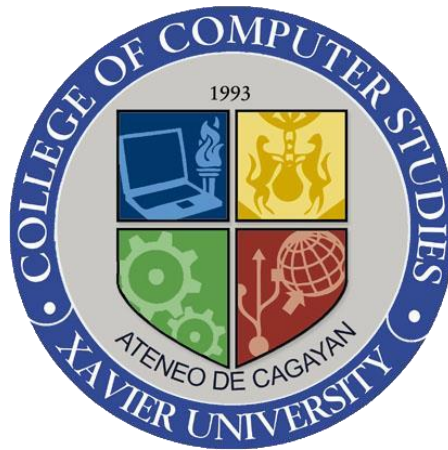


XAVIER UNIVERSITY – ATENEO DE CAGAYAN

**COLLEGE OF COMPUTER STUDIES
DEPARTMENT OF COMPUTER SCIENCE**



**A WEB BASED APPLICATION ON AIR QUALITY USING
PREDICTIVE ANALYTICS**

A Thesis Presented to
Department of Computer Science
College of Computer Studies

In partial Fulfilment of the Requirements for the Degree of
Bachelor of Science in Computer Science

by

Hazel Jay Mari A. Agnes
Patrick N. Gomez
Apple Jane A. Manayaga

March 2017

ADVISER'S RECOMMENDATION SHEET

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Ad Majorem dei Gloriam for the greater glory of God.

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ABSTRACT

Air pollution is one of the major international issues to this day. There are many sectors contributing to the pollutants present in the atmosphere, and the transportation sector contributed more than half of the following pollutants: Carbon Monoxide (CO), Oxides of Nitrogen (NO_x) and Oxides of Sulphur (SO_x). These pollutants are commonly emitted by the vehicles. In Cagayan de Oro City, 47% of the vehicles belong to the Motorcycles and Tricycles MC/TC type. Each year, the population of the vehicles are growing and from the year 2010-2015, there was a growth of 11.43% in MC/TC. With the growth of MC/TC population, there is also growth in the pollutants present in the atmosphere. The researchers want to raise awareness among the Kagay-anons about the effects of vehicle count to the air quality of the city. Thus, the researchers developed a Web-Based Application on Air Quality Using Predictive Analytics which will show the effect of a certain number of MC/TC to the air quality of the city.

KEYWORDS: *Air Quality, Predictive Analytics, Air Quality predictive analytics, Emission, Vehicle Emission, Pollutants.*

Chapter 1

Introduction

1.1 Background of the Study

The present-day atmosphere is quite different from the natural atmosphere that existed before the Industrial Revolution (circa, 17601). All man-made (anthropogenic) emissions into the air can be called air pollution because they alter the chemical composition of the natural atmosphere (Daly, Zannetti, 2017). Mobile sources contribute significantly to most pollutant emissions. (Pimentel, et al, 2015) The Philippines is ranked 48th among the nations of the world in terms of carbon emission in the transport sector (Gilaga, 2010). UN Convention and Kyoto Protocol agreed to help minimize Greenhouse Gas emission worldwide. The Government is quantifying air quality for legislation and policy making.

Vehicles emit harmful chemicals during vehicle operation and refueling, there are also additional emissions linked with the refining and distribution of vehicle fuels. Pollution from the vehicle is split into primary and secondary pollution. The primary pollution is emitted directly into the atmosphere and the secondary pollution is the result of the chemical reactions between the pollutants in the air. Transportation contributed more than half of the Carbon Monoxide (CO), Nitrogen Oxide (NOx), and Sulphur Oxides (Sox) (Scientist, 2016).

There are various vehicle types in Cagayan de Oro City, and Motorcycles and Tricycles (MC/TC) takes up 48% of all the vehicles registered in the City, according to Land Transportation Office (LTO) data of 2015 Vehicles Registered by type. Air Monitoring is very important to prevent air pollution from getting worse, thus the researchers aimed to create an application that can help in giving awareness to the community on the state of the air quality of Cagayan de Oro City. The application

included a predictive analytics function which identifies the impact of a number of vehicles to the air quality of the city.

Analytics is a scientific process that transforms data into insights for making better decisions. It uses mathematical statistics and can be used to recommend actions. The specific Analytics used by the researchers is Predictive Analytics. It is a branch of data mining concerned with future probabilities. It uses dataset for adequate size and quality to have a clear definition of the concept to be predicted. (Elkan, 2013) Predictive analytics understands the behavior of a certain situation, identify unexpected opportunity and anticipate a problem before it even started. (Ereckson, 2007).

1.2 Statement of the Problem

Air Pollution identified as a major international issue (Thomas, 2014) and transportation contributed more than half of the CO, NO_x, and SO_x pollutants to the air (Scientist, 2016). Hazardous air pollutants are introduced into the air during vehicle operation which worsens the state of air pollution. Between the years of 1996 to 2006, it was found that there was a rapid increase of vehicles plying Cagayan de Oro City's streets. (EST Casebook Cagayan de Oro, 2007).

The citizens of the city are not fully aware of the cause of the vehicle's population to the air quality of the city. CDO City data indicate 5 out of 10 leading causes of morbidity in the city are air-pollution related illnesses (Pimentel, et al, 2015). The harmful emissions from vehicles can heighten the air pollutants.

