropdown = dropdowns[i];
            if (openDropdown.classList.contains('show')) {
}

```

```

        }
    }
}

</script>
<div class="user_img_name">
    
    <span>{{ strtok(Auth::user()->name, " ") }}</span>
</div>
<div class="user_img_logout">
    <a href="/logout">Logout</a>
</div>
</div>

<!-- Analytics Content -->
<div class="analytics">
    <div class="grid-container">
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay" style="color: #F16A70;"></span>
            </div>
            <div class="grid-item1-box2">
                <span id="title">Carbon Dioxide</span>
                <span>{{ Auth::user()->carbondioxide }} PPM</span>
            </div>
        </div>
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay-filled" style="color: #F9DC5C;"></span>
            </div>
            <div class="grid-item1-box2">
                <span id="title">Carbon Monoxide</span>
                <span>{{ Auth::user()->carbonmonoxide }} PPM</span>
            </div>
        </div>
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay" style="color: #F96E46;"></span>
            </div>
            <div class="grid-item1-box2">
                <span id="title">Hydrocarbon</span>
            </div>
        </div>
    </div>
</div>

```

```

        <span>{{ Auth::user()->hydrocarbon }} PPM</span>
    </div>
</div>
<div class="grid-item grid-item1" id="grid_color">
    <div class="grid-item1-box1">
        <span class="iconify" data-icon="fa-solid:road" style="color: #80ed99;"></span>
    </div>
    <div class="grid-item1-box2">
        <span id="title">Kilometers</span>
        <span>500 KM</span>
    </div>
</div>
<div class="grid-item grid-item5" id="grid_color">
    <div class="chart" style="height:330px; width: 100%;">
        <canvas id="myChart3">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="averagePpmAnalytics()">
    </script>
</div>
<div class="grid-item grid-item6" id="grid_color">
    <div class="chart" style="height:290px; width: 100%;">
        <canvas id="myChart4">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="barAnalytics()">
    </script>
</div>
<div class="grid-item grid-item7" id="grid_color">
    <div class="summary_log_content">
        <span>Summary log</span>
        <!-- auth()->user()->unreadnotifications as $summarys -->
        @foreach ($summary as $summarys)
            <div class="summary_log">
                <table>
                    <td>
                        <span>{{ $summarys->created_at }}</span>
                        <span>{{ Auth::user()->name }}, You just updated your profile.</span>
                    </td>
                    <!-- <td>
                        <a href="{{ route('markasread', $summarys->id) }}>
                            <div class="markasread">Markasread</div>
                        </a>
                    </td>
                </table>
            </div>
        @endforeach
    </div>
</div>

```

```

        </a>
    </td> -->
</table>
</div>
@endforeach
{{ auth()->user()->notifications()->simplePaginate(2)->links() }}
</div>
</div>
</div>
</div>
</div>
</div>
@endauth

</body>
</html>

```

Javascript File

Contains a code for execution of web pages

```

function carbonDioxide() {
    const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
    async functiongetJSON() {
        const response = await fetch(api_url);
        const data = await response.json();
        const json_file = data.feeds;
        console.log(json_file);

        // 03
        const carbondioxide3 = [];
        // 04
        const carbondioxide4 = [];
        // 08
        const carbondioxide8 = [];
        // 09
        const carbondioxide9 = [];
        // 10
        const carbondioxide10 = [];
        // 11
        const carbondioxide11 = [];
        // 12
        const carbondioxide12 = [];

        for (i = 0; i < json_file.length; i++) {

```

```

        if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
            carbondioxide3.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
            carbondioxide4.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
            carbondioxide8.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
            carbondioxide9.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
            carbondioxide10.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
            carbondioxide11.push(parseFloat(json_file[i].field3));
        }
        if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
            carbondioxide12.push(parseFloat(json_file[i].field3));
        }
    }

    var avgcarbondioxide3 = Math.round(
        carbondioxide3.filter(Number).reduce(function (a, b) {
            return a + b;
        }, 0) / carbondioxide3.length
    );
    var avgcarbondioxide4 = Math.round(
        carbondioxide4.filter(Number).reduce(function (a, b) {
            return a + b;
        }, 0) / carbondioxide4.length
    );
    var avgcarbondioxide8 = Math.round(
        carbondioxide8.filter(Number).reduce(function (a, b) {
            return a + b;
        }, 0) / carbondioxide8.length
    );
    var avgcarbondioxide9 = Math.round(
        carbondioxide9.filter(Number).reduce(function (a, b) {
            return a + b;
        }, 0) / carbondioxide9.length
    );
    var avgcarbondioxide10 = Math.round(

```

```

carbon dioxide10.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbon dioxide10.length
);
var avg carbon dioxide12 = Math.round(
    carbon dioxide12.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / carbon dioxide12.length
);
console.log(avg carbon dioxide8);
console.log(avg carbon dioxide9);
console.log(avg carbon dioxide10);
console.log(avg carbon dioxide12);
const ctx = document.getElementById("myChart").getContext("2d");
Chart.defaults.font.size = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#fff";
const myChart = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Dioxide",
                data: [avg carbon dioxide3, avg carbon dioxide4,
avg carbon dioxide8, avg carbon dioxide9, avg carbon dioxide10, 0, avg carbon dioxide12],
                backgroundColor: ["#fff"],
                borderColor: ["rgb(75, 192, 192)"],
                borderWidth: 1,
                tension: 0.5,
            },
        ],
    },
    options: {
        maintainAspectRatio: false,
    }
});

```

```

        scales: {
          x: {
            grid: {
              display: false,
            },
          },
          y: {
            grid: {
              display: false,
            },
          },
        },
        plugins: {
          legend: {
            display: false,
            labels: {
              color: "rgb(255, 99, 132)",
            },
          },
        },
      },
    });
}
getJSON();
}

function carbonMonoxide() {
  const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
  async function getJSON() {
    const response = await fetch(api_url);
    const data = await response.json();
    const json_file = data.feeds;
    console.log(json_file);

    // 03
    const carbonmonoxide3 = [];
    // 04
    const carbonmonoxide4 = [];
    // 08
    const carbonmonoxide8 = [];
    // 09
    const carbonmonoxide9 = [];
  }
}

```

```

// 10
const carbonmonoxide10 = [];
// 11
const carbonmonoxide11 = [];
// 12
const carbonmonoxide12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        carbonmonoxide3.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        carbonmonoxide4.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        carbonmonoxide8.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        carbonmonoxide9.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        carbonmonoxide10.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        carbonmonoxide11.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        carbonmonoxide12.push(parseFloat(json_file[i].field2));
    }
}
var avgcarbonmonoxide3 = Math.round(
    carbonmonoxide3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide3.length
);
var avgcarbonmonoxide4 = Math.round(
    carbonmonoxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide4.length
);
var avgcarbonmonoxide8 = Math.round(
    carbonmonoxide8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide8.length
);

```

```

        }, 0) / carbonmonoxide8.length
    );
var avgcarbonmonoxide9 = Math.round(
    carbonmonoxide9.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / carbonmonoxide9.length
);
var avgcarbonmonoxide10 = Math.round(
    carbonmonoxide10.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / carbonmonoxide10.length
);
var avgcarbonmonoxide12 = Math.round(
    carbonmonoxide12.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / carbonmonoxide12.length
);
console.log(avgcarbonmonoxide8);
console.log(avgcarbonmonoxide9);
console.log(avgcarbonmonoxide10);
console.log(avgcarbonmonoxide12);
const ctx = document.getElementById("myChart1").getContext("2d");
Chart.defaults.font.size = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#fff";
const myChart1 = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Monoxide",
                data: [avgcarbonmonoxide3, avgcarbonmonoxide4,
avgcarbonmonoxide8, avgcarbonmonoxide9, avgcarbonmonoxide10, 0, avgcarbonmonoxide12],
                backgroundColor: ["#fff"],

```

```

        borderColor: ["rgb(75, 192, 192)"],
        borderWidth: 1,
        tension: 0.5,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: false,
            },
        },
    },
    plugins: {
        legend: {
            display: false,
            labels: {
                color: "rgb(255, 99, 132)",
            },
        },
    },
},
});
}
getJSON();
}

```

```

function hydroCarbon() {
    const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
    async function getJSON() {
        const response = await fetch(api_url);
        const data = await response.json();
        const json_file = data.feeds;
        console.log(json_file);
    }
}

```

// 03

```

const hydrocarbon3 = [];
// 04
const hydrocarbon4 = [];
// 08
const hydrocarbon8 = [];
// 09
const hydrocarbon9 = [];
// 10
const hydrocarbon10 = [];
// 11
const hydrocarbon11 = [];
// 12
const hydrocarbon12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        hydrocarbon3.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        hydrocarbon4.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        hydrocarbon8.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        hydrocarbon9.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        hydrocarbon10.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        hydrocarbon11.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        hydrocarbon12.push(parseFloat(json_file[i].field1));
    }
}
var avghydrocarbon3 = Math.round(
    hydrocarbon3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon3.length
);
var avghydrocarbon4 = Math.round(

```

```

hydrocarbon4.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / hydrocarbon4.length
);
var avghydrocarbon8 = Math.round(
    hydrocarbon8.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / hydrocarbon8.length
);
var avghydrocarbon9 = Math.round(
    hydrocarbon9.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / hydrocarbon9.length
);
var avghydrocarbon10 = Math.round(
    hydrocarbon10.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / hydrocarbon10.length
);
var avghydrocarbon12 = Math.round(
    hydrocarbon12.filter(Number).reduce(function (a, b) {
        return a + b;
}, 0) / hydrocarbon12.length
);

const ctx = document.getElementById("myChart5").getContext("2d");
Chart.defaults.font.size = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#ffff";
const myChart5 = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {

```

```

        label: "Hydrocarbon",
        data: [avghydrocarbon3, avghydrocarbon4, avghydrocarbon8,
avghydrocarbon9, avghydrocarbon10, 0, avghydrocarbon12],
        backgroundColor: ["#fff"],
        borderColor: ["rgb(75, 192, 192)"],
        borderWidth: 1,
        tension: 0.5,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: false,
            },
        },
    },
    plugins: {
        legend: {
            display: false,
            labels: {
                color: "rgb(255, 99, 132)",
            },
        },
    },
},
});
}
getJSON();
}

function averagePpm() {
const ctx1 = document.getElementById("myChart2").getContext("2d");
const myChart2 = new Chart(ctx1, {
    type: "doughnut",
    data: {

```

```
labels: [
    "Monday",
    "Tuesday",
    "Wednesday",
    "Thursday",
    "Friday",
    "Saturday",
    "Sunday",
],
datasets: [
{
    data: [425, 436, 378, 432, 521, 420, 650],
    backgroundColor: [
        "#FFD447",
        "#F5BC00",
        "#EB5C68",
        "#D1233E",
        "#2B50AA",
        "#01BAEF",
        "#16DB93",
    ],
    borderColor: [
        "rgba(255, 99, 132, 0.2)",
        "rgba(255, 159, 64, 0.2)",
        "rgba(255, 205, 86, 0.2)",
        "rgba(75, 192, 192, 0.2)",
        "rgba(54, 162, 235, 0.2)",
        "rgba(153, 102, 255, 0.2)",
        "rgba(201, 203, 207, 0.2)",
    ],
    borderWidth: 1,
    tension: 0.5,
    hoverOffset: 4,
},
],
},
options: {
    maintainAspectRatio: false,
    plugins: {
        legend: {
            display: true,
            labels: {

```

```

        color: "rgb(255,250,250)",
    },
},
},
},
},
);
}
}

function averagePpmAnalytics() {
const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";

async functiongetJSON() {
const response = await fetch(api_url);
const data = await response.json();
const json_file = data.feeds;
const store_created_at = [];
// 03
const hydrocarbon3 = [];
const carbonmonoxide3 = [];
const carbondioxide3 = [];
// 04
const hydrocarbon4 = [];
const carbonmonoxide4 = [];
const carbondioxide4 = [];
// 08
const hydrocarbon8 = [];
const carbonmonoxide8 = [];
const carbondioxide8 = [];
// 09
const hydrocarbon9 = [];
const carbonmonoxide9 = [];
const carbondioxide9 = [];
// 10
const hydrocarbon10 = [];
const carbonmonoxide10 = [];
const carbondioxide10 = [];
// 11
const hydrocarbon11 = [];
const carbonmonoxide11 = [];
const carbondioxide11 = [];
// 12
const hydrocarbon12 = [];
const carbonmonoxide12 = [];

```

```

const carbondioxide12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        hydrocarbon3.push(parseFloat(json_file[i].field1));
        carbonmonoxide3.push(parseFloat(json_file[i].field2));
        carbondioxide3.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        hydrocarbon4.push(parseFloat(json_file[i].field1));
        carbonmonoxide4.push(parseFloat(json_file[i].field2));
        carbondioxide4.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        hydrocarbon8.push(parseFloat(json_file[i].field1));
        carbonmonoxide8.push(parseFloat(json_file[i].field2));
        carbondioxide8.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        hydrocarbon9.push(parseFloat(json_file[i].field1));
        carbonmonoxide9.push(parseFloat(json_file[i].field2));
        carbondioxide9.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        hydrocarbon10.push(parseFloat(json_file[i].field1));
        carbonmonoxide10.push(parseFloat(json_file[i].field2));
        carbondioxide10.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        hydrocarbon11.push(parseFloat(json_file[i].field1));
        carbonmonoxide11.push(parseFloat(json_file[i].field2));
        carbondioxide11.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        hydrocarbon12.push(parseFloat(json_file[i].field1));
        carbonmonoxide12.push(parseFloat(json_file[i].field2));
        carbondioxide12.push(parseFloat(json_file[i].field3));
    }
}
// 3
var avghydrocarbon3 = Math.round(
    hydrocarbon3.filter(Number).reduce(function (a, b) {
        return a + b;
    })
);

```

```

    }, 0) / hydrocarbon3.length
);
var avgcarbonmonoxide3 = Math.round(
  carbonmonoxide3.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbonmonoxide3.length
);
var avgcarbondioxide3 = Math.round(
  carbondioxide3.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbondioxide3.length
);
// 4
var avghydrocarbon4 = Math.round(
  hydrocarbon4.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / hydrocarbon4.length
);
var avgcarbonmonoxide4 = Math.round(
  carbonmonoxide4.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbonmonoxide4.length
);
var avgcarbondioxide4 = Math.round(
  carbondioxide4.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbondioxide4.length
);
// 8
var avghydrocarbon8 = Math.round(
  hydrocarbon8.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / hydrocarbon8.length
);
var avgcarbonmonoxide8 = Math.round(
  carbonmonoxide8.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbonmonoxide8.length
);
var avgcarbondioxide8 = Math.round(
  carbondioxide8.filter(Number).reduce(function (a, b) {
    return a + b;
}, 0) / carbondioxide8.length
);

```

```

);
// 9
var avghydrocarbon9 = Math.round(
    hydrocarbon9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon9.length
);
var avgcarbonmonoxide9 = Math.round(
    carbonmonoxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide9.length
);
var avgcarbondioxide9 = Math.round(
    carbondioxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide9.length
);
// 10
var avghydrocarbon10 = Math.round(
    hydrocarbon10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon10.length
);
var avgcarbonmonoxide10 = Math.round(
    carbonmonoxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide10.length
);
var avgcarbondioxide10 = Math.round(
    carbondioxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide10.length
);
// 11
var avghydrocarbon11 = Math.round(
    hydrocarbon11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon11.length
);
var avgcarbonmonoxide11 = Math.round(
    carbonmonoxide11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide11.length
)

```

```

);
var avgcarbon dioxide11 = Math.round(
    carbondioxide11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide11.length
);
// 12
var avghydrocarbon12 = Math.round(
    hydrocarbon12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon12.length
);
var avgcarbonmonoxide12 = Math.round(
    carbonmonoxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide12.length
);
var avgcarbon dioxide12 = Math.round(
    carbondioxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide12.length
);
const ctx1 = document.getElementById("myChart3").getContext("2d");
Chart.defaults.fontSize = 16;
Chart.defaults.color = "#fff";
const myChart3 = new Chart(ctx1, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Dioxide ",
                data: [
                    14,

```

```
    avgcarbondioxide4,
    avgcarbondioxide8,
    avgcarbondioxide9,
    avgcarbondioxide10,
    0,
    avgcarbondioxide12,
],
backgroundColor: ["#46B3A5"],
borderColor: ["#000000"],
borderWidth: 1,
tension: 0.5,
fill: true,
},
{
label: "Carbon Monoxide",
data: [
33,
avgcarbonmonoxide4,
avgcarbonmonoxide8,
avgcarbonmonoxide9,
avgcarbonmonoxide10,
0,
avgcarbonmonoxide12,
],
backgroundColor: ["#F6D68D"],
borderColor: ["#000000"],
borderWidth: 1,
tension: 0.5,
fill: true,
},
{
label: "HydroCarbon",
data: [
38,
avghydrocarbon4,
avghydrocarbon8,
avghydrocarbon9,
avgcarbonmonoxide10,
0,
avghydrocarbon12,
],
backgroundColor: ["#2c7da0"],
borderColor: ["#000000"],
```

```

        borderWidth: 1,
        tension: 0.5,
        fill: true,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: true,
            },
        },
    },
    plugins: {
        legend: {
            display: true,
            labels: {
                boxWidth: 40,
                color: "#fff",
            },
        },
    },
},
});
}

getJSON();
}

function barAnalytics() {
const ctx1 = document.getElementById("myChart4").getContext("2d");
Chart.defaults.color = "#fff";
Chart.defaults.fontSize = 16;
const myChart3 = new Chart(ctx1, {
    type: "bar",
    data: {

```

```
labels: [
    "Jeongyon",
    "Chaeyoung",
    "Mina",
    "Jiyo",
    "Momo",
    "Tzuyu",
    "Nayeon",
],
datasets: [
    {
        label: "Top 7 Leaderboards",
        data: [325, 436, 578, 632, 721, 820, 920],
        backgroundColor: [
            "#e60049",
            "#0bb4ff",
            "#50e991",
            "#9b19f5",
            "#ffa300",
            "#dc0ab4",
            "#b3d4ff",
        ],
        borderColor: ["#000000"],
        borderWidth: 1,
        tension: 0.5,
        fill: true,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: true,
            },
        },
    },
},
```

```

plugins: {
    legend: {
        display: true,
        labels: {
            boxWidth: 0,
            color: "#fff",
        },
    },
},
},
),
);
}

// Login

const signUpButton = document.getElementById("signUp");
const signInButton = document.getElementById("signIn");
const container = document.getElementById("container");

signUpButton.addEventListener("click", () => {
    container.classList.add("right-panel-active");
});

signInButton.addEventListener("click", () => {
    container.classList.remove("right-panel-active");
});

function reportMessage() {
    const name = document.getElementById("full_name");
    const subject = document.getElementById("subject");
    const message = document.getElementById("message");
    const success = document.getElementById("success");
    const danger = document.getElementById("danger");

    if (name.value == "" || subject.value == "" || message.value == "") {
        danger.style.display = "block";
        success.style.display = "none";
    } else {
        danger.style.display = "none";
        success.style.display = "block";
        alert("The message was successfully sent");
    }
}

```

```

function signup() {
    const password = document.getElementById("password");
    const repeat_password = document.getElementById("repeat_password");
    const name = document.getElementById("name");
    const email = document.getElementById("email");

    if (
        name.value == "" ||
        email.value == "" ||
        password.value == "" ||
        repeat_password.value == ""
    ) {
        alert("Fields is not be empty");
    }
}

function profileBtn() {
    document.getElementById("myDropdown").classList.toggle("show");
    window.onclick = function (event) {
        if (!event.target.matches("#dropbtn")) {
            // to fix
            // var dropdowns = document.getElementsByClassName("dropdown-content");
            var i;
            for (i = 0; i < dropdowns.length; i++) {
                var openDropdown = dropdowns[i];
                if (openDropdown.classList.contains("show")) {
                    openDropdown.classList.remove("show");
                }
            }
        }
    };
}

function notificationBtn() {
    document.getElementById("notificationDropdown").classList.toggle("notshow");
    window.onclick = function (event) {
        if (!event.target.matches("#dropbtn")) {
            // to fix
            // var dropdowns = document.getElementsByClassName("dropdown-content");
            var i;
            for (i = 0; i < dropdowns.length; i++) {
                var openDropdown = dropdowns[i];
            }
        }
    };
}

```

```

        if (openDropdown.classList.contains("show")) {
            openDropdown.classList.remove("show");
        }
    }
};

}

// Initialize and add the map
function initMap() {
    // The location of Uluru
    const uluru = { lat: -25.344, lng: 131.031 };
    // The map, centered at Uluru
    const map = new google.maps.Map(document.getElementById("map"), {
        zoom: 4,
        center: uluru,
    });
    // The marker, positioned at Uluru
    const marker = new google.maps.Marker({
        position: uluru,
        map: map,
    });
}

window.initMap = initMap;

```

Database migration code and visualization

Creating users table for register and sensors in the database.

```

<?php

use Illuminate\Database\Migrations\Migration;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Support\Facades\Schema;

return new class extends Migration
{
    /**
     * Run the migrations.
     *
     * @return void
     */
}
```

```

/*
public function up()
{
    Schema::create('users', function (Blueprint $table) {
        $table->id();
        $table->string('name');
        $table->string('email')->unique();
        $table->timestamp('email_verified_at')->nullable();
        $table->string('contact')->nullable();
        $table->string('birthday')->nullable();
        $table->string('address')->nullable();
        $table->string('vehicle')->nullable();
        $table->string('city')->nullable();
        $table->string('usertype')->nullable();
        $table->string('image_path')->nullable();
        $table->string('platenumber')->nullable();
        $table->float('carbondioxide')->default(0);
        $table->float('carbonmonoxide')->default(0);
        $table->float('hydrocarbon')->default(0);
        $table->integer('avgcarbondioxide')->default(0);
        $table->integer('avgcarbonmonoxide')->default(0);
        $table->integer('avghydrocarbon')->default(0);
        $table->integer('avgppm')->default(0);
        $table->string('password');
        $table->rememberToken();
        $table->timestamps();
    });
}

/**
 * Reverse the migrations.
 *
 * @return void
 */
public function down()
{
    Schema::dropIfExists('users');
}
};

```

MySQL database

Showing rows 0 - 1 (2 total, Query took 0.0017 seconds.) [platenumber: LBQ328 - 123456...]

`SELECT * FROM `users` ORDER BY `platenumber` DESC`

`UPDATE `users` SET `avgppm` = '79' WHERE `users`.`id` = 2;`

	id	name	email	email_verified_at	contact	birthday	address	vehicle	city	usertype	image_path	platenumber	carbondioxide	carbonmonoxide	hydrocarbon	avgcarbondioxide	avgcarbonmonoxide	avghydrocarbon	av
1	2	Llorente, Fernando Llorente	hitatami@gmail.com	NULL	09277007936	1999-04-10	Santos, Pasay City	Yamaha Mio 125 i	Makati	Company	NULL	LBQ328	32.74	97.30	102.00	26	106	105	79
2	1	Patrick Lester Punculan	punculan233@gmail.com	NULL	09162097077	2000-03-17	Ventura Sampaloc Manila	Yamaha Mio 125 i	Ermila	Company	1655137719-Patrick Lester Punculan.jpg	XYZ2213	22.00	105.00	104.00	22	105	104	77

Showing rows 0 - 1 (2 total, Query took 0.0017 seconds.) [platenumber: LBQ328 - 123456...]

`SELECT * FROM `users` ORDER BY `platenumber` DESC`

`UPDATE `users` SET `avp` = '79' WHERE `users`.`id` = 2;`

	id	name	email	email_verified_at	contact	birthday	address	vehicle	city	usertype	image_path	platenumber	carbondioxide	carbonmonoxide	hydrocarbon	avgcarbondioxide	avgcarbonmonoxide	avghydrocarbon	av	remember_token	created_at	updated_at	
1	2	Llorente, Fernando Llorente	hitatami@gmail.com	NULL	09277007936	1999-04-10	Santos, Pasay City	Yamaha Mio 125 i	Makati	Company	NULL	LBQ328	32.74	97.30	102.00	26	106	105	79	\$2y\$10\$9k97NisJe66DFzKUVBSx0sGtbBZJURs7dwmsW...	NULL	2022-06-13 16:30:21	2022-06-13 16:30:21
2	1	Patrick Lester Punculan	punculan233@gmail.com	NULL	09162097077	2000-03-17	Ventura Sampaloc Manila	Yamaha Mio 125 i	Ermila	Company	1655137719-Patrick Lester Punculan.jpg	XYZ2213	22.00	105.00	104.00	22	105	104	77	\$2y\$10\$9k97NisJe66DFzKUVBSx0sGtbBZJURs7dwmsW...	NULL	2022-06-13 16:28:09	2022-06-13 16:28:09

Notification Table

Notify users table that represents by a single class that is stored in the database.

```
<?php

use Illuminate\Database\Migrations\Migration;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Support\Facades\Schema;

return new class extends Migration
{
    /**
     * Run the migrations.
     *
     * @return void
     */
    public function up()
    {
        Schema::create('notifications', function (Blueprint $table) {
            $table->uuid('id')->primary();
            $table->string('type');
            $table->morphs('notifiable');
            $table->text('data');
            $table->timestamp('read_at')->nullable();
            $table->timestamps();
        });
    }

    /**
     * Reverse the migrations.
     *
     * @return void
     */
    public function down()
    {
        Schema::dropIfExists('notifications');
    }
};
```

5.4 Testing of Carbon Sense (CENSE)

In order to determine the accuracy and the functionality of the system, testing of the device, UI, and overall function of the device is necessary. As one of the focus of the project is to have an accurate reading of the data given by the sensors and modules, testing methods are required to achieve this. In terms of functionality, on the other hand, the project objectives should be addressed and achieved. Testing methods that are applied are the gathering of sensor data, the sending of local data (Arduino memory) into the cloud database (Web Database, ThingSpeak), and the notification system of the Web UI, SMS, and E-Mail.

5.4.1 Sensor Testing

The sensor testing is conducted to determine whether the sensors of the device is sensing or gathering the data from the real world. The sensors that are tested are the Carbon sensors (MQ-2, MQ-7, MQ-135) and the GPS sensor, NEO-6M. The accuracy of these sensors is vital in order for the analysis to be correct.

Accuracy

The testing for accuracy was performed by examining three carbon sensors namely: MQ-2 for Hydrocarbon, MQ-7 for Carbon Monoxide, and MQ-135 for Carbon Dioxide. The sensors were calibrated by pre-heating it for at least 8 hours. Once the tested components are functioning properly and calibration was already finished, the designers used a standard gas analyzer called "FGA-4100," which is a commercial device used to measure the concentration of gaseous compound within a mixture of multiple gases.

Figure 5-45. FGA-4100



The accuracy of CENSE device was tested by comparing it to a designed standard gas analyzer. Eight (8) motorcycles are tested in order to compare the accuracy whether it is close to the readings of the standard gas analyzer, which is FGA-4100 that is available in most emission centers in the Philippines.

Model	GAS ANALYZER			CENSE		
	HC	CO	CO2	HC	CO	CO2
Yamaha Aerox	102	0.92	1.2	105	0.98	2.2
Yamaha MIO	175	1.62	1.6	189	1.71	1.8
Honda 125 Stunner	476	0.96	0	554	1.12	0.65
Suzuki Raider R150	118	0.25	1.9	121	0.27	1.9
SYM	3912	5.76	0	3877	5.72	0.43
Honda Click 125i	404	0.44	2.6	419	0.51	2.9
Yamaha MIO Sporty 2017	412	0.72	0	416	0.74	0.12
NZ Yamaha	706	3.02	0	697	2.96	0.23

Table 5-7. CENSE vs. Gas Analyzer carbon reading

The table shows the reading of eight (8) different motorcycle vehicles that is tested and measured by an industry-grade gas analyzer compared to our device, CENSE. It shows a percentage error of only 10-14% which is an acceptable percentage error as per standards of DTI and LTO. The highest recorded Hydrocarbon is the SYM motorcycle while the lowest is the Yamaha Aerox. In CO, the highest remains the SYM and the lowest is Suzuki Raider R150. In CO2, the lowest are Honda 125 Stunner, SYMM, Yamaha Mio Sporty 2017, and NZ Yamaha.

Measuring the geo-location is also important to be at most ~95% accurate. By determining the latitude and longitude, the coordinates will then help the user on where he/she is at that exact point. The accuracy test is as follows. 8 M