1.3 Conceptual Framework

The researchers formulated this conceptual framework which aims to explain the processes of data. The application accepts input of Vehicle Count from LTO, and

pollution; CO, NO_x, and SO_x from Xavier University Engineering Resources Center (XUERC).

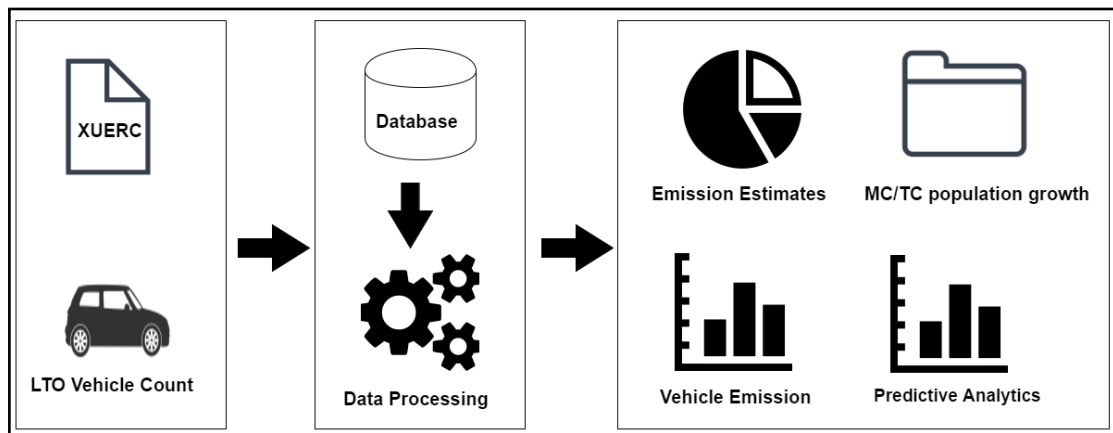


Figure 1.1 Conceptual framework of the study

The data accepted by the application is stored in the database. Several functions are generated from the data accepted by the system. The Emission Estimates is where the different sources of emission are projected through graphs. Vehicle Emission and MC/TC population growth are also graphed. In data processing, this is where the calculations for predictive analytics happen. The web application allows the Regular Users to adjust the levels of MC/TC count for the user to see the effect of a certain number of MC/TC to the air quality of the city.

1.4 Objectives

1.4.1 General Objectives

This study aims to develop a web application with predictive analytics that can be used to predict the effects of the MC/TC count to the Emission Inventory of major air pollutants in Cagayan de Oro City.

1.4.2 Specific Objectives

The specific objectives are as follows:

- To gather data from (LTO) Land Transportation Office for the vehicle count, the recent Emission Inventory of Cagayan de Oro City, and the specific pollutants from vehicle emission; specifically, CO, NO_x, and Sox.
- To design a web-based application, on air quality based on the requirements gathered.
- To develop a web-based application that uses predictive analytics.
- To test the web-based application using alpha test.

1.5 Scope and Limitation

The researchers chose to develop a web application since the statistics showed that in 2016, 43.5% total population of the Philippines uses the internet. (The Internet, 2016). As the internet users are growing, it is preferable to use the web for the application in terms of its accessibility. The Web Application can also be accessed through mobile devices, since the mobile web refers to browser-based internet services. The study will only focus in Cagayan de Oro City, and the vehicle type that is focused in the study is MC/TC only, since 48% of all the vehicles in Cagayan de Oro City are from the MC/TC category.

The application allows the Analyst to input updated vehicle count, and specified pollutants; CO, NO_x, and SO_x. The application then generates graphs of the pollutants caused by vehicle emission. The application also displays the Emission Estimate of the city. The MC/TC population growth through the years 2010-2015 is also projected in the application.

The data for the pollutants are gathered from XUERC and the available data

for the pollutants is from the year 2011 only. The Vehicle count per vehicle type data gathered from LTO and is from the year 2010-2015 only.

The researchers use predictive analytics in this study thus; the use of other kinds of analytics is not included. Users have the option to adjust the MC/TC count using a slider, which gives out a view on the effects of the additional MC/TC to the Emission Inventory.

Bootstrap is used as the front-end framework of the system for faster and easier web development. The application is locally hosted. The researchers attached a Real-time Air Quality Index Visual Map of the world where 9,000 air quality monitoring devices are published in the map.

1.6 Significance of the Study

The application is useful for the community to be aware of the effects of the number of MC/TC to the air quality of Cagayan de Oro City since 48% of the registered vehicles in the city are from the MC/TC category. With the awareness, the Analysts and government officials can help form new laws for the regulation of MC/TC population.

To the analyst, the study is a great help in foreseeing the effect of a certain population of vehicles to the vehicle emission. The application is useful in monitoring and giving awareness to the city.

To the researchers, it is a great privilege to be able to contribute to the body of knowledge of Computer Science. This helps the researchers in voicing out their concern for climate change.