```
03:41:17.889 -> Initializing.. Latitude= 14.535563 Longitude= 121.010870
03:41:19.918 -> MQ-2 Data: 205.00
03:41:20.864 -> MQ-7 Data: 142.00
03:41:21.855 -> MQ-135 Data: 39.00
03:41:31.941 -> AT
03:41:31.941 -> OK
03:41:31.988 -> AT+CPIN?
03:41:31.988 -> +CPIN: READY
03:41:31.988 -> OK
```

Figure 5-46. Serial Monitor output on CENSE device testing

According to Arduino's Serial Monitor, latitude value of 14.535563 and longitude value of 121.010870 is received by the device. It was then sent to the real-time database which shows the following location on the Cense:COmon app compared to the actual reading of longitude and latitude value on maps.google.com, a geographic-focused website on determining the actual location of the coordinates on Earth.

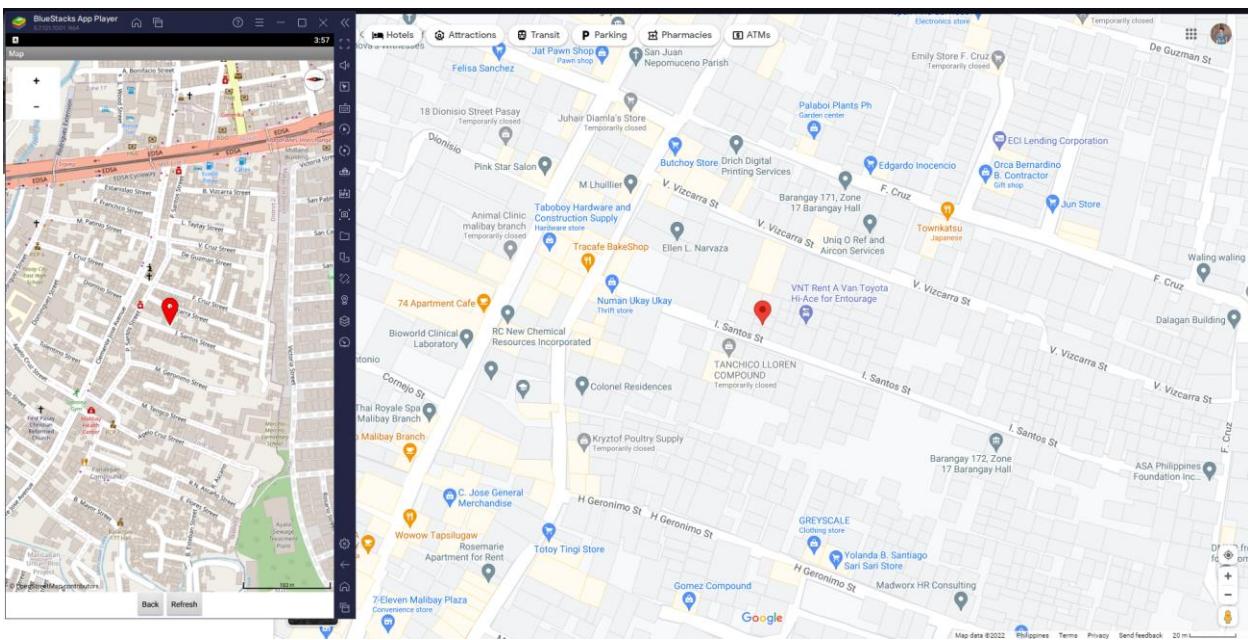


Figure 5-47. Geo-location determined by CENSE – Cense:COmon app (left, experiment), Google Maps (right, actual)

It is safe to say that the coordinates determined by the mobile application is the same as the actual coordinates read by Google Maps. It is safe to assume that the accuracy of the sensor used is around ~98.99%.

Alerts and Notification

To determine whether the device is functioning as intended, the Web UI should notify the user/driver if a certain carbon data exceed the pre-determined threshold limit. The figure below shows that the UI is notifying the user/driver that the Hydrocarbon data has exceeded the threshold limit.

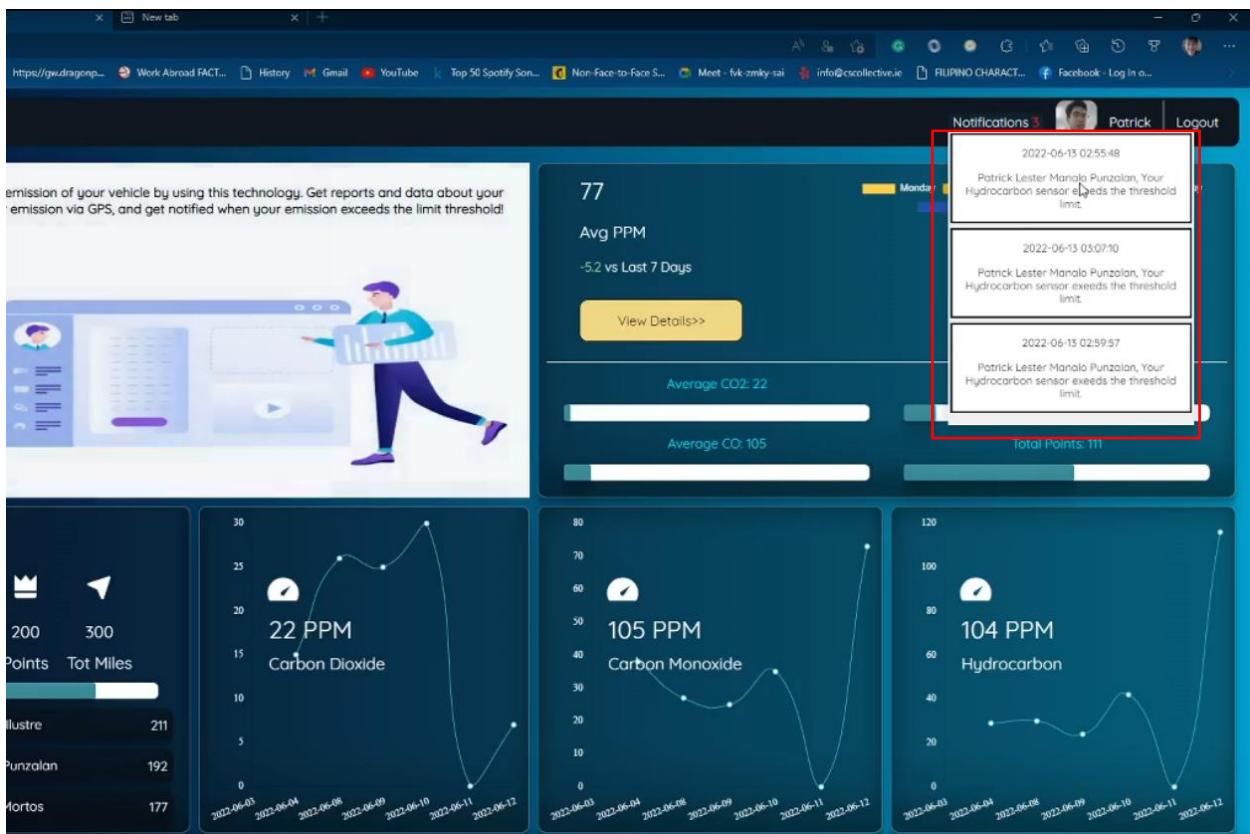


Figure 5-48. Notification has been made on the Cense Web UI

It is seen on the figure above that the notification is made when a certain carbon data has exceeded the threshold limit. Not only that, but SMS should also be sent to the user/driver to ensure proper communication with the user of the device.

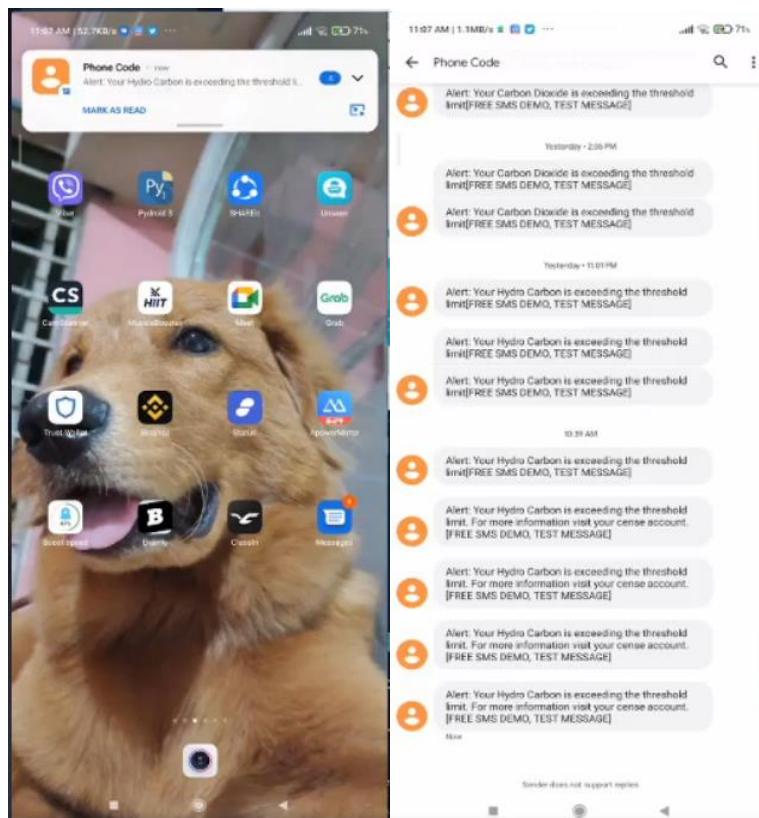


Figure 5-49. The smartphone of the user receiving an alert from Cense

At the figure above, it is demonstrated that the user has received a message from Cense when he/she exceeds the pre-determined threshold of the carbon data.

According to the objective of the project, a solution should be provided to the users/drivers in order to solve the potential anomaly that the motorcycle could be experiencing. The figure below shows the solutions or things to do when a certain carbon data has exceeded the threshold limit. It also shows when both the CO and HC exceeded the threshold limit.

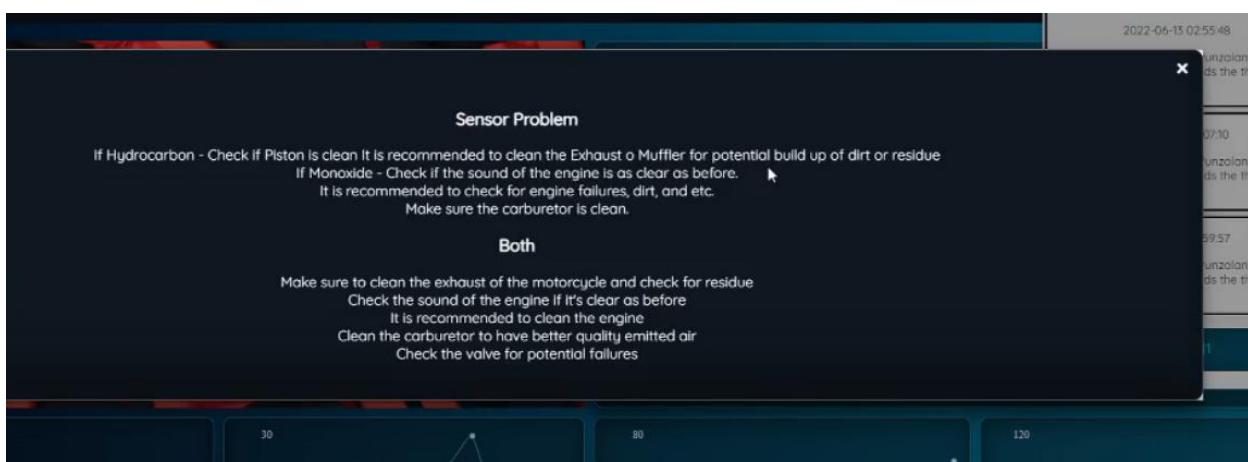


Figure 5-50. Solution window from Cense Web UI

5.5 Assessment of the Attainment of Project Objectives

To properly address the objective, assessment of the attainment of the project objectives is necessary to determine whether the problems are solved, and the objectives are achieved. There are five (5) main objectives of the project. The following is the assessment of each project objective which is then elaborated each.

Project Objective #1 - Measure different factors that contribute to the release of carbon emission through sensors without affecting the components when placed under certain conditions like heat.

Project Objective #1 is properly addressed because according to the testing of carbon sensor data, the accuracy given by the device is almost as accurate as an industry level gas analyzer. Figure below shows actual testing of the device that is running for around 10-15 minutes. The motorcycle in the figure is continuously revved throughout the testing.



Figure 5-51. Actual testing of Cense into Motorcycle

Given the heat emitted by the exhaust and the heat of the environment is at least 33 °C, collectively, around 70-80 °C is felt when close to the exhaust.

Presented below is a Temperature Chart which is in degrees Celsius, the comparison between several parts of the motorcycle and device relative to the time it is presented.

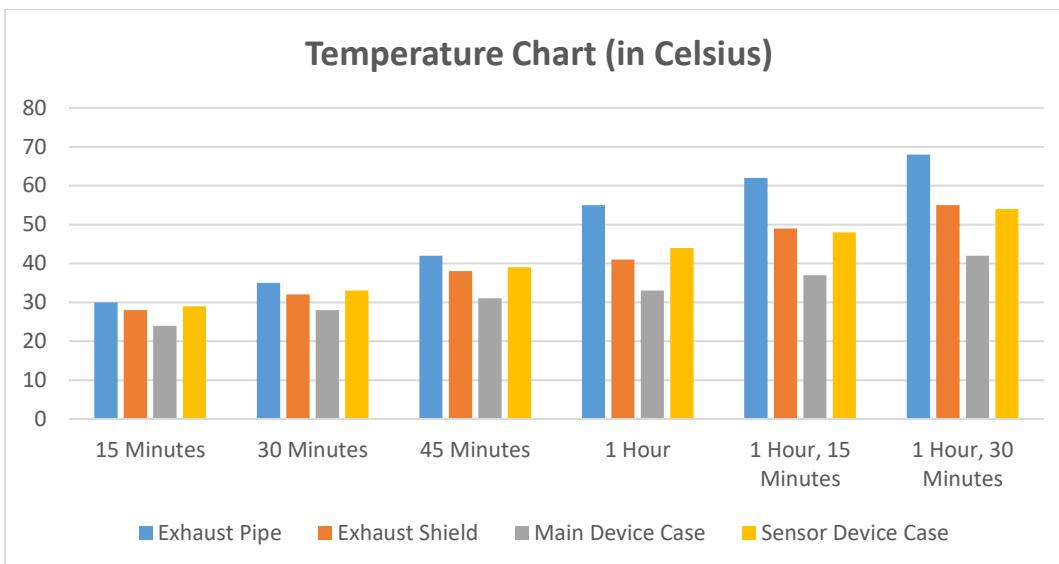


Figure 5-52. Temperature Chart

The chart shows that in the whole 1 hour and 30 minutes of testing, having 15-minute interval temperature check on specific parts of the motorcycle and device, the highest temperature recorded in the 15 minute mark is 30°C while at the near end of the testing, at 1 hour and 30 minutes, the peak temperature hits to 68°C.

Also presented below is a checklist whether if the component is still functional amidst the heat testing made.

	15 Minutes	30 Minutes	45 Minutes	1 Hour	1 Hour, 15 Minutes	1 Hour, 30 Minutes
Arduino Uno Rev 3	Working	Working	Working	Working	Working	Working
NEO 6M GPS	Working	Working	Working	Working	Working	Working
SIM800L GSM	Working	Working	Working	Working	Working	Working
MQ-2 Sensor	Working	Working	Working	Working	Working	Working
MQ-7 Sensor	Working	Working	Working	Working	Working	Working
MQ-135 Sensor	Working	Working	Working	Working	Working	Working

Table 5-8. Component Checklist

As seen on the table, all the components such as the main microcontroller unit, the Arduino Rev 3, remains working throughout the testing. The modules which are the NEO 6M GPS and SIM800L GSM are also working throughout the testing. All of the carbon sensors remains in a working condition as well.

Project Objective #2 - Transmit real-time data to drivers on the measured different carbon compounds like Carbon Monoxide, Carbon Dioxide, and Hydrocarbon.

This project objective is properly addressed because according to the discussion above, real-time data is sent to the Web UI database as well as in the mobile application with the help of ThingSpeak. It is not just

the carbon data that is sent, but also the exact latitude and longitude on where the device is located is also sent to the real-time database. The figure below shows the carbon data sent to the mobile app and Web UI.

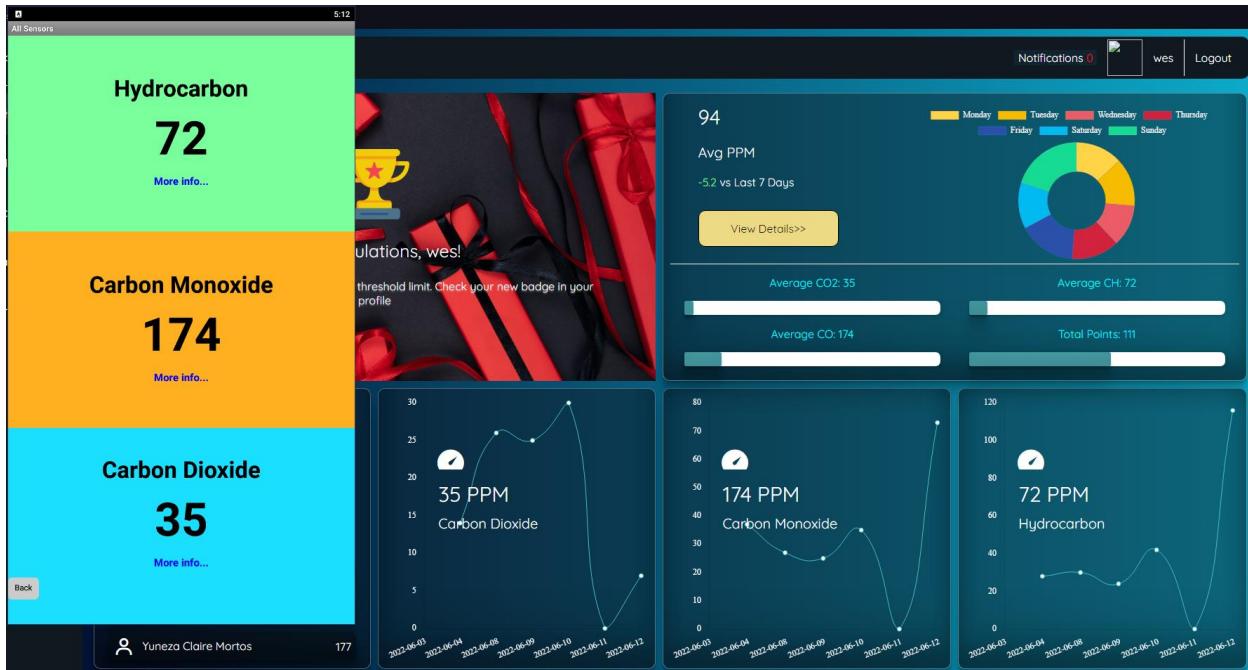


Figure 5-53. The Cense:Common app (far left) shows the same data compared to the Web UI (lower right)

The graph below shows the data sent intervals upon 1 hour and 30 minutes of testing.

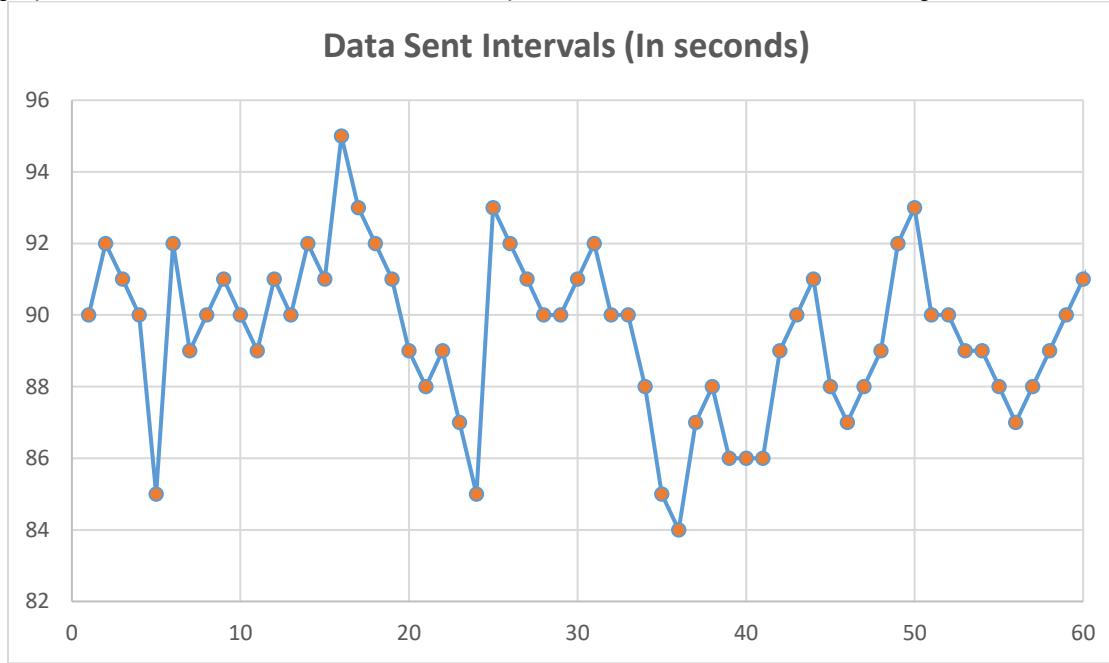


Figure 5-53. Data Sent Intervals

The graph shows the amount of needed in order to send the carbon data and gps data of the device into the cloud database for recording and analysis in the Web UI and Mobile Application. The average sending time

is around 89.53 seconds per data sent which is passable in a GPRS wireless communication environment since standard interval is at 93 seconds per data sent.

Project Objective #3 - Alert users if their emission exceeds the threshold limit.

As discussed on the testing of the project device, it is shown that alerts and notifications are made when the carbon data threshold is exceeded to alert the driver/user whether he/she needs to check the motorcycle or not. Solutions are also provided to help the driver/user on what to do when certain anomaly happens.

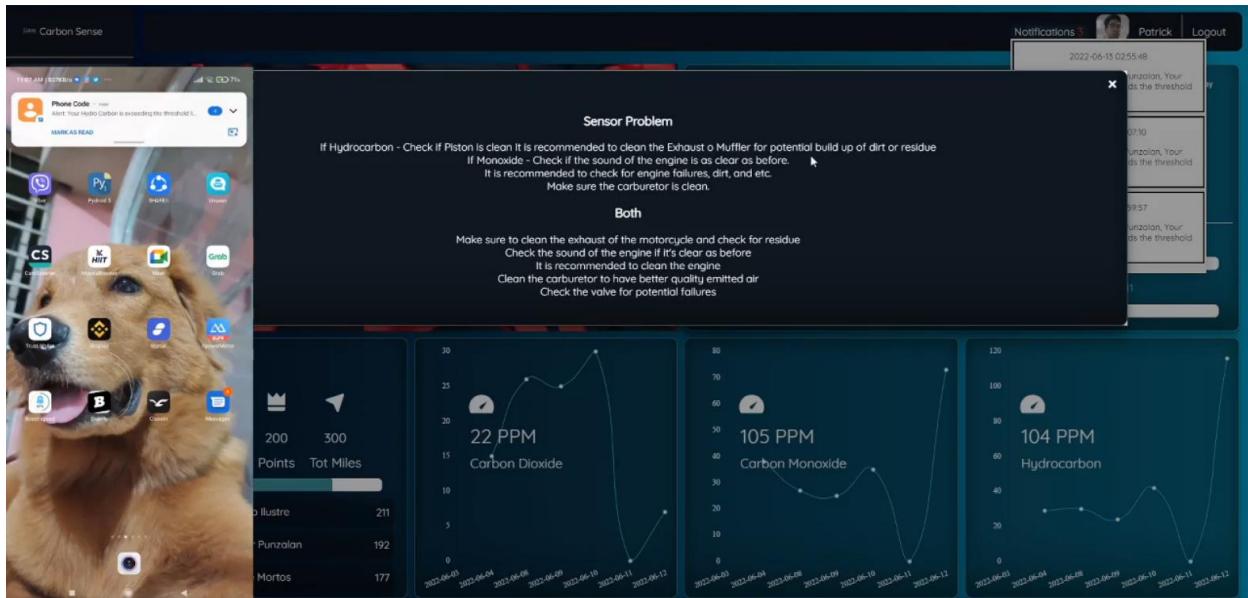


Figure 5-54. The user's mirrored smartphone (far left) received an SMS, notification (right), and solution (middle) when threshold is exceeded.

Project Objective #4 - Create a cost-effective device capable of monitoring the motorcycle's carbon emission level.

The figure above shows the breakeven graph obtained from the cost benefit analysis in the perspective of the drivers. The CBA can be obtained in four (4) stages.

- Stage 1: Identify all relevant cost and benefits over the whole project lifetime.
- Stage 2: Give a monetary value to each.
- Stage 3: Forecast future cost and benefits.
- Stage 4: Compile data and interpret.

The figure below shows the information obtained in stages 1, 2, and 3. In stage 1, both the private and external aspects of cost and benefits are considered. In stage 2, the monetary values are given even the external aspect of the fields. The method used by the designers is shadow pricing to determine the estimate of the cost of each variable. In stage 3, the future cost and benefits are set to at least 5 years in the market. Inflation occurs that is why there is a slight increase in the values of each fields.

Table 5-9. Cost and Benefit Breakdown

	1 st year	2 nd year	3 rd year	4 th year	5 th year
PRIVATE COST					
Device	4600	4700	4800	4900	5000
Power	483.84	503.84	523.84	543.84	563.84
EXTERNAL COST					
Tech Literacy	50	60	70	80	90
PRIVATE BENEFITS					
Prolong quality of motorcycle	5000	5200	5400	5600	5800
EXTERNAL BENEFITS					
Saves driver's time in waiting for emission test	100	110	120	130	140
Environmental awareness	1000	1100	1200	1300	1400

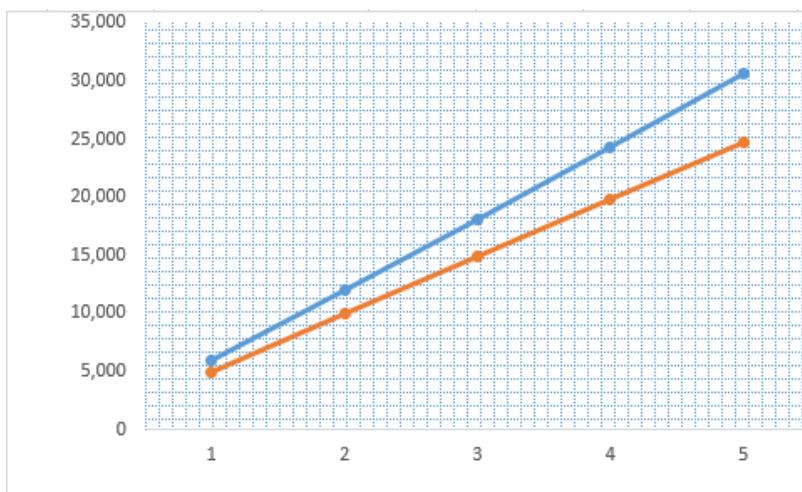
The table shows the total cost and benefit. This also includes the total present value of costs and benefits for 5 years with a 3% interest rate.

Table 5-10. Future Revenues

	1 st year	2 nd year	3 rd year	4 th year	5 th year
Total Costs	5,134	5,264	5,394	5,524	5,654
Present Value	4,984	4,962	4,936	4,908	4,877
Total Present Value	4,984	9,946	14,882	19,790	24,667
Total Benefits	6,100	6,410	6,720	7,030	7,340
Present Value	5,922	6,042	6,150	6,246	6,332
Total Present Value	5,922	11,964	18,114	24,360	30,692

After collecting each total, the breakeven graph is shown to determine the interpretation of the values.

Figure 5-55. Breakeven Analysis



The blue line represents the benefit line while the red line represents the cost line. As shown in the figure, the blue line lies above the red line which interprets that there is Return of Investment (ROI). At the same time, the two lines never cross for this particular project which means that the drivers could immediately recover the money that they spent in buying the CENSE device.

Project objective #5 - Test the accuracy and functionality of the system.

The last, and probably the most important objective of the project is to test the accuracy and functionality of the system. As discussed on the testing, the carbon sensor data is accurately read using the carbon sensors used for the project. The GPS data is also crucial to the accuracy and functionality of the system, as discussed on testing, it accurately located the geo-location of the device. Proper notification is also made whether the carbon data has exceeded the threshold limit. Both the Web UI and Mobile Application are also accessible to the user as well. Figure below shows the welcome screens of both the Web UI and Mobile Application which is free for the users to navigate and utilize.



Figure 5-56. Web UI (left) and CENSE:COmon App (right) ready to be used by users of CENSE

In order to determine whether the accuracy of the carbon data readings are correct, the table below shows the comparison of the reading of CENSE compared to an industry-level gas analyzer (FGA-4100)

Model	GAS ANALYZER			CENSE		
	HC	CO	CO2	HC	CO	CO2
Yamaha Aerox	102	0.92	1.2	105	0.98	2.2
Yamaha MIO	175	1.62	1.6	189	1.71	1.8
Honda 125 Stunner	476	0.96	0	554	1.12	0.65
Suzuki Raider R150	118	0.25	1.9	121	0.27	1.9
SYM	3912	5.76	0	3877	5.72	0.43
Honda Click 125i	404	0.44	2.6	419	0.51	2.9
Yamaha MIO Sporty	412	0.72	0	416	0.74	0.12
2017	706	3.02	0	697	2.96	0.23
NZ Yamaha						

CENSE vs. Gas Analyzer (FGA-4100) carbon reading comparison

According to the table, comparing the Gas Analyzer reading with our system, it is safe to say that around 10-12% of percentage error are only present in the actual testing of accuracy. It is also said in the standard that a testing not more than 20% is viable and applicable in real-life use and reading making CENSE a possible player in the market of gas analysis and reading.

5.6 Summary of Findings

The system of CENSE is designed to help the motorcycle drivers determine the anomalies of their own motorcycles by detecting, sensing, and measuring the Carbons that is emitted by the vehicle. The emission of motorcycles contain several compounds of gas. These gases have their own specific purpose on the mechanism of the motorcycles engine, piston, and several more. By determining the gas emitted, it could be the sign of a certain anomaly on the vehicle. The device of CENSE has modules and components which determines these gases and measures them accurately. It also has a GPS module to determine the location of the driver. Lastly, it has an SMS module that acts as the wireless communication module to transfer the data that is collected from the real world into the device.

Originally, the design has three (3) design options to further elaborate on the differences of each other. Constraints are set on the project to ensure that these constraints are considered before deciding on the final design option. Design Option 1 has MQ-9 as the main sensor for Carbon Monoxide, Arduino Nano BLE as the main microcontroller board, CFRP as the main material for creating the case, and a removable pp3 battery pack. Design Option 2 has the MQ-7 as the main Carbon Monoxide sensor, Arduino Uno Rev3 as the main board, having ABS plastic as the main material in creating the case of the device, and a rechargeable battery pack which has 6000 mAh capacity. Lastly, the Design Option 3 has TGS-203 as the main Carbon Monoxide sensor, Gizduino Uno-SE as the main board, cast carbon steel as the main material for the case, and AA battery pack to power up the device. Ran through various testing and comparison, it has then been decided that among all tests and comparison, relative to the constraints, Design Option 2 reigns as the best design for the project.

Having Design Option 2 as the main device that we will be using, after actual testing when the device is built, it has proven itself as the best option to be considered for this project. Having relatively low percentage of error (less than 20%) on measuring the carbon data is good enough compared to an industry-level gas analyzer which is used for testing and registration of the vehicles in the Philippines. The downside of the present gas analyzers is that it is too bulky, and not modular enough to be used from a place to another place. In talks about the GPS data that is received by the system, it also showed great range of accuracy with a confidence of at least 98.99% in geo-tagging and geo-locating making the Design Option 2 still the best design for this project, CENSE.

In actual testing of the device compared to the industry standard gas analyzer, the accuracy of the device in terms of carbon reading is at 90 – 85% having only 10-15% percentage error in the overall testing. With this, it is safe to say that CENSE is capable on delivering an industry-level standard in reading carbon data that is needed for gas emission tests. Regarding the actual heat testing, the device and the sensor are capable in handling peak temperature of 68 °C because all of the components remain working on the test environment. In conclusion, it is safe to say that all of the objective are met, addressed and achieved.

5.7 Conclusion

To conclude, the proponents were able to properly complete the project considering the variables, objectives, and constraints present. The assessment and testing proved that the project objectives, which states that the device should measure the carbon emitted even under certain circumstances, accurately measure the Carbon data and GPS data, notify the user on certain scenarios such as anomalies, be cost-effective and capable, and be accurate and functional as much as possible, were all successfully achieved by the proponents.

5.8 Recommendations

Provided below is a list that the proponents have considered in order to further improve the design project. List is as follows:

- Measure more compound data such as NOx and NO (chemiluminescence) and O₂ to further expand the potential problems or anomalies of the motorcycle when measured.
- Consider using a better microcontroller board that has more memory, more features that are relevant to the project, while being as compact as possible. ERC32 is a good example.
- While mentioning ERC32 above, it is considered to prefer a much faster wireless communication module for the project because it deals with real-time data. SIM800L is a “passable” wireless communication module but it has certain delays depending on the area. Consider having a module or a board that has a Wi-Fi capability for faster transmission of data.
- The current device of this project is portable enough to be carried around and be attached on the exhaust of the motorcycle but it is recommended to have an even smaller form factor and a lighter one.
- Consider adding a feature on the Web UI that elaborates using of forums, articles, or messaging to further help the user when a potential anomaly is detected due to high numbers of carbon. With this, having a specific model of motorcycle wouldn't be a problem when another user already solved a particular problem and having it posted in the forums.

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APPENDICES

Appendix A:
Survey Form

PRODUCT SURVEY FORM												
#	Product Name	Respondent			Market Competition			Product			Customer Feedback	
		Location	Age	Gender	Price	Affordable	Expensive	Slow	Medium	Fast	Will Purchase	Will not Purchase
1	CENSE	Pasay	54	M	₱458 6	✓				✓	✓	
2		Pasay	32	M		✓				✓	✓	
3		Pasay	27	M		✓				✓	✓	
4		Cavite	42	M		✓				✓	✓	
5		Cavite	21	M		✓				✓	✓	
6		Pasay	41	M		✓				✓	✓	
7		Pasay	25	M		✓				✓	✓	
8		Pasay	31	M		✓				✓	✓	
9		Pasay	39	M		✓				✓	✓	
10		Pasay	23	M			✓			✓	✓	

Appendix B: Source Code

```
gprsSerial.println("AT");
delay(1000);

gprsSerial.println("AT+CPIN?");
delay(1000);

gprsSerial.println("AT+CREG?");
delay(1000);

gprsSerial.println("AT+CGATT?");
delay(1000);

gprsSerial.println("AT+CIPSHUT");
delay(1000);

gprsSerial.println("AT+CIPSTATUS");
delay(2000);

gprsSerial.println("AT+CIPMUX=0");
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CSTT=\"internet.globe.com.ph\"");//start task and setting the APN,
delay(1000);

ShowSerialData();

gprsSerial.println("AT+CIICR");//bring up wireless connection
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CIFSR");//get local IP adress
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CIPSPRT=0");
delay(2000);

ShowSerialData();

gprsSerial.println("AT+CIPSTART=\"TCP\",\"api.thingspeak.com\",\"80\"");
//start up the connection
```

```

delay(5000);

ShowSerialData();

gprsSerial.println("AT+CIPSEND");//begin send data to remote server
delay(3000);
ShowSerialData();

String str="GET https://api.thingspeak.com/update?api_key=V1N1IANBAKGSE538&field1=" +
String(mq2_val) + "&field2=" + String(mq7_val) + "&field3=" + String(mq135_val) + "&field4=" +
String(latitude) + "&field5=" + String(longitude);
Serial.println(str);
gprsSerial.println(str);//begin send data to remote server

delay(4000);
ShowSerialData();

gprsSerial.println((char)26);//sending
delay(4000);//waitting for reply, important! the time is base on the condition of internet
gprsSerial.println();

ShowSerialData();

gprsSerial.println("AT+CIPSHUT");//close the connection
delay(100);
ShowSerialData();
}

}

///////////
void ShowSerialData()
{
while(gprsSerial.available()!=0)
Serial.write(gprsSerial.read());
delay(5000);

}

///////////
void GpsData()
{
//Can take up to 60 seconds
boolean newData = false;
for (unsigned long start = millis(); millis() - start < 2000;){
    while (neogps.available()){
        if (gps.encode(neogps.read())){
            newData = true;
            break;
        }
    }
}
}

```

```

        }
    }
}

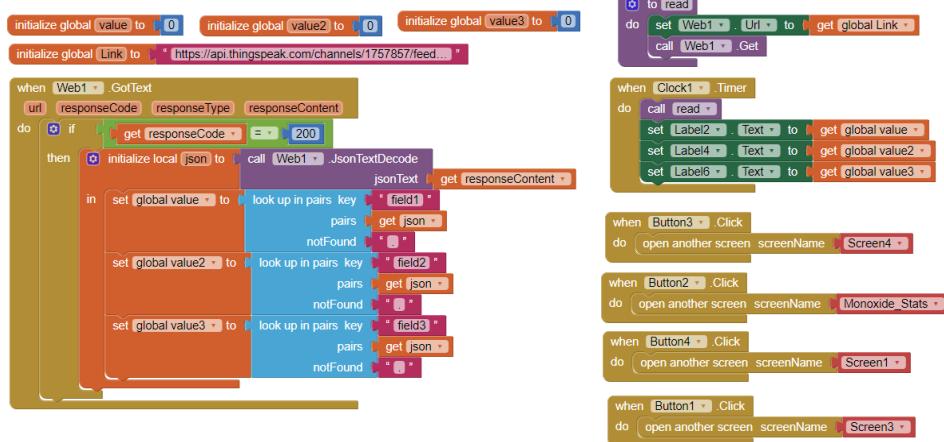
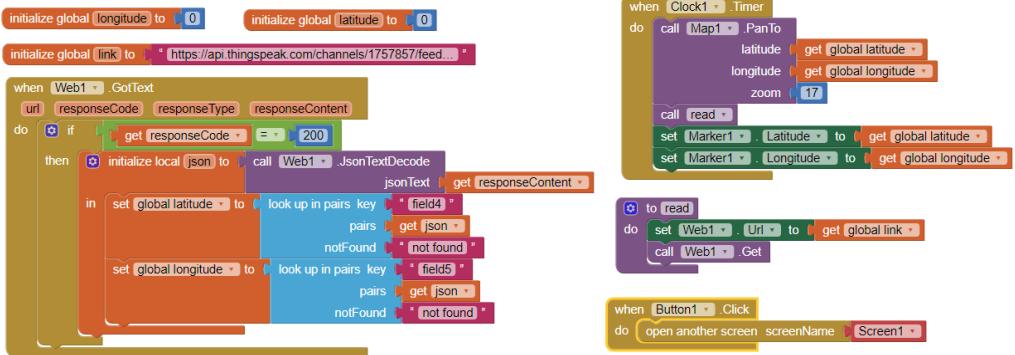
//If newData is true
if(true){
    newData = false;

    String latitude, longitude;
    float altitude;
    unsigned long date, time, speed, satellites;

    latitude = String(gps.location.lat(), 6); // Latitude in degrees (double)
    longitude = String(gps.location.lng(), 6); // Longitude in degrees (double)
    altitude = gps.altitude.meters(); // Altitude in meters (double)
    date = gps.date.value(); // Raw date in DDMMYY format (u32)
    time = gps.time.value(); // Raw time in HHMMSSCC format (u32)
    speed = gps.speed.kmph();

    Serial.print("Latitude= ");
    Serial.print(latitude);
    Serial.print(" Longitude= ");
    Serial.println(longitude);
}
}

```



```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Carbon Sense</title>
  <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}>
  <!-- Boxicons CDN Link -->
  <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
```

```

<!-- w3schools Link -->
<link rel="stylesheet"
      href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
<!-- ChartJS -->
<script
      src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
<!-- Google Fonts -->
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link
      href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap"
      rel="stylesheet">
<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>

<body class="home_img">

<div class="navbar" id="navbar_home">
  <ul>
    <li id="active"><a href="/">Home</a></li>
    <li><a href="/features">Features</a></li>
    <li><a href="/aboutus">About Us</a></li>
    <li><a href="/register">Register</a></li>
    <li><a href="/login">Login</a></li>
  </ul>
</div>

<div class="title_align">

  <div id="title">
    <span>Carbon Sense Technology</span>
  </div>

  <div id="title_info">
    <span>
      A technology that measures and monitors the carbon levels, Carbon Monoxide, Carbon Dioxide, and Hydrocarbon of motorcycles.
    </span>
    <br>
    <span id="title_info_help">Help fight climate change now!</span>
  </div>
</div>

```

```

        </p>
    </div>

    <br>
    <br>

    <div class="learn_how">
        <a href="/features">LEARN HOW!</a>
    </div>

</div>

</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}"/>
    <!-- Boxicons CDN Link -->
    <link href="https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css"
          rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}"/>

</head>
<body class="features_body_color">
    <div class="navbar3">

```

```

<ul>
    <li id ="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
    <div class="nav_hover">
        <li><a href="/">Home</a></li>
        <li id="active"><a href="/features">Features</a></li>
        <li><a href="/aboutus">About Us</a></li>
        <li><a href="/register">Register</a></li>
        <li><a href="/login">Login</a></li>
    </div>
</ul>
</div>
<div class="features_content">
    <div class="align_content">
        <div class="box_img" id="margin_box">
            
        </div>
        <div class="box_img" id="margin_box1">
            
        </div>
    </div>
    <div class="title_fight">
        <span>Together we cease the climate change! </span>
    </div>
    <div class="title_measure">
        <span>MEASURE YOUR EMISSION NOW!</span>
    </div>
    <div class="title_monitor">
        <span>Monitor the carbon emission of your motorcycle by using
            this technology. Get reports and data </span>
        <span>about your emission, receive normally feedbacks of your
            motorcycle, and get notified when your emission</span>
        <span>exceeds the limit threshold!</span>
    </div>
    <div class="features_activity">
        <div class="monitor">
            <i class='bx bx-search-alt'></i>
            <span>Monitor</span>
        </div>
        <div class="monitor">
            <i class='bx bx-bar-chart-square'></i>
            <span>Measure</span>
        </div>
    </div>

```

```

<div class="monitor">
    <i class='bx bxs-report' ></i>
    <span>Report</span>
</div>
<div class="monitor">
    <i class='bx bxs-bell-ring'></i>
    <span>Notification</span>
</div>
<div class="monitor">
    <i class='bx bx-list-check' ></i>
    <span>Feedback</span>
</div>
</div>
</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8" >
    <meta http-equiv="X-UA-Compatible" content="IE=edge" >
    <meta name="viewport" content="width=device-width, initial-scale=1.0" >
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script
        src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js">
    </script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">

```

```

<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-
logos.jpeg')}}">

</head>
<body class="features_body_color">
<div class="navbar3">
<ul>
<li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
<div class="nav_hover">
<li><a href="/">Home</a></li>
<li><a href="/features">Features</a></li>
<li id="about_us_active"><a href="/aboutus">About Us</a></li>
<li><a href="/register">Register</a></li>
<li><a href="/login">Login</a></li>
</div>
</ul>
</div>

<div class="about_us">
<div class="about_us_title">
<span id="margin_title" >About Us</span>
<div class="meeting">
<div class="meeting_content" id="meeting_content_description">
<span style="text-align: justify; letter-spacing: 2px;">We are the
Carbon Sense Team. This website will use to record continuous
CO2 and CO of direct atmospheric measurements using high-
precision instrument. DON'T BE A FOSSIL FOOL.</span>
</div>
<div class="meeting_content">

</div>
</div>
</div>
<div class="auvideo_content">
<div class="video_title">
<span>Introducing The GHG Emission Solutions For Motorcycles</span>
</div>
<div class="video_content">
<div class="video_file">
<video width="600" height="100%" controls>
<source src="{{asset('photos/project.mp4')}}" type="video/mp4">

```

```

Your browser does not support HTML5 video.
</video>
</div>
<div class="video_details">
  <div class="video_details_title">
    <h2>CARBON SENSE</h2>
    <small style="text-align: center;">A Real-time Monitoring of
      Carbon Emission from Motorcycle Vehicles using IoT.</small>
  </div>
  <p style="text-indent: 20px;">The IoT provides opportunity not
only for creation of new businesses and investments, but for
reduction of carbon emissions. It enables production of highly
automated and connected vehicles that change the global
automotive market.
  </p>
  <h2>Real Time Monitoring</h2>
  <p style="text-indent: 20px;">Relays the active and ongoing
status of your motorcycle. Display relevant data on our
customizable dashboards.</p>
  <h2>Easy to use</h2>
  <p style="text-align: center;">Fast and easy to use software and
hardware.</p>
</div>
</div>
</div>
<div class="team_content">
  <div class="meet_the_team">
    <span>Meet Our Team</span>
  </div>
  <div class="team_img">
    <div class="team_img_border" id="team_img_border1">
      
    <div class="team_img_content">
      <span id="title">carbon sense technology</span>
      <span id="focus">Software and Hardware
        Developer</span>
      <span id="team_img_name">Lois Fernando Ilustre</span>
      <span id="about_you" style="letter-spacing: 3px;">Hi! my name
        is Lois Fernando Ilustre. I'm a student of Technological Institute of
        the Philippines. I took up Computer Engineering Course as a career and
        major in DataScience.</span>
      <span id="team_img_name" >Contact Us </span>
    </div>
  </div>
</div>

```

```

<span id="team_img_name" style="font-size: 18px; border-
    bottom: 1px solid black">With Our Social Media
Accounts</span>
<a href="https://www.facebook.com/IamLoisBro" target="_blank"
    class="fa fa-facebook"></a>
<a href="https://twitter.com/ImLoisBro" target="_blank"
    class="fa fa-twitter"></a>
<a href="https://www.instagram.com/imloisbro/" target="_blank"
    class="fa fa-instagram"></a>
</div>
</div>
<div class="team_img_border" id="team_img_border2">