1.7 Definition of Terms

Air Quality – is the state of the air around. Good air quality refers to the clean, clear, and unpolluted air. Poor air quality is a result of several factors, including emissions from various sources, both natural and “human-caused”. (Quality, 2016)

Analytics – is an encompassing and multidimensional field that uses mathematics, statistics, predictive modeling and machine-learning techniques to find meaningful patterns and knowledge in recorded data. It involves studying past historical data to research potential trends, to analyze the effects of certain decisions or events, or to evaluate the performance of a given tool or scenarios. (Analytics What it is and Why it matters, 2016)

Application – is the use of a technology, system or a product. a program or piece of software designed and written to fulfill a purpose of the user. It is designed to perform a specific function directly for the user or, in some cases, for another application program (Rouse, 2017)

Carbon Monoxide – (CO) an odorless, colorless, and poisonous gas is formed by the combustion of fossil fuels such as gasoline and is emitted primarily from cars and trucks. When inhaled, CO blocks oxygen from the brain, heart, and other vital organs. Fetuses, newborn children, and people with chronic illnesses are especially susceptible to the effects of CO. (Cars, Trucks, and Air Pollution, 2014)

Database – is a collection of information that is organized so that it can be easily accessed, manage and update. The data are organized into rows, columns and

is indexed to make it easier to find relevant information. The data gets updated, expanded and deleted as new information is added. (Rouse, 2017)

Emissions – are discharges of a pollutant from a source like factories or group of sources like vehicle into the air. (BC Air Quality, 2016)

Framework – It is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into somethings useful. In computer systems, it is often layered structure indicating that kind of programs can or should be built and how they would interrelate. (Rouse M. , 2015)

Mobile – mobile is a self-propelled road vehicle and off-road vehicle, commonly wheeled, that does not operate on rails, such as trains or trans and used for commercial purposes in the highways in the transportation or passengers, or passengers and property. (Websters, n.d.)

Oxides of Nitrogen – (NO_x) a mixture of gases that are composed of nitrogen and oxygen. Two of the most toxicologically significant compounds are nitric (NO) and nitrogen dioxide (NO₂). (Oxides of Nitrogen, 2014)

Pollutants - a substance that pollutes something, especially water or the atmosphere. It can be physical or chemical and in forms of smoke, gases, and heat. At high enough concentrations endangers the environment and the people's health. (BC Air Quality, 2016)

Predictive Analytics - the branch of the advanced analytics which is used to make future predictions. It uses man techniques from data mining, statistics, modeling, machine learning, and artificial intelligence to analyze current data to make predictions about the future. (imanuel, n.d.)

Sulfur Oxides – (SO_x) emission is mainly due to the presence and burning of Sulphur compound in the fuel. (Anish, 2016)

Sulfur Dioxide - Power plants and motor vehicles create this pollutant by burning sulfur-containing fuels, especially diesel. Sulfur dioxide can react in the atmosphere to form fine particles and poses the largest health risk to young children and asthmatics. (Anish, 2016)

CHAPTER 2

REVIEW ON RELATED LITERATURE

2.1 Local Studies

The Philippines is ranked 48th among 212 nations in relation to Carbon Emission in the Transportation Sector. Due to increasing Green House Gases that causes the environmental crisis, countries through international agreement; UN Convention and Kyoto Protocol agreed to help minimize Green House Gas emission worldwide. The Philippines adapted to this agreement and established RA 8749 'Philippine Air Act' on 1999. The act sets maximum limits of pollutants in vehicle exhausts. The researchers of the article aimed to identify and assess a number of gaseous pollutants produced by the vehicles in Dipolog City. The city's air quality over the years was seen to be declining. The researchers aim to identify the pollutants discharged from vehicles in Dipolog City which can help the lawmakers and environmentalists. (Bernard G. Gilaga, 2010).

The researchers discovered that the largest volumes of vehicle type per day are the motorcycles, followed by the passenger car and public utility. Motorcycles, passenger cars, passenger utility and goods utility mostly use gasoline, though there are also those which uses diesel. On the emission test, the motorcycle has the highest HC emission, and CO. Passenger car, passenger utility car, and good utility car went next. For the diesel vehicles, opacity as the only measure for the toxic compounds to be noted which affects the public health and the environment. Passenger Car has the highest opacity. Through the emission data that was gathered, all vehicles using diesel fuel had the value below the standard value $k=2.5$ (Bernard G. Gilaga, 2010). Through the data gathered, it is seen that the motorized tricycles are the vehicles contributing a

lot of negative emissions in the atmosphere, and they have the majority of the volume all the vehicles. Motorized tricycles in Dipolog City should be reduced in number to significantly reduce the Green House Gas emission in the city. The CO produced by the motor vehicle in the city is greater than the monthly tropospheric CO reading by NASA Terra Satellite. (Bernard G. Gilaga, 2010).

The researchers used two analytical tools to propose a model for air quality health risk, these are the AHP and GIS. AHP or Analytical Hierarchy Process is a multi-criteria decision analysis (MCDA) tool that enables the decision maker to develop certain hierarchy of alternatives of factors according to priority or importance, while GIS or the Geographic Information application is basically a computer based tool for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships. (Siador & Promentilla, 2016).

There are two parameters evaluated using AHP and GIS tools, which are the hazard and the exposure indices. To determine the risk level, the two indices, are calculated separately. The hazard index is measured by pollutants having three criteria the SO_x, NO_x, and PM with their sources stationary, mobile and area. It is known to cause bronchoconstriction, emphysema, airway inflammation, aggravation of heart disease, and other health complications. (Siador & Promentilla, 2016)

Many studies prove the connection between air pollution and health. Metro Manila has obtained high exposure index thus, policies are made to monitor air pollution, as they could classify the area sources. This might address the population density issues (Siador & Promentilla, 2016).