<div class="team_img_content">
<span id="title">carbon sense technology</span>
<span id="focus">Software and Hardware
    Developer</span>
<span id="team_img_name">Yuneza Claire Mortos</span>
<span id="about_you" style="letter-spacing: 3px;">Hi! my name
    is Yuneza Claire Mortos. I'm a student of Technologic
al Institute of the Philippines. I took up Computer
    Engineering Course as a career and major in
    DataScience.</span>
<span id="team_img_name" >Contact Us </span>
<span id="team_img_name" style="font-size: 18px; border-
    bottom: 1px solid black">With Our Social Media
Accounts</span>
<a href="https://www.facebook.com/wagyuneza" target="_blank"
    class="fa fa-facebook"></a>
<a href="https://twitter.com/yonessaur" target="_blank"
    class="fa fa-twitter"></a>
</div>
</div>
<div class="team_img_border" id="team_img_border3">

    target="_blank" alt="patrick.png">
<div class="team_img_content">
<span id="title">carbon sense technology</span>
<span id="focus">Software and Hardware
    Developer</span>
<span id="team_img_name">Patrick Lester M. Punzalan</span>

```

```

<span id="about_you" style="letter-spacing: 3px;">Hi! my name is Patrick
Lester Punzalan. I'm a student of Technological Institute of the
Philippines. I took up Computer Engineering Course as a career and
major in DataScience.</span>
<span id="team_img_name" >Contact Us</span>
<span id="team_img_name" style="font-size: 18px; border-
bottom: 1px solid black">With Our Social Media
Accounts</span>
<a href="https://www.facebook.com/patwickku/" target="_blank"
class="fa fa-facebook"></a>
<a href="https://twitter.com/patwickku" target="_blank"
class="fa fa-twitter"></a>
<a href="https://www.instagram.com/patwickku/" target="_blank"
class="fa fa-instagram"></a>
</div>
</div>
</div>
</div>

<div>
<br>
</div>
<div>
<br>
</div>

</div>
</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}"/>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/login.css') }}"/>
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css'
        rel='stylesheet'>
    <!-- w3schools Link -->

```

```

<link rel="stylesheet"
      href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
<!-- ChartJS -->
<script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
<!-- Google Fonts -->
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
<!-- Login -->
<link href="https://fonts.googleapis.com/css?family=Montserrat&display=swap" rel="stylesheet">
<link rel="stylesheet"
      href="https://use.fontawesome.com/releases/v5.8.2/css/all.css"
      integrity="sha384-oS3vJWv+0UjzBfQzYUhtDYW+Pj2yciDJxpsK1OYPAYjqT085Qq/1cq5FLXAZQ7Ay"
      crossorigin="anonymous">
<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">

</head>
<body class="features_body_color">
  <div class="navbar3">
    <ul>
      <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
      <div class="nav_hover">
        <li><a href="/">Home</a></li>
        <li><a href="/features">Features</a></li>
        <li><a href="/aboutus">About Us</a></li>
        <li id="active"><a href="/register">Register</a></li>
        <li><a href="/login">Login</a></li>
      </div>
    </ul>
  </div>
  <div class="login_content">
    <div class="login_margin">
      <div class="container" id="container">
        <div class="form-container sign-in-container">
          <form action="/register" method="POST" class="login_form">
            @csrf

```

```

<h1>Create Account</h1>
<input class="login_input" type="text" name="name"
placeholder="Full Name" id="full_name" required />
@error('name')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="email"
placeholder="Email" id="email" required/>
@error('email')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="contact"
placeholder="Contact" id="contact" required/>
@error('contact')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="birthday"
placeholder="Date of birth" onfocus="(this.type='date')" id="birthday" >
@error('birthday')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="address"
placeholder="Address" id="address" required/>
@error('address')
<div class="form_error">
{{ $message }}
</div>
@enderror
<input class="login_input" type="text" name="vehicle"
placeholder="Vehicle" id="vehicle" required/>
@error('vehicle')
<div class="form_error">
{{ $message }}
</div>
@enderror

```

```

<select class="login_input" type="text" name="city"
placeholder="City" id="city" style="width: 100%; height: 45px; background-
color: #eee; border: none; padding: 12px 15px; margin: 8px 0;" required>
    <option value="">Select City</option>
    <option value="Caloocan">Caloocan</option>
    <option value="Calumpang">Calumpang</option>
    <option value="Dasmariñas Village">Dasmariñas
        Village</option>
    <option value="Ermita">Ermita</option>
    <option value="Intramuros">Intramuros</option>
    <option value="Las Piñas">Las Piñas</option>
    <option value="Makati">Makati</option>
    <option value="Malabon">Malabon</option>
    <option value="Malate">Malate</option>
    <option value="Mandaluyong">Mandaluyong</option>
    <option value="Manila">Manila</option>
    <option value="Marikina">Marikina</option>
    <option value="Muntinlupa">Muntinlupa</option>
    <option value="National Capital Region">National
        Capital Region</option>
    <option value="Navotas">Navotas</option>
    <option value="Niugan">Niugan</option>
    <option value="Paco">Paco</option>
    <option value="Pandacan">Pandacan</option>
    <option value="Parañaque">Parañaque</option>
    <option value="Pasay">Pasay</option>
    <option value="Pasig">Pasig</option>
    <option value="Pateros">Pateros</option>
    <option value="Port Area">Port Area</option>
    <option value="Quezon City">Quezon City</option>
    <option value="Quiapo">Quiapo</option>
    <option value="Sambayanihan People's
        Village">Sambayanihan People's Village</option>
    <option value="San Juan">San Juan</option>
    <option value="San Miguel">San Miguel</option>
    <option value="Santa Ana">Santa Ana</option>
    <option value="Santa Cruz">Santa Cruz</option>
    <option value="Singkamas">Singkamas</option>
    <option value="Taguig">Taguig</option>
    <option value="Tanza">Tanza</option>
    <option value="Tanza">Tanza</option>
    <option value="Tondo">Tondo</option>
    <option value="Valenzuela">Valenzuela</option>

```

```

        </select>
        @error('city')
        <div class="form_error">
            {{ $message }}
        </div>
        @enderror
        <select class="login_input" type="text" name="usertype"
placeholder="User Type" id="usertype" style="width: 100%; height: 45px;
background-color: #eee; border: none; padding: 12px 15px; margin: 8px 0;" required >
            <option value="" style="color: green; font-weight: bold;">>User
Type</option>
            <option value="Company">Company</option>
            <option value="Self">Self</option>
        </select>
        @error('usertype')
        <div class="form_error">
            {{ $message }}
        </div>
        @enderror
        <input class="login_input" type="text" name="platenumber"
placeholder="Vehicle Plate Number" id="platenumber" required/>
        @error('platenumber')
        <div class="add_errors">
            {{ $message }}
        </div>
        @enderror
        <input class="login_input" type="password" name="password"
placeholder="Password" id="password" required/>
        <input class="login_input" type="password"
name="password_confirmation" placeholder="Repeat your password"
id="repeat_password" for="password_confirmation" required/>

        @error('password')
        <div style="margin-top: 10px; color: red; margin-
bottom:10px;">
            {{ $message }}
        </div>
        @enderror
        <button onclick="signup()">Sign Up</button>
        @error('repeat_password')
        <div style="margin-top: 10px; color: red;">
            {{ $message }}
        </div>
    
```

```

        </div>
    @enderror
    @if(\Session::has('success'))
        <div class="register-success">
            {{ \Session::get('success') }}
        </div>
    @endif
    </form>
</div>
<div class="overlay-container">
    <div class="overlay">
        <div class="overlay-panel overlay-left">
            <h1>Welcome Back!</h1>
            <p>Enter your personal details and start your carbon journey
                with us!</p>
            <button class="ghost" id="signIn">Sign In</button>
        </div>
        <div class="overlay-panel overlay-right">
            <h1>Hello, Friend!</h1>
            <p>Enter your personal details and start your carbo journey
                with us!</p>
            <a href="/login"><button class="ghost">SignIn</button></a>
        </div>
    </div>
</div>
<script type="text/javascript" src="{{ asset('js/index.js') }}" >
</script>
</div>
</div>
</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">

```

```

<title>Carbon Sense</title>
<link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
<link rel="stylesheet" type="text/css" href="{{ asset('css/login.css') }}">
<!-- Boxicons CDN Link -->
<link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
<!-- w3schools Link -->
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
<!-- ChartJS -->
<script
    src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
<!-- Google Fonts -->
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
<!-- Login -->
<link href="https://fonts.googleapis.com/css?family=Montserrat&display=swap" rel="stylesheet">
<link rel="stylesheet"
      href="https://use.fontawesome.com/releases/v5.8.2/css/all.css" integrity="sha384-oS3vJWv+0UjzBfQzYUhtDYW+Pj2yciDJxpsK10YPAYjqT085Qq/1cq5FLXAZQ7Ay" crossorigin="anonymous">
<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>
<body class="features_body_color">
    <div class="navbar3">
        <ul>
            <li id="carbon_sense" style="float: left; margin-left: 20px;"><a href="/" style="font-size: 30px;">Carbon Sense Technology</a></li>
            <div class="nav_hover">
                <li><a href="/">Home</a></li>
                <li><a href="/features">Features</a></li>
                <li><a href="/aboutus">About Us</a></li>
                <li><a href="/register">Register</a></li>
                <li id="active"><a href="/login">Login</a></li>
            </div>
        </ul>
    </div>
    <div class="login_content">
        <div class="login_margin">

```

```

<div class="container" id="container">
    <div class="form-container sign-up-container">
        </div>
    <div class="form-container sign-in-container">
        <form method="POST" action="/login">
            @csrf
            <h1>Sign in</h1>
            <div class="social-container">
                <a href="#" class="social"><i class="fab fa-facebook-f"></i></a>
                <a href="#" class="social"><i class="fab fa-google-plus-g"></i></a>
                <a href="#" class="social"><i class="fab fa-linkedin-in"></i></a>
            </div>
            <span>or use your account</span>
            <input type="email" name="email"
                   placeholder="Email" />
            @error('email')
                <div style="margin-top: 10px; color: red;
                           margin-bottom: 10px;">
                    {{ $message }}
                </div>
            @enderror
            <input type="password" name="password"
                   placeholder="Password"
                   id="password"/> @error('password')
                <div style="margin-top: 10px; color: red;
                           margin-bottom: 10px;">
                    {{ $message }}
                </div>
            @enderror
            <a href="#">Forgot your password?</a>
            <button>Sign In</button>

            @if (session('status'))
                <div style="color: red; margin-top: 10px;">
                    {{ session('status') }}
                </div>
            @endif

        </form>
    </div>

```

```

<div class="overlay-container">
  <div class="overlay">
    <div class="overlay-panel overlay-left">
      <h1>Welcome Back!</h1>
      <p>To keep connected with us please login with your personal info</p>
      <button class="ghost" id="signIn">Sign In</button>
    </div>
    <div class="overlay-panel overlay-right">
      <h1>Hello, Friend!</h1>
      <p>Sign in to keep our carbon-carbon bond strong!</p>
      <a href="/register"><button class="ghost">Sign Up</button></a>
    </div>
  </div>
  <script type="text/javascript" src="{{ asset('js/index.js') }}">
    </script>
  </div>
</div>
</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Carbon Sense</title>
  <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}">
  <!-- Boxicons CDN Link -->
  <link href="https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css" rel='stylesheet'>
  <!-- w3schools Link -->
  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
  <!-- ChartJS -->

```

```

<script
  src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
<!-- Google Fonts -->
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
<!-- JS Script -->
<script src="{{ asset('js/index.js') }}"></script>

<link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}">
</head>
@auth
<body id="dashboard_color">

<div class="sidebar">
  <div class="name_logo">
    <a href="/welcome" style="font-size: 15px; color: white;">
      </img>
      Carbon Sense
    </a>
  </div>
  <a class="active" href="/welcome" id="sidebar_hover">
    <i class='bx bxs-dashboard'></i>
    Dashboard</a>
  <a href="/analytics" id="sidebar_hover">
    <i class='bx bxs-chart'></i>
    Analytics
  </a>
  <a href="/location" id="sidebar_hover">
    <i class='bx bx-current-location'></i>
    Location
  </a>
  <a href="/emailus" id="sidebar_hover">
    <i class='bx bx-envelope'></i>
    Email Us
  </a>
  <a href="/useraccount" id="sidebar_hover">
    <i class='bx bx-user'></i>
    User Account
  </a>
</div>

```

```

</div>

<div class="content">
  <div class="navbar">
    <div class="dropdown">
      <button onclick="myFunction()" class="dropbtn">Notifications
        <span style="color: red;">{{ auth()->user()->unreadNotifications->count() }}</span>
      </button>
      <div id="myDropdown" class="dropdown-content">
        <div id="notificationDropdown" class="notification-content">
          @foreach ($summary as $summary)
            <div class="notification_css">
              <table>
                <td>
                  <button id="myBtn" style ="background-color: white;">
                    <p>{{ $summary->created_at }}</p>
                    <p>{{ Auth::user()->name }}, Your Hydrocarbon sensor exceeds the threshold limit.</p>
                  </button>
                </td>
              </table>
            </div>
          @endforeach
        </div>
      </div>
    </div>
  </div>
<!-- The Modal -->
<div id="myModal" class="modal">

  <!-- Modal content -->
  <div class="modal-content">
    <div class="modal-header" style="text-align: center;">
      <span class="close">&times;</span>
      <h4 style="text-align: center; letter-spacing: 6px; color: rgba(16, 24, 32, 0.468)">Sensor Alert</h4>
    <h3>Sensor Problem</h3>
    <span style="display: block;">If Hydrocarbon - Check if Piston is clean It is recommended to clean the Exhaust o Muffler for potential build up of dirt or residue</span>
    <span style="display: block;">If Monoxide - Check if the sound of the engine is as clear as before.</span>
    <span style="display: block;">It is recommended to check for engine failures, dirt, and etc.</span>
    <span style="display: block;">Make sure the carburetor is clean.</span>
    <h3>Both</h3>
    <span style="display: block;">Make sure to clean the exhaust of the motorcycle and check for residue</span>
  </div>
</div>

```

```

<span style="display: block;">Check the sound of the engine if
it's clear as before</span>
<span style="display: block;">It is recommended to clean the
engine</span>
<span style="display: block;">Clean the carburetor to have better
quality emitted air</span>
<span style="display: block;">Check the valve for potential
failures</span>
<br>
<br>
</div>
</div>

</div>

</td>
<!-- <td>
    <a href="{{ route('markasread', $summarys->id) }}">
        <div class="markasread">Markasread</div>
    </a>
</td> -->
</table>
</div>
<script>
// Get the modal
var modal = document.getElementById("myModal");

// Get the button that opens the modal
var btn = document.getElementById("myBtn");

// Get the <span> element that closes the modal
var span = document.getElementsByClassName("close")[0];

// When the user clicks the button, open the modal
btn.onclick = function() {
    modal.style.display = "block";
}

// When the user clicks on <span> (x), close the modal
span.onclick = function() {
    modal.style.display = "none";
}

```

```

    // When the user clicks anywhere outside of the modal, close it
    window.onclick = function(event) {
        if (event.target == modal) {
            modal.style.display = "none";
        }
    }
    </script>
@endforeach
</div>
</div>
</div>

<script>
/* When the user clicks on the button,
toggle between hiding and showing the dropdown content */
function myFunction() {
    document.getElementById("myDropdown").classList.toggle("show");
}

// Close the dropdown if the user clicks outside of it
window.onclick = function(event) {
    if (!event.target.matches('.dropbtn')) {
        var dropdowns = document.getElementsByClassName("dropdown-content");
        var i;
        for (i = 0; i < dropdowns.length; i++) {
            var openDropdown = dropdowns[i];
            if (openDropdown.classList.contains('show')) {
            }
        }
    }
}
</script>
<div class="user_img_name">
    
    <span>{{ strtok(Auth::user()->name, " ") }}</span>
</div>
<div class="user_img_logout">
    <a href="/logout">Logout</a>
</div>
</div>

<div class="analytics">
    <div class="dashboard-grid-container">

```

```

<div class="dashboard-grid-item dashboard-grid-item-1" id="grid_color_first">
  <div id="align">
    <div class="slideshow-container">
      <div class="mySlides fade">
        <!-- <div class="numbertext">1 / 3</div> -->
        <div class="grid_image-1">
          <span>
        </span>
        <p style="font-size: 25px;">Congratulations, {{ strtok(Auth::user()->name, " ") }}!</p>
        <p style="color: #FFF; text-shadow: 0px 2px 2px rgba(255, 255, 255, 0.4); ">You have emitted less carbon than the threshold limit. Check your new badge in your profile</p>
      </div>
    </div>

    <div class="mySlides fade">
      <!-- <div class="numbertext">2 / 3</div> -->
      <div class="grid_image-2">
        <p>We continue to adapt and evolve our project model to ensure that we are meeting our customer's expectations. One example of this has been the use of modern technology and the introduction of the real-time tracking of GHG using sensors. It has the features that are useful to combat climate change in regards to technology.</p>
      </div>
    </div>

    <div class="mySlides fade">
      <!-- <div class="numbertext">3 / 3</div> -->
      <div class="grid_image-3">
        <p>Fact</p>
        <span>To save most of humanity from extinction before it's impossible, at this 11th hour we must execute history's largest government-enforced mass mobilization of resources to get close to the 2025 targets. </p>
        <span>If our governments fail to get us close to the 2025 targets, our focus must shift to minimizing fatalities for as long as possible as well as planning for a massive population loss and a sudden global decline.</p>
      </div>
    </div>

```

```

<div class="mySlides fade">
<!-- <div class="numbertext">3 / 3</div> -->
<div class="grid_image-4">
    <p>Monitor the carbon emission of your vehicle by using this
        technology. Get reports and data
        about your emission, track your emission via GPS, and get
        notified when your emission exceeds
        the limit threshold!</p>
    
</div>
</div>
</div>
<br>

<div style="text-align:center">
<span class="dot"></span>
<span class="dot"></span>
<span class="dot"></span>
<span class="dot"></span>
<span class="dot"></span>
</div>
</div>
<script>
let slideIndex = 0;
showSlides();

function showSlides() {
    let i;
    let slides = document.getElementsByClassName("mySlides");
    let dots = document.getElementsByClassName("dot");
    for (i = 0; i < slides.length; i++) {
        slides[i].style.display = "none";
    }
    slideIndex++;
    if (slideIndex > slides.length) {slideIndex = 1}
    for (i = 0; i < dots.length; i++) {
        dots[i].className = dots[i].className.replace(" active", "");
    }
    slides[slideIndex-1].style.display = "block";
    dots[slideIndex-1].className += " active";
    setTimeout(showSlides, 3000); // Change image every 2 seconds
}
</script>

```

```

</div>
<div class="dashboard-grid-item dashboard-grid-item-2" id="grid_color">
    <div class="carbon_dioxide">
        <i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
        <span id="total">{{ Auth::user()->carbonmonoxide }} PPM</span>
        <span id="title">Carbon Monoxide</span>
    </div>
    <div class="chart" style="height:380px; width: 100%;">
        <canvas id="myChart1">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="carbonMonoxide()">
    </script>
</div>
<div class="dashboard-grid-item dashboard-grid-item-3" id="grid_color">
    <div class="carbon_dioxide">
        <i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
        <span id="total">{{ Auth::user()->hydrocarbon }} PPM</span>
        <span id="title">Hydrocarbon</span>
    </div>
    <div class="chart" style="height:380px; width: 100%;">
        <canvas id="myChart5">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="hydroCarbon()">
    </script>
</div>
<div class="dashboard-grid-item dashboard-grid-item-4" id="grid_color">
    <div class="whole_content">
        <div class="first_content">
            <div class="avg_ppm">
                <span id="total" style="font-size: 29px">{{ Auth::user()->avgppm }}</span>
                <p id="avg" style="font-size: 20px">Avg PPM</p>
                <p><span style="color: #90EE90;">-5.2 </span>vs Last 7 Days</p>
            <div class="details">
                <div class="box"><a href="">View Details</a></div>
            </div>
        </div>
        <div class="pie_chart">
            <div class="chart2" style="height:100%; width: 100%;">

```

```

<canvas id="myChart2">
</canvas>
</div>
<script src="{{ asset('js/index.js') }}" onLoad="averagePpm()">
</script>
</div>
</div>
<div class="second_content">
<div id="first_column">
<p>Average CO2: {{ Auth::user()->avgcarbondioxide }}</p>
<progress value="{{ Auth::user()->avgcarbondioxide }}"
max="1000"></progress>
<p>Average CO: {{ Auth::user()->avgcarbonmonoxide }}</p>
<progress value="{{ Auth::user()->avgcarbonmonoxide }}"
max="1200"></progress>
</div>
<div id="first_column">
<p>Average CH: {{ Auth::user()->avghydrocarbon }}</p>
<progress value="{{ Auth::user()->avghydrocarbon }}"
max="1000"></progress>
<p>Total Points: 111</p>
<progress value="111" max="200"></progress>
</div>
</div>
</div>
<div class="dashboard-grid-item dashboard-grid-item-5" id="grid_color">
<div class="dashboard-grid-item-2-wholecontent">
<div class="dashboard-grid-item-2-firstcontent">
<span> Tracker</span>
</div>
<div class="dashboard-grid-item-2-secondcontent">
<table id=table>
<tr>
<td><i class='bx bxs-flame' ></i></td>
<td><i class='bx bxs-crown' ></i></td>
<td><i class='bx bxs-navigation' ></i></td>
</tr>
<tr id="points">
<td>{{ Auth::user()->avgppm }}</td>
<td>200</td>
<td>300</td>
</tr>

```

```

        <tr id="title">
            <td>Avg PPM</td>
            <td>Points</td>
            <td>Tot Miles</td>
        </tr>
    </table>
</div>
<div class="dashboard-grid-item-2-thirdcontent">
    <div class="progress">
        <progress value="153" max="200"></progress>
    </div>
</div>
<div class="center_box">
    <div class="box">
        <i class='bx bx-user' style="font-size: 30px;"></i>
        <span id="name">Lois Fernando Ilustre</span>
        <span id="points">211</span>
    </div>
    <div class="box">
        <i class='bx bx-user' style="font-size: 30px;"></i>
        <span id="name">Patrick Lester Punzalan</span>
        <span id="points">192</span>
    </div>
    <div class="box">
        <i class='bx bx-user' style="font-size: 30px;"></i>
        <span id="name">Yuneza Claire Mortos</span>
        <span id="points">177</span>
    </div>
</div>
</div>
<div class="dashboard-grid-item dashboard-grid-item-6" id="grid_color">
    <div class="carbon_dioxide">
        <i class='bx bxs-tachometer' style="font-size: 45px; color: rgb(255, 255, 255); margin-bottom: 0;"></i>
        <span id="total">{{ Auth::user()->carbondioxide }} PPM</span>
        <span id="title">Carbon Dioxide</span>
    </div>
    <div class="chart" style="height:380px; width: 100%;">
        <canvas id="myChart">
        </canvas>
    </div>
<script src="{{ asset('js/index.js') }}" onLoad="carbonDioxide()">

```

```

        </script>
    </div>
</div>
</div>
</div>
@endauth
@guest
<body id="dashboard_color">
<div class="sidebar">
<div class="name_logo">
<a href="/welcome" style="font-size: 18.5px; color: white;">
<i class="fa fa-motorcycle" style="font-size:20px;"></i>
Carbon Sense
</a>
</div>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bxs-dashboard'></i>
Dashboard</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bxs-chart'></i>
Analytics
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-current-location' ></i>
Location
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-envelope' ></i>
Email Us
</a>
<a href="" style=" cursor: default; pointer-events: none;">
<i class='bx bx-user' ></i>
User Account
</a>
</div>

<div class="content">
<div class="navbar">
<div class="guest">
<a href="/home">Home</a>
<a href="/register">Register</a>
<a href="/login">Login</a>
</div>

```

```

        </div>
    </div>
</content>
</body>
@endguest
</body>
</html>

```

```

<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Carbon Sense</title>
    <link rel="stylesheet" type="text/css" href="{{ asset('css/style.css') }}>
    <!-- Boxicons CDN Link -->
    <link href='https://unpkg.com/boxicons@2.1.2/css/boxicons.min.css' rel='stylesheet'>
    <!-- w3schools Link -->
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">
    <!-- ChartJS -->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/3.7.1/chart.min.js"></script>
    <!-- Google Fonts -->
    <link rel="preconnect" href="https://fonts.googleapis.com">
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
    <link href="https://fonts.googleapis.com/css2?family=Quicksand&display=swap" rel="stylesheet">
    <script src="https://code.iconify.design/2/2.2.1/iconify.min.js"></script>
    <!-- JS script -->
    <script src="{{ asset('js/index.js') }}></script>
    <link rel="icon" type="image/x-icon" href="{{asset('photos/Cense-logos.jpeg')}}>

</head>
@auth
<body id="dashboard_color">
    <div class="sidebar">
        <div class="name_logo">
            <a href="/welcome" style="font-size: 15px; color: white;">
                
            </a>
        </div>
    </div>
</body>

```

```

Carbon Sense
</a>
</div>
<a href="/welcome" id="sidebar_hover">
  <i class='bx bxs-dashboard'></i>
  Dashboard</a>
<a class="active" href="/analytics" id="sidebar_hover">
  <i class='bx bxs-chart'></i>
  Analytics
</a>
<a href="/location" id="sidebar_hover">
  <i class='bx bx-current-location'></i>
  Location
</a>
<a href="/emailus" id="sidebar_hover">
  <i class='bx bx-envelope'></i>
  Email Us
</a>
<a href="/useraccount" id="sidebar_hover">
  <i class='bx bx-user'></i>
  User Account
</a>
</div>

<div class="content">
  <div class="navbar">
    <div class="dropdown">
      <button onclick="myFunction()" class="dropbtn">Notifications
        <span style="color: red;">{{ auth() -> user() -> unreadNotifications -> count() }}</span>
      </button>
      <div id="myDropdown" class="dropdown-content">
        <div id="notificationDropdown" class="notification-content">
          @foreach ($summary as $summarys)
            <div class="notification_css">
              <table>
                <td>
                  <button id="myBtn" style = "background-color: white;">
                    <p>{{ $summarys -> created_at }}</p>
                    <p>{{ Auth::user() -> name }}, Your Hydrocarbon exceeds to the threshold limit.</p>
                  </button>
                </td>
              </table>
            </div>
          @endforeach
        </div>
      </div>
    </div>
  </div>
</div>

```

```

<!-- The Modal -->
<div id="myModal" class="modal">

    <!-- Modal content -->
    <div class="modal-content">
        <div class="modal-header" style="text-align: center;">
            <span class="close">&times;</span>
            <h4 style="text-align: center; letter-spacing: 6px; color: rgba(16, 24, 32, 0.468)">Sensor Alert</h4>
            <h3>Sensor Problem</h3>
            <span style="display: block;">If Hydrocarbon - Check if Piston is clean It is recommended to clean the Exhaust or Muffler for potential build up of dirt or residue</span>
            <span style="display: block;">If Monoxide - Check if the sound of the engine is as clear as before.</span>
            <span style="display: block;">It is recommended to check for engine failures, dirt, and etc.</span>
            <span style="display: block;">Make sure the carburetor is clean.</span>
            <h3>Both</h3>
            <span style="display: block;">Make sure to clean the exhaust of the motorcycle and check for residue</span>
            <span style="display: block;">Check the sound of the engine if it's clear as before</span>
            <span style="display: block;">It is recommended to clean the engine</span>
            <span style="display: block;">Clean the carburetor to have better quality emitted air</span>
            <span style="display: block;">Check the valve for potential failures</span>
            <br>
            <br>
        </div>
    </div>

</div>

</td>
</table>
</div>
<script>
// Get the modal
var modal = document.getElementById("myModal");

```

```

    // Get the button that opens the modal
    var btn = document.getElementById("myBtn");

    // Get the <span> element that closes the modal
    var span = document.getElementsByClassName("close")[0];

    // When the user clicks the button, open the modal
    btn.onclick = function() {
        modal.style.display = "block";
    }

    // When the user clicks on <span> (x), close the modal
    span.onclick = function() {
        modal.style.display = "none";
    }

    // When the user clicks anywhere outside of the modal, close it
    window.onclick = function(event) {
        if (event.target == modal) {
            modal.style.display = "none";
        }
    }
}

</script>
@endforeach

</div>
</div>
</div>

<script>
/* When the user clicks on the button,
toggle between hiding and showing the dropdown content */
function myFunction() {
    document.getElementById("myDropdown").classList.toggle("show");
}

// Close the dropdown if the user clicks outside of it
window.onclick = function(event) {
    if (!event.target.matches('.dropbtn')) {
        var dropdowns = document.getElementsByClassName("dropdown-content");
        var i;
        for (i = 0; i < dropdowns.length; i++) {
            var openDropdown = dropdowns[i];

```

```

        if (openDropdown.classList.contains('show')) {
            }
        }
    }
}

</script>
<div class="user_img_name">
    
    <span>{{ strtok(Auth::user()->name, " ") }}</span>
</div>
<div class="user_img_logout">
    <a href="/logout">Logout</a>
</div>
</div>

<!-- Analytics Content -->
<div class="analytics">
    <div class="grid-container">
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay" style="color: #F16A70;"></span>
            </div>
            <div class="grid-item1-box2">
                <span id="title">Carbon Dioxide</span>
                <span>{{ Auth::user()->carbondioxide }} PPM</span>
            </div>
        </div>
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay-filled" style="color: #F9DC5C;"></span>
            </div>
            <div class="grid-item1-box2">
                <span id="title">Carbon Monoxide</span>
                <span>{{ Auth::user()->carbonmonoxide }} PPM</span>
            </div>
        </div>
        <div class="grid-item grid-item1" id="grid_color">
            <div class="grid-item1-box1">
                <span class="iconify" data-icon="carbon:airplay" style="color: #F96E46;"></span>
            </div>
        </div>
    </div>

```

```

<div class="grid-item1-box2">
    <span id="title">Hydrocarbon</span>
    <span>{{ Auth::user()->hydrocarbon }} PPM</span>
</div>
</div>
<div class="grid-item grid-item1" id="grid_color">
    <div class="grid-item1-box1">
        <span class="iconify" data-icon="fa-solid:road" style="color: #80ed99;"></span>
    </div>
    <div class="grid-item1-box2">
        <span id="title">Kilometers</span>
        <span>500 KM</span>
    </div>
</div>
<div class="grid-item grid-item5" id="grid_color">
    <div class="chart" style="height:330px; width: 100%;">
        <canvas id="myChart3">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="averagePpmAnalytics()">
    </script>
</div>
<div class="grid-item grid-item6" id="grid_color">
    <div class="chart" style="height:290px; width: 100%;">
        <canvas id="myChart4">
        </canvas>
    </div>
    <script src="{{ asset('js/index.js') }}" onLoad="barAnalytics()">
    </script>
</div>
<div class="grid-item grid-item7" id="grid_color">
    <div class="summary_log_content">
        <span>Summary log</span>
        <!-- auth()->user()->unreadnotifications as $summarys -->
        @foreach ($summary as $summarys)
            <div class="summary_log">
                <table>
                    <td>
                        <span>{{ $summarys->created_at }}</span>
                        <span>{{ Auth::user()->name }}, You just updated your profile.</span>
                    </td>
                <!-- <td>

```

```

        <a href="{{ route('markasread', $summarys->id) }}">
            <div class="markasread">Markasread</div>
        </a>
    </td> -->
</table>
</div>
@endforeach
{{ auth()->user()->notifications()->simplePaginate(2)->links() }}
</div>
</div>
</div>
</div>
</div>
@endauth

</body>
</html>

```

```

function carbonDioxide() {
    const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
    async functiongetJSON() {
        const response = await fetch(api_url);
        const data = await response.json();
        const json_file = data.feeds;
        console.log(json_file);

        // 03
        const carbondioxide3 = [];
        // 04
        const carbondioxide4 = [];
        // 08
        const carbondioxide8 = [];
        // 09
        const carbondioxide9 = [];
        // 10
        const carbondioxide10 = [];
        // 11
        const carbondioxide11 = [];
        // 12
        const carbondioxide12 = [];
    }
}

```

```

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        carbondioxide3.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        carbondioxide4.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        carbondioxide8.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        carbondioxide9.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        carbondioxide10.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        carbondioxide11.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        carbondioxide12.push(parseFloat(json_file[i].field3));
    }
}
var avgcarbondioxide3 = Math.round(
    carbondioxide3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide3.length
);
var avgcarbondioxide4 = Math.round(
    carbondioxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide4.length
);
var avgcarbondioxide8 = Math.round(
    carbondioxide8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide8.length
);
var avgcarbondioxide9 = Math.round(
    carbondioxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide9.length
);

```

```

var avgcarbon dioxide10 = Math.round(
    carbondioxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide10.length
);
var avgcarbon dioxide12 = Math.round(
    carbondioxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide12.length
);
console.log(avgcarbon dioxide8);
console.log(avgcarbon dioxide9);
console.log(avgcarbon dioxide10);
console.log(avgcarbon dioxide12);
const ctx = document.getElementById("myChart").getContext("2d");
Chart.defaults.font.size = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#fff";
const myChart = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Dioxide",
                data: [avgcarbon dioxide3, avgcarbon dioxide4,
avgcarbon dioxide8, avgcarbon dioxide9, avgcarbon dioxide10, 0, avgcarbon dioxide12],
                backgroundColor: ["#fff"],
                borderColor: ["rgb(75, 192, 192)"],
                borderWidth: 1,
                tension: 0.5,
            },
        ],
    },
    options: {

```

```

        maintainAspectRatio: false,
        scales: {
            x: {
                grid: {
                    display: false,
                },
            },
            y: {
                grid: {
                    display: false,
                },
            },
        },
        plugins: {
            legend: {
                display: false,
                labels: {
                    color: "rgb(255, 99, 132)",
                },
            },
        },
    },
);
}
getJSON();
}

//



function carbonMonoxide() {
const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
async function getJSON() {
    const response = await fetch(api_url);
    const data = await response.json();
    const json_file = data.feeds;
    console.log(json_file);

    // 03
    const carbonmonoxide3 = [];
    // 04
    const carbonmonoxide4 = [];
    // 08
    const carbonmonoxide8 = [];
    // 09

```

```

const carbonmonoxide9 = [];
// 10
const carbonmonoxide10 = [];
// 11
const carbonmonoxide11 = [];
// 12
const carbonmonoxide12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        carbonmonoxide3.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        carbonmonoxide4.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        carbonmonoxide8.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        carbonmonoxide9.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        carbonmonoxide10.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        carbonmonoxide11.push(parseFloat(json_file[i].field2));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        carbonmonoxide12.push(parseFloat(json_file[i].field2));
    }
}
var avgcarbonmonoxide3 = Math.round(
    carbonmonoxide3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide3.length
);
var avgcarbonmonoxide4 = Math.round(
    carbonmonoxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide4.length
);
var avgcarbonmonoxide8 = Math.round(
    carbonmonoxide8.filter(Number).reduce(function (a, b) {

```

```

        return a + b;
    }, 0) / carbonmonoxide8.length
);
var avgcarbonmonoxide9 = Math.round(
    carbonmonoxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide9.length
);
var avgcarbonmonoxide10 = Math.round(
    carbonmonoxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide10.length
);
var avgcarbonmonoxide12 = Math.round(
    carbonmonoxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide12.length
);
console.log(avgcarbonmonoxide8);
console.log(avgcarbonmonoxide9);
console.log(avgcarbonmonoxide10);
console.log(avgcarbonmonoxide12);
const ctx = document.getElementById("myChart1").getContext("2d");
Chart.defaults.font.size = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#fff";
const myChart1 = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Monoxide",
                data: [avgcarbonmonoxide3, avgcarbonmonoxide4,
avgcarbonmonoxide8, avgcarbonmonoxide9, avgcarbonmonoxide10, 0, avgcarbonmonoxide12],

```

```

        backgroundColor: ["#fff"],
        borderColor: ["rgb(75, 192, 192)"],
        borderWidth: 1,
        tension: 0.5,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: false,
            },
        },
    },
    plugins: {
        legend: {
            display: false,
            labels: {
                color: "rgb(255, 99, 132)",
            },
        },
    },
},
});
}
getJSON();
}

function hydroCarbon() {
const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";
async function getJSON() {
const response = await fetch(api_url);
const data = await response.json();
const json_file = data.feeds;
console.log(json_file);
}
}

```

```

// 03
const hydrocarbon3 = [];
// 04
const hydrocarbon4 = [];
// 08
const hydrocarbon8 = [];
// 09
const hydrocarbon9 = [];
// 10
const hydrocarbon10 = [];
// 11
const hydrocarbon11 = [];
// 12
const hydrocarbon12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        hydrocarbon3.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        hydrocarbon4.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        hydrocarbon8.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        hydrocarbon9.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        hydrocarbon10.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        hydrocarbon11.push(parseFloat(json_file[i].field1));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        hydrocarbon12.push(parseFloat(json_file[i].field1));
    }
}
var avghydrocarbon3 = Math.round(
    hydrocarbon3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon3.length
);

```

```

var avghydrocarbon4 = Math.round(
    hydrocarbon4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon4.length
);
var avghydrocarbon8 = Math.round(
    hydrocarbon8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon8.length
);
var avghydrocarbon9 = Math.round(
    hydrocarbon9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon9.length
);
var avghydrocarbon10 = Math.round(
    hydrocarbon10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon10.length
);
var avghydrocarbon12 = Math.round(
    hydrocarbon12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon12.length
);

const ctx = document.getElementById("myChart5").getContext("2d");
Chart.defaults.fontSize = 12;
Chart.defaults.font.family = "Helvetica Neue";
Chart.defaults.color = "#fff";
const myChart5 = new Chart(ctx, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [

```

```

        },
        label: "Hydrocarbon",
        data: [avghydrocarbon3, avghydrocarbon4, avghydrocarbon8,
avghydrocarbon9, avghydrocarbon10, 0, avghydrocarbon12],
        backgroundColor: ["#fff"],
        borderColor: ["rgb(75, 192, 192)"],
        borderWidth: 1,
        tension: 0.5,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: false,
            },
        },
    },
    plugins: {
        legend: {
            display: false,
            labels: {
                color: "rgb(255, 99, 132)",
            },
        },
    },
},
});
}
getJSON();
}

function averagePpm() {
const ctx1 = document.getElementById("myChart2").getContext("2d");
const myChart2 = new Chart(ctx1, {
    type: "doughnut",

```