The risk level of each city was quantified through a composite score of hazard

and exposure indices, and classified in a descriptive manner, (i.e. good, fair, unhealthy, very unhealthy, and emergency). Aside from the pollutant hazard, human or social parameters there were also highlighted as the exposure index and captured its uncertainty factors in relation to air pollution. The study could be further improved if instead of cities, airshed would be analyzed. Airsheds are parts of atmosphere that behave in a coherent way with respect to the dispersal of atmospheric emission (DENR, 2009). It would cover not only Metro Manila but other regions as the well. Because of the major limitation of the study, another important improvement would be the completeness emission inventory of every area and updated statistics and spatial data. (Siador & Promentilla, 2016).

Real-Time-Based Smoke Belching monitoring application has been designed to monitor smoke belchers and violators among diesel user public utility vehicles (PUV). Smoke belching is considering as number one benefactor of pollution for its vigorous discharge of smoke from the vehicle's pipe. The Philippine government periodically uses public and private smoke Analysts to measure the number of pollutants of vehicle machine into the air. This Analyst measures the opaqueness of smoke with the help of opacity meter, thus the quantity if the unburned fuel in the exhaust of diesel engine can then be estimated. (Rodelas, Paraluman, & Guia, 2016). Purposive sampling was used in this research to identify the number of the public vehicle operators and drivers who are the participants of this research. An opacity meter connected to an Arduino ATmega 644 microcontroller and Gizduino Global application for Mobile (GSM) shield was prototyped and used for this research. The device can detect opaqueness of the smoke produced by the exhaust of any public vehicles. There is different software like the Arduino Integrated Development Environment was used by the researchers. This software reads C++ language,

XAMPP Platform, and Visual Basic.Net. Descriptive Statistics was used to analyze the data in this researcher. (Rodelas, Paraluman, and Guia, 2016).

The researchers could find the materials needed for the application that is locally available. The software used was user-friendly and could monitor the plate number and the absorption coefficient of each plate number registered in the application. It was found out by the researchers during the development that dust might affect the light source and the LDR sensor. The light source must be directed to the LDR sensor for it to conduct a better reading. The registered jeepneys and the emission results can be viewed by the Land Transportation Office (LTO) using the localhost database. (Rodelas, Paraluman, & Guia, 2016).

The reliability of the application's functions which is in sending and receiving data is very evident. The application could directly and in the real-time monitor, the PUV tested as smoke belching. Smoke belching is measured by light absorption coefficient using the Light Dependent Resistor (LDR) and Light Emitted Diode (LED) that can be found in the opacity meter. (Rodelas, Paraluman, & Guia, 2016).

The gas Analyst or Exhaust Emission Analysts is a device that measures the air pollutants an engine emits. Gasoline-fueled vehicles emit the following pollutants: HC, CO, and NOx. The government set a limit to these pollutants emitted due to the effects it has to do with the environment and the health. Every year, vehicles are tested in the emission center to check if their emission rates are still within the boundaries, if the vehicles can't pass the test, the owners won't be given a license. The real situation is that most vehicles emit gasses more than the allowable limit within twelve months of use, due to this, the Land Transportation Office (LTO) launched a roadside inspection. They randomly select vehicles along the roads of Metro Manila and conducted an emission test on the spot using a portable Analyst. The portable

Analyst developed in this study is more affordable. The Portable Automobile Exhaust Emission is developed. The device has two functions; gas Analyst for vehicles powered by gasoline, and opacimeter for vehicles powered by diesel. There are multiple parts to the device; keypad, microcontroller, thermal printer, and LCD.

Several factors of the development of portable automobile exhaust emission were considered; the whole prototype, the size, and the weight of the device. The final product ended up to be the size of an industrialized flashlight and can be carried by the users. The sensor does not only measure HC, CO, and NO_x, it also measures the opacity. The last test for the device is that the results of the device be compared to results with existing emission testing centers. The tests determine that 90% precision was achieved. (Baylon, Dy, Quidilla, & San Pascual, 2007)

2.2 Foreign Studies

In this paper, classification of air pollution was discussed. In today's generation, the atmosphere has now the component of chemicals existing in industry atmosphere. All manmade emission is considered as air pollution because of the chemicals present in the natural atmosphere. With this, pollution can be classified as harmful. It is considered harmful in terms of an adverse effect in terms of the health of living organisms. (Daly & Zannetti, 2007)

Atmospheric Chemical Composition such as Nitrogen has Percent by Volume of 78.1%, Oxygen has 20.9% and Argon has 0.92%. The increase of CO, Methane, and NO_x can be called air pollution. Carbon in the atmosphere leads to climate change. Natural emission like a volcanic eruption is another disadvantage of this approach and does not consider as the natural emission of air pollution. (Daly & Zannetti, 2007)

There are two types of pollutants, they are known to be the primary and the

secondary pollutants. Primary are an element that is directly produced into the atmosphere like Carbon compound elements, Nitrogen, sulfur, halogen compounds more on the secondary pollutants are indirectly produced from source. In air Pollution Regulation, United State has been regulating Clean Air Act all over the world with this criterion of pollutant are classified regulated by the USA-EPA. There are 6 principal pollutants namely TSP, Sulfur Dioxide, Nitrogen Oxides, Carbon Monoxide, Ozone, and Lead. Radioactive Pollution is also considered as air pollution. (Daly & Zannetti, 2007).