```

data: {
  labels: [
    "Monday",
    "Tuesday",
    "Wednesday",
    "Thursday",
    "Friday",
    "Saturday",
    "Sunday",
  ],
  datasets: [
    {
      data: [425, 436, 378, 432, 521, 420, 650],
      backgroundColor: [
        "#FFD447",
        "#F5BC00",
        "#EB5C68",
        "#D1233E",
        "#2B50AA",
        "#01BAEF",
        "#16DB93",
      ],
      borderColor: [
        "rgba(255, 99, 132, 0.2)",
        "rgba(255, 159, 64, 0.2)",
        "rgba(255, 205, 86, 0.2)",
        "rgba(75, 192, 192, 0.2)",
        "rgba(54, 162, 235, 0.2)",
        "rgba(153, 102, 255, 0.2)",
        "rgba(201, 203, 207, 0.2)",
      ],
      borderWidth: 1,
      tension: 0.5,
      hoverOffset: 4,
    },
  ],
},
options: {
  maintainAspectRatio: false,
  plugins: {
    legend: {
      display: true,
    }
  }
}

```

```

        labels: {
            color: "rgb(255,250,250)",
        },
    },
},
},
}),
}
}

function averagePpmAnalytics() {
    const api_url = "https://api.thingspeak.com/channels/1757857/feeds.json?";

    async functiongetJSON() {
        const response = await fetch(api_url);
        const data = await response.json();
        const json_file = data.feeds;
        const store_created_at = [];
        // 03
        const hydrocarbon3 = [];
        const carbonmonoxide3 = [];
        const carbondioxide3 = [];
        // 04
        const hydrocarbon4 = [];
        const carbonmonoxide4 = [];
        const carbondioxide4 = [];
        // 08
        const hydrocarbon8 = [];
        const carbonmonoxide8 = [];
        const carbondioxide8 = [];
        // 09
        const hydrocarbon9 = [];
        const carbonmonoxide9 = [];
        const carbondioxide9 = [];
        // 10
        const hydrocarbon10 = [];
        const carbonmonoxide10 = [];
        const carbondioxide10 = [];
        // 11
        const hydrocarbon11 = [];
        const carbonmonoxide11 = [];
        const carbondioxide11 = [];
        // 12
        const hydrocarbon12 = [];
    }
}

```

```

const carbonmonoxide12 = [];
const carbondioxide12 = [];

for (i = 0; i < json_file.length; i++) {
    if (json_file[i].created_at.slice(0, 10) == "2022-06-03") {
        hydrocarbon3.push(parseFloat(json_file[i].field1));
        carbonmonoxide3.push(parseFloat(json_file[i].field2));
        carbondioxide3.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-04") {
        hydrocarbon4.push(parseFloat(json_file[i].field1));
        carbonmonoxide4.push(parseFloat(json_file[i].field2));
        carbondioxide4.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-08") {
        hydrocarbon8.push(parseFloat(json_file[i].field1));
        carbonmonoxide8.push(parseFloat(json_file[i].field2));
        carbondioxide8.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-09") {
        hydrocarbon9.push(parseFloat(json_file[i].field1));
        carbonmonoxide9.push(parseFloat(json_file[i].field2));
        carbondioxide9.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-10") {
        hydrocarbon10.push(parseFloat(json_file[i].field1));
        carbonmonoxide10.push(parseFloat(json_file[i].field2));
        carbondioxide10.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-11") {
        hydrocarbon11.push(parseFloat(json_file[i].field1));
        carbonmonoxide11.push(parseFloat(json_file[i].field2));
        carbondioxide11.push(parseFloat(json_file[i].field3));
    }
    if (json_file[i].created_at.slice(0, 10) == "2022-06-12") {
        hydrocarbon12.push(parseFloat(json_file[i].field1));
        carbonmonoxide12.push(parseFloat(json_file[i].field2));
        carbondioxide12.push(parseFloat(json_file[i].field3));
    }
}
// 3
var avghydrocarbon3 = Math.round(
    hydrocarbon3.filter(Number).reduce(function (a, b) {

```

```

        return a + b;
    }, 0) / hydrocarbon3.length
);
var avgcarbonmonoxide3 = Math.round(
    carbonmonoxide3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide3.length
);
var avgcarbondioxide3 = Math.round(
    carbondioxide3.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide3.length
);
var avgcarbondioxide4 = Math.round(
    carbondioxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide4.length
);
// 4
var avghydrocarbon4 = Math.round(
    hydrocarbon4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon4.length
);
var avgcarbonmonoxide4 = Math.round(
    carbonmonoxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide4.length
);
var avgcarbondioxide4 = Math.round(
    carbondioxide4.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide4.length
);
var avghydrocarbon8 = Math.round(
    hydrocarbon8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon8.length
);
var avgcarbonmonoxide8 = Math.round(
    carbonmonoxide8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide8.length
);
var avgcarbondioxide8 = Math.round(
    carbondioxide8.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide8.length
);

```

```

    }, 0) / carbondioxide8.length
);
// 9
var avghydrocarbon9 = Math.round(
    hydrocarbon9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon9.length
);
var avgcarbonmonoxide9 = Math.round(
    carbonmonoxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide9.length
);
var avgcarbondioxide9 = Math.round(
    carbondioxide9.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide9.length
);
// 10
var avghydrocarbon10 = Math.round(
    hydrocarbon10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon10.length
);
var avgcarbonmonoxide10 = Math.round(
    carbonmonoxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide10.length
);
var avgcarbondioxide10 = Math.round(
    carbondioxide10.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide10.length
);
// 11
var avghydrocarbon11 = Math.round(
    hydrocarbon11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon11.length
);
var avgcarbonmonoxide11 = Math.round(
    carbonmonoxide11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide11.length
);

```

```

        }, 0) / carbonmonoxide11.length
    );
var avgcarbon dioxide11 = Math.round(
    carbondioxide11.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide11.length
);
// 12
var avghydrocarbon12 = Math.round(
    hydrocarbon12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / hydrocarbon12.length
);
var avgcarbonmonoxide12 = Math.round(
    carbonmonoxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbonmonoxide12.length
);
var avgcarbondioxide12 = Math.round(
    carbondioxide12.filter(Number).reduce(function (a, b) {
        return a + b;
    }, 0) / carbondioxide12.length
);
const ctx1 = document.getElementById("myChart3").getContext("2d");
Chart.defaults.font.size = 16;
Chart.defaults.color = "#fff";
const myChart3 = new Chart(ctx1, {
    type: "line",
    data: {
        labels: [
            "2022-06-03",
            "2022-06-04",
            "2022-06-08",
            "2022-06-09",
            "2022-06-10",
            "2022-06-11",
            "2022-06-12",
        ],
        datasets: [
            {
                label: "Carbon Dioxide ",
                data: [

```

```
    14,
    avgcarbonmonoxide4,
    avgcarbonmonoxide8,
    avgcarbonmonoxide9,
    avgcarbonmonoxide10,
    0,
    avgcarbonmonoxide12,
],
backgroundColor: ["#46B3A5"],
borderColor: ["#000000"],
borderWidth: 1,
tension: 0.5,
fill: true,
},
{
label: "Carbon Monoxide",
data: [
33,
avgcarbonmonoxide4,
avgcarbonmonoxide8,
avgcarbonmonoxide9,
avgcarbonmonoxide10,
0,
avgcarbonmonoxide12,
],
backgroundColor: ["#F6D68D"],
borderColor: ["#000000"],
borderWidth: 1,
tension: 0.5,
fill: true,
},
{
label: "HydroCarbon",
data: [
38,
avghydrocarbon4,
avghydrocarbon8,
avghydrocarbon9,
avgcarbonmonoxide10,
0,
avghydrocarbon12,
],
backgroundColor: ["#2c7da0"],
```

```

        borderColor: ["#000000"],
        borderWidth: 1,
        tension: 0.5,
        fill: true,
    },
],
},
options: {
    maintainAspectRatio: false,
    scales: {
        x: {
            grid: {
                display: false,
            },
        },
        y: {
            grid: {
                display: true,
            },
        },
    },
    plugins: {
        legend: {
            display: true,
            labels: {
                boxWidth: 40,
                color: "#fff",
            },
        },
    },
},
}),
});
}

getJSON();
}

function barAnalytics() {
const ctx1 = document.getElementById("myChart4").getContext("2d");
Chart.defaults.color = "#fff";
Chart.defaults.fontSize = 16;
const myChart3 = new Chart(ctx1, {
    type: "bar",

```

```
data: {
  labels: [
    "Jeongyon",
    "Chaeyoung",
    "Mina",
    "Jiyo",
    "Momo",
    "Tzuyu",
    "Nayeon",
  ],
  datasets: [
    {
      label: "Top 7 Leaderboards",
      data: [325, 436, 578, 632, 721, 820, 920],
      backgroundColor: [
        "#e60049",
        "#0bb4ff",
        "#50e991",
        "#9b19f5",
        "#ffa300",
        "#dc0ab4",
        "#b3d4ff",
      ],
      borderColor: ["#000000"],
      borderWidth: 1,
      tension: 0.5,
      fill: true,
    },
  ],
},
options: {
  maintainAspectRatio: false,
  scales: {
    x: {
      grid: {
        display: false,
      },
    },
    y: {
      grid: {
        display: true,
      },
    },
  },
}
```

```

        },
        plugins: {
            legend: {
                display: true,
                labels: {
                    boxWidth: 0,
                    color: "#fff",
                },
            },
        },
    },
});

// Login

const signUpButton = document.getElementById("signUp");
const signInButton = document.getElementById("signIn");
const container = document.getElementById("container");

signUpButton.addEventListener("click", () => {
    container.classList.add("right-panel-active");
});

signInButton.addEventListener("click", () => {
    container.classList.remove("right-panel-active");
});

function reportMessage() {
    const name = document.getElementById("full_name");
    const subject = document.getElementById("subject");
    const message = document.getElementById("message");
    const success = document.getElementById("success");
    const danger = document.getElementById("danger");

    if (name.value == "" || subject.value == "" || message.value == "") {
        danger.style.display = "block";
        success.style.display = "none";
    } else {
        danger.style.display = "none";
        success.style.display = "block";
        alert("The message was successfully sent");
    }
}

```

```

}

function signup() {
    const password = document.getElementById("password");
    const repeat_password = document.getElementById("repeat_password");
    const name = document.getElementById("name");
    const email = document.getElementById("email");

    if (
        name.value == "" ||
        email.value == "" ||
        password.value == "" ||
        repeat_password.value == ""
    ) {
        alert("Fields is not be empty");
    }
}

function profileBtn() {
    document.getElementById("myDropdown").classList.toggle("show");
    window.onclick = function (event) {
        if (!event.target.matches("dropbtn")) {
            // to fix
            // var dropdowns = document.getElementsByClassName("dropdown-content");
            var i;
            for (i = 0; i < dropdowns.length; i++) {
                var openDropdown = dropdowns[i];
                if (openDropdown.classList.contains("show")) {
                    openDropdown.classList.remove("show");
                }
            }
        }
    };
}

function notificationBtn() {
    document.getElementById("notificationDropdown").classList.toggle("notshow");
    window.onclick = function (event) {
        if (!event.target.matches("dropbtn")) {
            // to fix
            // var dropdowns = document.getElementsByClassName("dropdown-content");
            var i;
            for (i = 0; i < dropdowns.length; i++) {

```

```

        var openDropdown = dropdowns[i];
        if (openDropdown.classList.contains("show")) {
            openDropdown.classList.remove("show");
        }
    }
};

}

// Initialize and add the map
function initMap() {
    // The location of Uluru
    const uluru = { lat: -25.344, lng: 131.031 };
    // The map, centered at Uluru
    const map = new google.maps.Map(document.getElementById("map"), {
        zoom: 4,
        center: uluru,
    });
    // The marker, positioned at Uluru
    const marker = new google.maps.Marker({
        position: uluru,
        map: map,
    });
}

window.initMap = initMap;

```

```

<?php

use Illuminate\Database\Migrations\Migration;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Support\Facades\Schema;

return new class extends Migration
{
    /**
     * Run the migrations.
     *
     * @return void
     */

```

```

public function up()
{
    Schema::create('users', function (Blueprint $table) {
        $table->id();
        $table->string('name');
        $table->string('email')->unique();
        $table->timestamp('email_verified_at')->nullable();
        $table->string('contact')->nullable();
        $table->string('birthday')->nullable();
        $table->string('address')->nullable();
        $table->string('vehicle')->nullable();
        $table->string('city')->nullable();
        $table->string('usertype')->nullable();
        $table->string('image_path')->nullable();
        $table->string('platenumber')->nullable();
        $table->float('carbondioxide')->default(0);
        $table->float('carbonmonoxide')->default(0);
        $table->float('hydrocarbon')->default(0);
        $table->integer('avgcarbondioxide')->default(0);
        $table->integer('avgcarbonmonoxide')->default(0);
        $table->integer('avghydrocarbon')->default(0);
        $table->integer('avgppm')->default(0);
        $table->string('password');
        $table->rememberToken();
        $table->timestamps();
    });
}

/**
 * Reverse the migrations.
 *
 * @return void
 */
public function down()
{
    Schema::dropIfExists('users');
}
};

```

Showing rows 0 - 1 (total: 2) (Query took 0.0017 seconds.) [platenumber: LBQ328... - 123456...]

```
SELECT * FROM `users` ORDER BY `platenumber` DESC
```

Profiling | Edit inline | Explain SQL | Create PHP code | Refresh | Edit inline | Edit | Create PHP code |

UPDATE `users` SET `avppm` = '79' WHERE `users`.`id` = 2;

Edit inline | Edit | Create PHP code |

	Show all	Number of rows:	25	Filter rows	Search this table	Sort by key	None															
+ Options																						
+ T																						
	Edit	Copy	Delete	2	Lois Fernando Ilustre	hitatami@gmail.com	NULL	09277007939	1999-04-10	603 I Santos, Pasay City	Yamaha Mio 125 i	Makati Company	NULL	LBQ328	32.74	97.30	102.00	26	106	105	79	
	Edit	Copy	Delete	1	Patrick Lester Punzalan	punzalan233@gmail.com	NULL	09162097072	2000-03-17	603 C Ventura St Sampaloc Manila	Yamaha Mio 125 i	Ermila Company	Patrick Lester Punzalan.jpg	1655137719-	XYZZ13	22.00	105.00	104.00	22	105	104	77

Check all | With selected: Edit | Copy | Delete | Export | Show all | Number of rows: 25 | Filter rows | Search this table | Sort by key | None |

Query results operations | Print | Copy to clipboard | Export | Display chart | Create view | Bookmark this SQL query | Label: | Let every user access this bookmark | Bookmark this SQL query | Console |

Showing rows 0 - 1 (total: 2) (Query took 0.0017 seconds.) [platenumber: LBQ328... - 123456...]

```
SELECT * FROM `users` ORDER BY `platenumber` DESC
```

Profiling | Edit inline | Explain SQL | Create PHP code | Refresh | Edit inline | Edit | Create PHP code |

UPDATE `users` SET `avppm` = '79' WHERE `users`.`id` = 2;

Edit inline | Edit | Create PHP code |

	Show all	Number of rows:	25	Filter rows	Search this table	Sort by key	None															
+ Options																						
+ T																						
	Edit	Copy	Delete	2	Lois Fernando Ilustre	hitatami@gmail.com	NULL	09277007939	1999-04-10	603 I Santos, Pasay City	Yamaha Mio 125 i	Makati Company	NULL	LBQ328	32.74	97.30	102.00	26	106	105	79	
	Edit	Copy	Delete	1	Patrick Lester Punzalan	punzalan233@gmail.com	NULL	09162097072	2000-03-17	603 C Ventura St Sampaloc Manila	Yamaha Mio 125 i	Ermila Company	Patrick Lester Punzalan.jpg	1655137719-	XYZZ13	22.00	105.00	104.00	22	105	104	77

Check all | With selected: Edit | Copy | Delete | Export | Show all | Number of rows: 25 | Filter rows | Search this table | Sort by key | None |

Query results operations | Print | Copy to clipboard | Export | Display chart | Create view | Bookmark this SQL query | Label: | Let every user access this bookmark | Bookmark this SQL query | Console |

```
<?php

use Illuminate\Database\Migrations\Migration;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Support\Facades\Schema;
```

```
return new class extends Migration
{
    /**
     * Run the migrations.
     *
     * @return void
     */
    public function up()
    {
        Schema::create('notifications', function (Blueprint $table) {
            $table->uuid('id')->primary();
            $table->string('type');
            $table->morphs('notifiable');
            $table->text('data');
            $table->timestamp('read_at')->nullable();
            $table->timestamps();
        });
    }

    /**
     * Reverse the migrations.
     *
     * @return void
     */
    public function down()
    {
        Schema::dropIfExists('notifications');
    }
};
```

APPENDIX C: User Manual

INTENDED USE

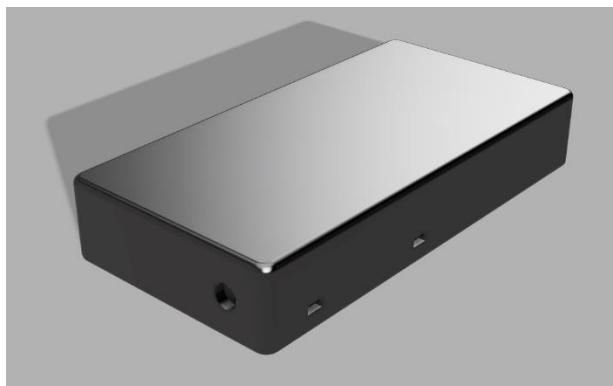
Carbon Sense, or CENSE, is a carbon monitoring device that tracks carbon emission levels of motorcycles, as well as analyzing its results, and then notifying users if their carbon emission levels are high. This device works by using three carbon sensors mainly Carbon Monoxide, Carbon Dioxide, and Hydrocarbon, and then, sends an alert or notification once the following carbon levels reached their maximum threshold.

The standard in identifying the carbon emission standards is according to the guidelines released by the Land Transportation Office (LTO). The table below shows the acceptable rate of emission according to the motorcycle's registration date.

DATE TO	CO PERCENTAGE (% BY VOLUME)	Hydrocarbon (PPM AS HEXANE)
12/31/2015	0.5	2500
12/31/2007	3.5	6000
12/31/2002	4.5	8000

Upon first setup of the device, the user must install the hardware module into the motorcycle. This includes clamping the device onto the motorcycle by using a hose clamp and placing the sensing module as close as possible to the muffler.

HARDWARE MODULES



Left: Main Module



Right: Sensing Module

The photo on the left is main module where the main components can be found. This includes the Arduino, GPS module, and the GSM or SMS module. This hardware module is placed beside the exhaust shield of the motorcycle. On the other hand, the photo on the right is the sensing module of the device. It is placed directly, with its face fronting upward, onto the motorcycle's muffler. The sensors such as MQ-2 for Hydrocarbon, MQ-7 for Carbon Monoxide, and MQ-135 for Carbon Dioxide are found in this module.

HOW TO INSTALL

Step 1: The driver installs the hardware module into the motorcycle
Clamp the main module beside the exhaust shield of the motorcycle. Also, place the sensing module in front of the muffler.

Step 2: Registration of the driver
The driver must register his personal details on the website carboncense.herokuapp.com in order to make his account. The website allows the drivers to check their carbon emission levels.

Step 3: Download the “COmon” mobile application
The “COmon” mobile application allows the driver to check their carbon emission in a real-time manner and the real-time location of the driver.

Step 4: Power on the device
Connect the power to the device. Wait for the device to boot up. This might take a few minutes.

Step 5: Preheat the motorcycle
After turning on the device, wait for the motorcycle to preheat for 15 minutes and the device to boot up for the same 15 minutes.

Step 6: Setup completed
After 15 minutes, the device is up and working and is ready to accompany you in your transportation throughout the day.

Step 7: Carbon emission wrap-up
At the end of the day, the drivers can check their emission levels on the website by using the account that they registered in step 2. The emission levels are clustered according to their averages in the span of days, weeks, and even months.

LOIS FERNANDO ILUSTRE

COMPUTER ENGINEERING

Technological Institute of the Philippines (TIP) M

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Cellular No.: +639277007939



CAREER OBJECTIVE

A person who imposes leadership and integrity in the workplace that is also willing to learn the ropes as a beginner to hone field that is designated for him. I am adaptive with regards to the environment of the workplace both in the place itself and me. I am able to work under pressure and is capable of managing multiple tasks in one. I am proficient in doing things and for new information and skillset.

DESIGN PROJECTS COMPLETED/ RESEARCHES

The effectivity of used engine oil as a constituent in producing homemade whiteboard marker ink
The main objective of this research paper is to determine whether engine oil is capable on being an ingredient or component whiteboard marker comparable to the commercialized one. We have also utilized here the use of activated charcoal as a component.

Web-Based Lending Management System with Credit Score Algorithm for "Countryboys" Lending Corporation
This project focuses on creating a lending management system for a lending corporation named Countryboys located at web-based lending management system features several tools that are beneficial for the admins and the staff of the analysis, statistical data, as well as management of users/clients to determine whether they are capable on being lent by the through their credit score.

COVID-19 Prediction Using Linear Regression and Support Vector Machine
This project focuses on predicting the potential rise of cases of the upcoming pandemic (when this was made) which was system uses linear regression as the main variable in order to predict the data as well as support vector machine (SVM) mathematically predicts the active cases, recoveries, and deaths of the given data.

Fake News Detection Program using Logistic Regression and SVM
This project focuses on determining the fake news that are usually being spread in social media websites that tricks the seem "real" but it is just a hoax. We used Scikit Learn as well as TFID Vectorizer to determine the dataset that we have trained the data as well in order to determine whether the future news (data) would be fake or not. Logistic Regression and utilized to predict the data and to determine whether the findings are accurate or not.

A Machine Learning Approach in Analyzing and Predicting the Music Popularity Based on Audio Features from Spotify data
This project focuses on utilizing a machine learning method in determining and predicting, for future purposes, the music from audio features from the music platform giant, Spotify. With this, we have determined several audio features are just, in popular around the world. One of which is on how long the song is, as well as if it is "danceable" or not based on beats, and instruments used. We have analyzed this data by using Random Forest Classifier, Linear Regression, and last but not Kmeans clustering.

Helpier

This project is the project that we presented for Amazon Web Services' (AWS)-hosted event, Build On, ASEAN 2021, which up in the whole Philippines, which is entitled Helpier. Helpier is a web-based application platform for people who are looking app in order to make a donation online. This app also ensures that the donation that they made are reached to the people needing it. It's not just on donations but rather on other offerings of work as well such as academic, physical work, latter. It also features a token system in which the user could garner tokens as he/she donates more, he/she will earn more it is a social system that makes everyone an inclusion into the society, not just to those people who are willing to help but who are really in need not just in times of calamity, but also on a normal busy day.

ON-THE-JOB TRAINING/ PRACTICUM/ INTERNSHIP EXPERIENCE

- Database Junior Administrator
COMELEC - Pasay City Chapter
Former Pasay City Public Library, Pasadena, c
January 08, 2018 - March 16, 2018
COMELEC Pasay City is the main COMELEC office for Pasay residents. This is the facility on where you should register your voters id and this is where voting happens as well.

KNOWLEDGE, SKILLS AND ATTITUDE

Having graduated from TIP with its orientation towards outcome-based education, I have acquired and can demonstrate the following student acquire outcomes (knowledge, skills and attitudes) necessary to the practice of the computing profession:

- Analyze complex problems and identify and define the computing requirements appropriate for solution.
- Use modern techniques and tools of the computing practice in complex activities.
- Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.

LEADERSHIP ACTIVITY

Supreme Student Council (A.Y 2017-2018) - **President**
Supreme Student Council (A.Y 2018-2019) - **President**
Computer Engineering Student Society (S.Y. 2021-2022) - **Vice President**

SEMINARS AND TRAININGS ATTENDED

- Design Project Learning Series
Zoom Conference
November 16, 2021
- Blockchain: The Next Generation Technology
Zoom Conference
July 26, 2021
- Raspberry Pi Essentials
Zoom Conference
July 28, 2021
- Social Engineering Attacks: Don't be a Victim, Be Equipped
Zoom Conference
July 24, 2021
- Cyber Threats: Attack, Defense, Intelligence
Zoom Conference
July 23, 2021
- An Introduction to Object Detection with Deep Learning
Zoom Conference
July 21, 2021
- Backend Trend: An Introduction to NodeJs
Zoom Conference
July 19, 2021
- Above the Clouds
Zoom Conference
July 12, 2021

- Beginning Python 1: Python I/O, functions, variables, operators, data types, string manipulation
Zoom Conference
June 07, 2021
- Beginning Python 2: Control flow, Booleans and conditional logic, relational operators, if-else and while statements
Zoom Conference
June 08, 2021
- Beginning Python 3: Data structures, lists and dictionaries
Zoom Conference
June 09, 2021
- Beginning Python 4: Tying it all together - Creating simple programs in Python
Zoom Conference
June 10, 2021
- Intro to the AWS Management Console; Building websites with HTML, CSS & JavaScript 1
Zoom Conference
June 11, 2021
- Building websites with HTML and CSS & JavaScript 2
Zoom Conference
June 15, 2021
- Deploying web applications with Amazon Simple Storage Service (Amazon S3) and Amazon Elastic Beanstalk
Zoom Conference
June 16, 2021
- Database programming with Amazon DynamoDB
Zoom Conference
June 17, 2021
- Introduction to Machine Learning with Amazon SageMaker
Zoom Conference
June 22, 2021
- Deep Learning with AWS
Zoom Conference
June 25, 2021

EXTRA AND CO-CURRICULAR ENGAGEMENTS AND VOLUNTEER WORKS

- Supreme Student Council - AMA Makati SHS
President
June 05, 2017 - March 22, 2019
- Computer Engineering Student Society
Vice President
August 23, 2021 - Present

OTHER SKILLS

Technical Skills
Leadership Skills
Creativity
Communication Skills

REFERENCE

Jennifer Enriquez
Department Head - CPE
Technological Institute of the Philippines - Manila
jennifer.enriquez@tip.edu.ph

-

YUNEZA CLAIRE MORTOS

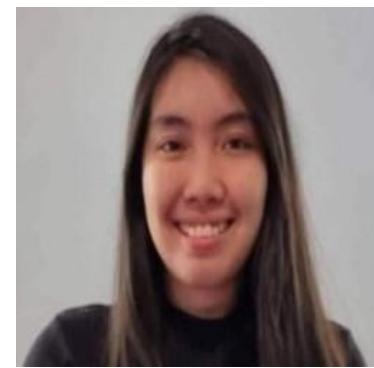
COMPUTER ENGINEERING

Technological Institute of the Philippines (TIP) M

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Cellular No.: +639999255056



CAREER OBJECTIVE

As a final year student in Computer Engineering, I am eager to build a career in a growing organization or company where opportunities are in my hands in order to develop my profession and practical experience extensively.

DESIGN PROJECTS COMPLETED/ RESEARCHES

Deep Learning Based Image Recognition for Chili Plant Disease Detection

Identification of plant diseases is one of the ways to prevent loss of yield in agriculture. Monitoring and studying the visually observable patterns of the disease on a plant is included in disease detection thus the implementation of image recognition is highly required for an optimal result. KNN, CNN, and SVM are some of the models that my team used in creating this project.

E-climate

A website that allows collaborators to plan, strategize, and conduct events that have the goal of giving solutions to lessen the impact of climate change in the country.

Web-Based Lending Management System with Credit Score Algorithm for "Countryboys" Lending Corporation

It is an online loaning management system for a loaning corporation in Cavite which is used for real-time loaning management settings. Its features include electronic mailing with the corporation, online validation of submitted digital documents, digitalized monthly reports, efficient monitoring of credit performances, and automated monitoring of each transaction.

COVID-19 Prediction Using Linear Regression and Support Vector Machine

This is a model that calculates the total confirmed cases, total deaths reported, total recovered cases throughout the world by using the dataset provided by Kaggle entitled, "Novel Corona Virus 2019 Dataset" which is a live dataset where people around the world updates the data regularly. In this model, forecasting of the severity of the virus is also included like determining if the case is getting more severe or finally getting lighter. The algorithms that are used in this project are Linear Regression Algorithm and Support Vector Machine.

Fake News Detection Program using Logistic Regression and SVM

This project is a machine learning-based algorithm wherein it can separate fake news from real news through a sample of collected news articles online. It utilizes Scikit Learn feature of extraction, TF-IDF Vectorizer, and a linear model of Scikit Learn, the Logistic Regression. Support Vector Machine is also used to test the accuracy of the data.

A Machine Learning Approach in Analyzing and Predicting the Music Popularity Based on Audio Features from Spotify data

This project primarily focuses on predicting whether a song is popular based on its audio features. The data that was used in creating this model is extracted from Spotify. The project also used different algorithms or models such as Linear Regression, Random Forest Classifier, and Kmeans Clustering for training the data.

Helpier

Helpier is a Web Application platform that aims to connect both benefactors and beneficiaries, it has a function wherein benefactors and beneficiaries can list and post the help that they need and the help that they can give. All listing is sorted by category so that users can easily find the listing that they are looking for, it is also location-based meaning the listing that is nearest to every user will have a higher chance to be chosen by the user. Helpier also has a Token, Levelling, Badge, Leaderboards, and Challenges system, this is to encourage everyone to give more help rather than to ask for more help, they can compete with other users just like in a competitive online game. Helpier has multiple security identification features to ensure that every user is legitimate and a review and rating system in order to avoid misuse and to build trust between the benefactor and beneficiaries. Helpier is a Web Application platform built for the purpose of building an exclusive society

ON-THE-JOB TRAINING/ PRACTICUM/ INTERNSHIP EXPERIENCE

- Intern

Romblon Electric Cooperative incorporation

Romblon, Romblon

October 01, 2018 - March 01, 2019

I was an intern in an Incorporation in our province during OJT in Senior High School. I worked as an Accountant in which I prepared financial statements for the company. I was also assigned to marketing and communication wherein I was designated for talking and convincing people to get in apply for ROMELCO. Lastly, I also designed marketing materials like flyers and banners for the corporation.

KNOWLEDGE, SKILLS AND ATTITUDE

Having graduated from TIP with its orientation towards outcome-based education, I have acquired and can demonstrate the following student acquire outcomes (knowledge, skills and attitudes) necessary to the practice of the computing profession:

- Analyze complex problems and identify and define the computing requirements appropriate for solution.
- Use modern techniques and tools of the computing practice in complex activities.
- Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.

LEADERSHIP ACTIVITY

Supreme Student Council (S.Y. 2015-2016) -**Public Information Officer**

Supreme Student Council (S.Y. 2016-2017) - **Representative**

Society of Scholars T.I.P. Manila (S.Y. 2018-2019) - **Representative**

Computer Engineering Student Society (S.Y. 2020-2021) - **Treasurer**

Computer Engineering Student Society (S.Y. 2021-2022) - **President**

SEMINARS AND TRAININGS ATTENDED

- Beginning Python 1: Python I/O, functions, variables, operators, data types, string manipulation

Zoom Link

June 07, 2022

- Beginning Python 2: Control flow, Booleans and conditional logic, relational operators, if-else and while statements

Zoom Link

June 08, 2021

- Beginning Python 3: Data structures, lists and dictionaries

Zoom Link

June 09, 2022

- Beginning Python 4: Tying it all together - Creating simple programs in Python

Zoom Link

June 10, 2021

- Intro to the AWS Management Console; Building websites with HTML, CSS & JavaScript 1

Zoom Link

June 11, 2021

- Building websites with HTML and CSS & JavaScript 2

Zoom Link

June 15, 2022

- Deploying web applications with Amazon Simple Storage Service (Amazon S3) and Amazon Elastic Beanstalk

Zoom Link

June 16, 2021

- Database programming with Amazon DynamoDB

Zoom Link

June 17, 2021

- Introduction to Machine Learning with Amazon SageMaker

Zoom Link

June 22, 2021

- Deep Learning with AWS

Zoom Link

June 25, 2022

- Above the Clouds

Zoom Link

July 12, 2022

- Backend Trend: An Introduction to NodeJs

Zoom Link

July 19, 2022

- An Introduction to Object Detection with Deep Learning

Zoom Link

July 21, 2022

- Cyber Threats: Attack, Defense, Intelligence

Zoom Link

July 23, 2022

- Social Engineering Attacks: Don't be a Victim, Be Equipped

Zoom Link

July 24, 2021

- Raspberry Pi Essentials

Zoom Link

July 28, 2021

- Blockchain: The Next Generation Technology

Zoom Link

July 26, 2021

- Design Project Learning Series

Zoom Link

November 16, 2021

EXTRA AND CO-CURRICULAR ENGAGEMENTS AND VOLUNTEER WORKS

- Supreme Student Council

Public Information Officer

June 01, 2015 - March 31, 2016

- Supreme Student Council

Representative

June 01, 2016 - March 31, 2017

- Society of Scholars

Representative

June 04, 2018 - March 29, 2019

- Computer Engineering Student Society

Treasurer

August 27, 2020 - June 02, 2021

- Computer Engineering Student Society

President

August 23, 2021 - February 12, 2022

OTHER SKILLS

Technical Skills
Active Listening
Intrapersonal Skills
Creativity
Leadership

REFERENCE

Jennifer Enriquez
Department Head
Technological Institute of the Philippines
jennifer.enriquez@tip.edu.ph

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PATRICK LESTER PUNZALAN

COMPUTER ENGINEERING

Technological Institute of the Philippines (TIP) M

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Tel. No.: 559-5524

Email Address: punzalan2233@gmail.com

Cellular No.: +630916209707



CAREER OBJECTIVE

I am an individual who's passionate about work, sincere in his words, approachable by anyone, reliable, honest, and trustworthy of everything. I would like to secure a challenging position in a reputable organization that'll be a great help for me to expand my learnings, knowledge, and skills.

DESIGN PROJECTS COMPLETED/ RESEARCHES

Web-Based Lending Management System with Credit Score Algorithm for "Countryboys" Lending Corporation

The project mentioned above focuses on creating a lending management system for a lending corporation named "Countryboys" located at Cavite. This web-based lending management system features several tools that are beneficial for the admins and the staff of the company. From graphs, analysis, statistical data, as well as management of users/clients to determine whether they are capable of being lent by the company through their credit score.

Fake News Detection Program using Logistic Regression and SVM

This project anchors about determining the forgery news that is usually being spread on social media websites that tricks the netizens by making it seem "real" but it is just a hoax. We used Scikit Learn as well as TFID Vectorizer to determine the dataset that we have found and we've trained the data as well in order to determine whether the future news (data) would be fake or not. Logistic Regression and SVM are being utilized to predict the data and to determine whether the findings are accurate or not.

A Machine Learning Approach in Analyzing and Predicting the Music Popularity Based on Audio Features from Spotify Data

This project focused on utilizing a machine learning method in determining and predicting, for future purposes, the music popularity based on audio features from the music platform giant, Spotify. With this, we have determined several audio features are just, in reality, really popular around the world. One of which is on how long the song is, as well as if it is "danceable" or not based on beats, symphony, tunes, and instruments used. We have analyzed this data by using Random Forest Classifier, Linear Regression, and last but not least, Kmeans clustering.

COVID-19 Prediction Using Linear Regression and Support Vector Machine

The project focuses on predicting the potential rise of cases of the upcoming pandemic (when this was made) which was COVID-19. This system uses linear regression as the main variable in order to predict the data as well as support vector machine (SVM) which mathematically predicts the active cases, recoveries, and deaths of the given data.

KNOWLEDGE, SKILLS AND ATTITUDE

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- Analyze complex problems and identify and define the computing requirements appropriate for solution.
- Use modern techniques and tools of the computing practice in complex activities.
- Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.

LEADERSHIP ACTIVITY

Computer Engineering Student Society (S.Y. 2021-2022) - Secretary

SEMINARS AND TRAININGS ATTENDED

- Beginning Python 1: Python I/O, functions, variables, operators, data types, string manipulation
Zoom Conference
June 07, 2021
- Beginning Python 2: Control flow, Booleans and conditional logic, relational operators, if-else and while statements
Zoom Conference
June 08, 2021
- Beginning Python 3: Data structures, lists and dictionaries
Zoom Conference
June 09, 2021
- Beginning Python 4: Tying it all together - Creating simple programs in Python
Zoom Conference
June 10, 2021
- Above the Clouds
Zoom Conference
July 12, 2021
- Backend Trend: An Introduction to NodeJs
Zoom Conference
July 19, 2021
- An Introduction to Object Detection with Deep Learning
Zoom Conference
July 21, 2021
- Cyber Threats: Attack, Defense, Intelligence
Zoom Conference
July 23, 2021
- Social Engineering Attacks: Don't be a Victim, Be Equipped
Zoom Conference
July 24, 2021
- Blockchain: The Next Generation Technology
Zoom Conference
July 26, 2021
- Raspberry Pi Essentials
Zoom Conference
July 28, 2021
- Design Project Learning Series
Zoom Conference
November 16, 2021

EXTRA AND CO-CURRICULAR ENGAGEMENT AND VOLUNTEER WORK

- Computer Engineering Student Society
Secretary
August 23, 2021 - Present

OTHER SKILLS

Creative, Fast Learner, Goal Oriented, Systematic, Hard Working, and Flexible to the environment.

REFERENCE

Jennifer Enriquez
Department Head - CPE
Technological Institute of the Philippines - Manila
jennifer.enriquez@tip.edu.ph

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