The first step in monitoring in controlling air pollution is monitoring the air, the researcher finds an innovative way in monitoring pollution by using devices distributed to different areas to get sample air that runs in real time using raspberry pi coded by python 2.7 that are calibrated based on standards. The research was conducted by stationed MQ7, MQ4, and LM35 air quality sensors, reading is transmitted using the internet to the Real-time streaming server and records its data using online analytics and Visualization tool. With this process, the data is now converted to a plot using the online plotting tool and estimate air quality using Air Quality Index guidelines set by Central Pollution Control Board for CO. With this study, it can raise awareness to the citizen and to the government itself to take precautionary actions by controlling gas emissions for them to have green and pollution free city. (Karamchandani, 2016). Vehicle emission is one of the inputs to air pollution dispersion which is used to estimate the ambient air quality. People exposed to traffic-related air pollution are associated with health effects. This study aims to produce a more reliable emission estimation model for vehicles based on real-world speed, road grade data, and acceleration. In the city of Bradford UK, thirty-three hours of driving over to an urban network was logged. The vehicles used were a

Toyota Prius which was equipped with VBoxII Lite and OBD Mini data logger. The device logged the speed and road grade during the journey. The data taken is then inputted into Instantaneous Emission Model PEHM which gives out the predictions of fuel consumption and the exhaust pollutant emission of the vehicle. With the output, new vehicle average-speed-emission curves were developed. (Khreis, 2016)

There is also a research that investigates the use of Machine Learning technologies to analyze and predict Carbon as an indicator for air quality in the environment. With this research, also, the author introduces some techniques for analyzing and collecting data using sensors.

Their test beds are located at Washington State University campus, 2 apartments and 1 working place the researchers place fluke air quality meter to measure air conditions. In the experiment, they have made they want to test if smart environment information can be used as a model of air quality and how accurate predictive features. To determine if the sensor data can be used to predict the air quality by using the ability of the machine learning algorithms. For future projects like this, the researchers would like to use these predictions to make automated task such as automated ventilation and purification of air. (Deleathe researchers, Lamb, & Cook).

The quality of air is connected to the level of pollutants; this is due to transmission and deposition phenomena and secondary pollutants formation. Primary pollutant conversion affects other environmental areas. It is necessary to obtain information on the type and amount of pollutants in the air or pollutants introduced into the air. There are many techniques in the study which can be classified as follows: compound type and concentration level, a measurement used, investigation period, automation of level measurements, site of measurement, how it was measured,

sampling mode, an appliance used for the sampling. The use of methods and analytical techniques provide information for the following: identifying the emission sources, assessing the interaction range of the emitters, estimation of protective measures, determining ambient air pollutants and investigating long-term concentration, studies of processes in the atmosphere, estimation of exposure rate by living organisms. These tasks with air quality are possible due to the various analytical techniques.

The determination and separation of compounds that are air pollutants are difficult and an expensive task. Application of total parameters; most of it are carbon in all pollutants, enables a limitation of necessary steps of analysis and evaluation of pollution. In the analytics of air pollution, two parameters are frequently used, the total hydrocarbons (TH) and the total non-methane hydrocarbons (TNMTH). These are expressed as sum calculated as carbon concentration. The limitation of instruments constraints the study to be varied and wider. The study was still able to deliver findings of the air quality. Air pollutants mostly are Carbon and in the analytics of air pollution, hydrocarbons and non-methane hydrocarbons are usually used. (Namiesnik & Wardencki, 2002).

2.3 Synthesis

The articles included in the researchers' review of related literature support that the web application is possible to develop as such Monitoring and Analytics of Atmospheric Air Pollution (Namiesnik & Wardencki, 2002), Development of Real-GSM (Rodelas, Paraluman, & Guia, 2016). The researchers also aimed to develop an application for monitoring the air quality, but the difference is that the researches focused on air quality monitoring using predictive analytics.

There are studies that focus on the predictive analytics on Air quality such as

Prediction of Air Quality in Smart Environment (Deleathe researchers, and et.al.), Pervasive Monitoring of CO and Methane Using Air Quality Prediction (Karamchandani, 2016) and Prediction Model Adaption Thanks to Control Chart Monitoring –Application to Pollutants Prediction (Thomas, 2014).

CHAPTER 3

Methodology

3.1 Research Design

The researchers used the Modified Waterfall as the design process for the application development. (See Figure3.1).

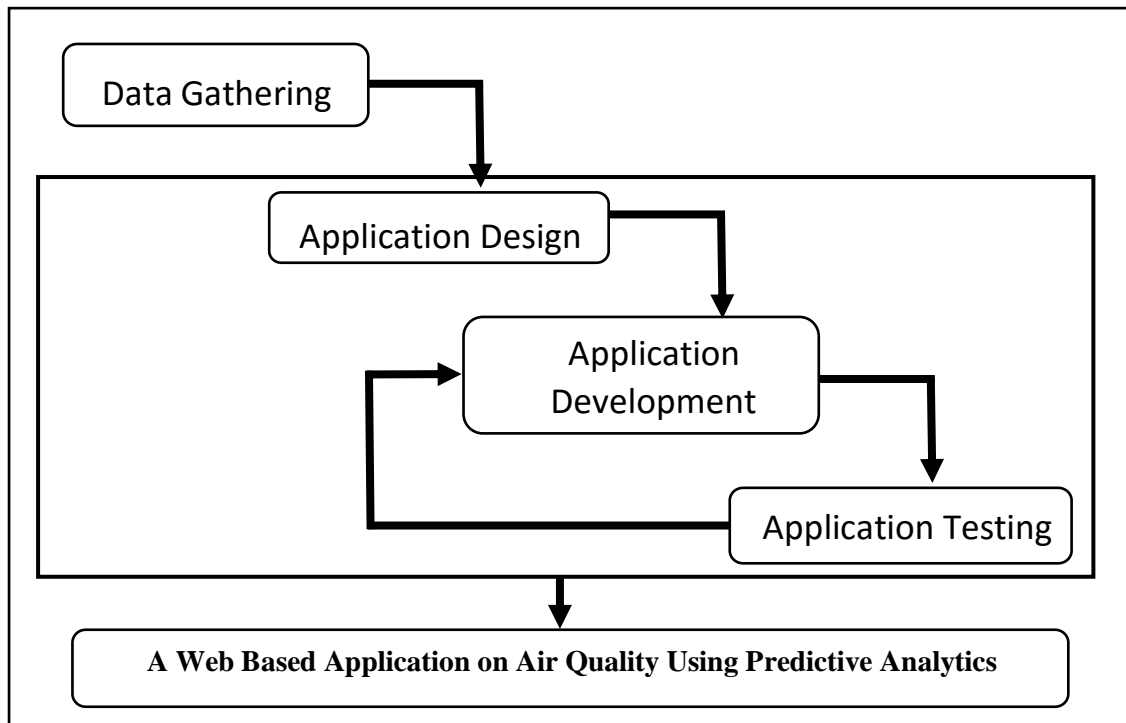


Figure 3.1 Modified Waterfall

There are four phases in the modified Waterfall, the Data Gathering, Application Design, Application Development, and lastly the Application Testing. The first phase is the Data Gathering. The researchers gathered data from the Land Transportation Office (LTO) for the registered vehicles according to vehicle type per year from 2010 to 2015. The researchers also gathered data from Xavier University Engineering Resource Center (XUERC) for the general Air Quality of Cagayan de Oro City and the specific pollutants present in the air such as CO, SO_x, and NO_x. The location of air quality monitoring devices in Cagayan de Oro city are situated in four different areas; One device is placed in Gusa where the sampler was placed on the

ledge above the Barangay Hall of Gusa. The second device is placed in the City Hall of Cagayan de Oro City. The sampler was placed on the Bridgeway, overlooking the river. The third device is placed in Xavier University's engineering building roof deck. The fourth device is placed in the Barangay Hall of Tablon. The second phase is application designing wherein researchers are to design the application's functionalities. The third phase is the Web Application Development wherein the researchers developed an application based on the research design, following the functionalities. Fourth is the Application testing wherein researchers are to alpha test the application, whether the application produces the expected output. If the expected output is not satisfied, the researchers go back to the Application Development phase.

The researchers set an implementation schedule for the target start and end dates to finish the different phases of the web application. (See Appendix A)

3.2 Detailed Methodology

3.2.1 Data Gathering

To obtain the needed data for the study, the researchers used the existing documents and records that are currently available at the XUERC.

The researchers made a personal interview with XUERC's head, on the air quality issues in Cagayan de Oro City. The data that are available at the XUERC may not be guaranteed to be complete and updated. The researchers also asked for the registered vehicles according to vehicle type per year from 2010 to 2015 from LTO.

The researchers made use of the data from XUERC which is part of their 'Clean Air Act Plan for Cagayan de Oro City, Philipines' study which was accepted by the ASEAN- German Technical Cooperation Clean Air for Smaller Cities in the Asean Region.

3.2.2 Application Design

In this phase, the researchers designed a Web Application which shows the contribution of the Vehicle emission to the overall Air Quality of Cagayan de Oro and generates graphs based on the results. The processed data is used as the basis for predictive analysis with the user's change in the vehicle count. The users have the option to adjust the vehicle count and a graph is generated to show the effect of the vehicle count to the overall air quality of the city.

3.2.3 Application Development

In this phase, the researchers developed the web application with the use of a front-end web framework which is Bootstrap. The Researchers also attached a leaflet-API-developed mapping of a Real-time Air Quality Index in the world. Google Chart is a simple JavaScript that is embedded in the web page which the researchers used to graph the data that are loaded into the application. XAMPP is used by the researchers as the web server which interprets scripts written in PHP. The process of the web application is documented to have a guideline and to keep track of the progress of the development.

3.2.4 Application Testing

In the testing phase, the researchers tested if the application met the specified requirements set by the developers. The application is tested using Google Chrome web browser for the functionality test.

The target analysts of this application are the administrators who will be the ones to manage the web application by updating the data and information that are needed. They are also the only authorized users who can create an account for other analysts.

CHAPTER 4

Results and Discussions

4.1 Interviews

The researchers requested for data of CO, NO_x, SO_x and AQI (See Appendix B and C) however, before the data was given, Engr. Jefferson Vallente Jr. mentioned that the XUERC is using a different unit of measurement than the AQI and the data they have is based on a one-time sampling only. The unit of measurements they are currently using are microgram per normal cubic meter ($\mu\text{g}/\text{Nm}^3$) and tons/year. Currently, Metro Manila is the only city that uses and has a data of the AQI.

4.2 Data Analysis

Engr. Vallente also mentioned about the guideline values established under the Clean Air Act of 1999 (see Table 4.1).

Table 4.1. Philippine National Ambient Air Quality (NAAQ) Guideline Values

POLLUTANTS	Short Term			Long Term		
	$\mu\text{g}/\text{Nm}^3$	ppm	Averaging Time	$\mu\text{g}/\text{Nm}^3$	Ppm	Averaging Time
TSP	230	-	24 hours	90		1 year
PM₁₀	150	-	24 hours	60		1 year
Sulfur Dioxide	180	0.07	24 hours	80	0.03	1 year
Nitrogen dioxide	150	0.08	24 hours			
Photochemical	140	0.07	1 hour			
oxidants as ozone	60	0.03	8 hours			
Lead	1.5	-	3 months	1.0		1 year

The monitored concentrations of the criteria pollutants include total suspended particulates (TSP), particulate matter 10 microns in diameter or smaller (PM₁₀), sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), carbon monoxide (CO), lead (Pb) and ozone (O₃). Table 4.1 shows the guidelines of Philippine National Ambient Air Quality (NAAQ). The researchers only focused on three pollutants which mostly are emitted by motor vehicles. These pollutants are the NO_x, SO_x, and CO which is not

included in the guideline. The researchers also asked data from LTO for registered vehicles according to vehicle type per year from 2010 to 2015. (See Appendix D)

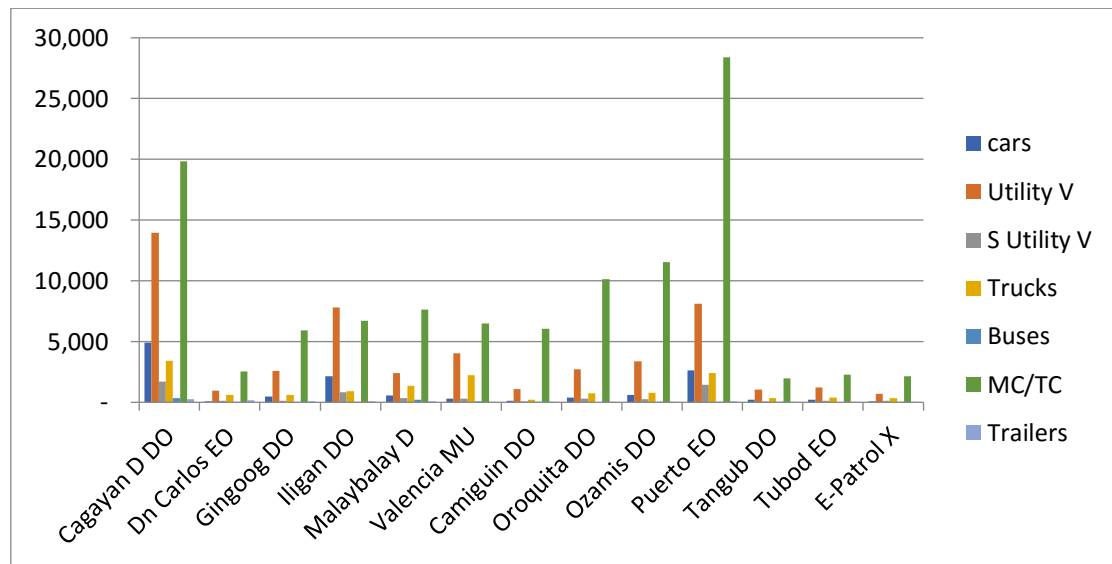


Fig.4.1. Total Number of registered motor Vehicles in Region X in the year 2010

The graph shows that Motorcycles and tricycles have the highest number of registrants in most cities in Region X. The researchers decided to focus on the motorcycles and tricycles of Cagayan de Oro City due to the reflected data which entails that said vehicle type has the most number in the city.

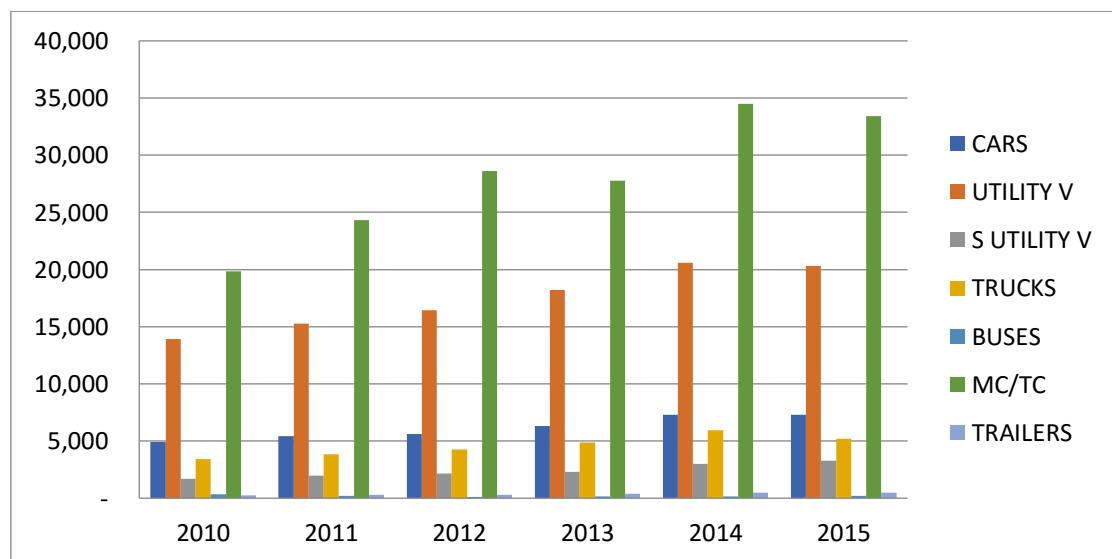


Fig 4.2. Total number of registered motor vehicles in Cagayan de Oro City by Motor Vehicle types, from 2010-2015

The number of motorcycles and tricycles are increasing rapidly each year from

year from the year 2010 to the year 2015.

From 2010 to 2012, the number of (MC/TC) Motorcycle and Tricycle vehicles increase but decreases in the year 2013. The population of MC/TC increase from the year 2013 to 2014. The MC/TC population almost took 50% of the population of the registered vehicles. The average percent increase for the cars is 10.41%, for the utility vehicles is 29.61%, 4.03% for Sports utility vehicles, 7.73% for the trucks, 0.35% for the buses, 0.60% for the trailers, and 47.26% for the motorcycles and tricycles.

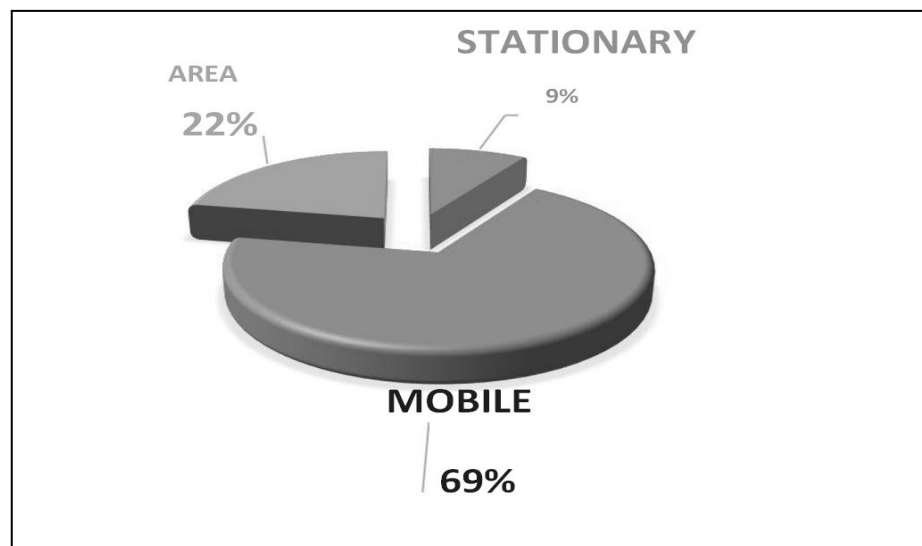


Fig 4.3. National Emission Inventory, by source, 2012

Based on the National Emissions Inventory which is conducted in 2012, the smajority by 69% of air pollutants came from the mobile sources such as cars, trucks, buses, and motorcycles. 22% of which is contributed by area sources such as construction activities, open burning of solid wastes and clearing in the uplands. And only 9% is contributed by stationary sources such as power plants and factories.

Table 4.2 Annual Average Pollutant Concentration in CDO, 2005 – 2011($\mu\text{g}/\text{Nm}^3$)

Year	SO ₂	NO ₂	O ₃	Benzene	Toluene	p-Xylene	PM ₁₀
2005	4.79	16.19	39.13	0.86	3.21	0.48	44.48
2006	4.98	17.56	39.85	1.00	3.20	0.57	38.43
2007	3.60	9.10	1.44	0.03	2.81	0.34	1.23
2008	4.44	12.06	0.66	0.65	2.87	0.16	-
2009	3.56	9.28	6.10	0.74	0.76	0.2	-
2010	5.23	14.98	29.96	1.57	2.48	0.49	-
2011	7.96	10.91	83.49	3.56	1.72	2.23	49.52**
NAAQGVs	80	150	60	-	-	-	60

Source: EMB Region X, Unpublished report, "Evaluation of Ambient Air Quality (Telemetry Station)" National Ambient Air Quality Guideline Values (NAAQGVs)

The data gathered are from the sampling site in Gusa, City Hall, Xavier University and Tablon during August 28 and 31, 2011.

Since July 2007, the monitoring station in Xavier University was not able to measure PM₁₀. Thus, limited monitoring was conducted on August 28 and 31, 2011 at the four sites in Cagayan de Oro City.

Table 4.3 On-Road Traffic Emissions by Vehicle Types in 2011 (tons/year)

Vehicle	UFP	CO	NO _x	SO _x	NMVOC	CO ₂
Motorelas	82	2,656	16	0.08	1,240	15,250
Motorcycle	7	3,585	60	1.05	183	19,836
Jeepneys	53	503	257	3.29	81	35,950
Taxi	6	69	52	0.78	8	14,501
Passenger Car	6	149	42	0.76	20	14,286
Sports Utility Vehicles	11	65	97	0.85	10	15,802
Buses	21	102	178	0.69	52	17,645
Other Light Duty vehicles	11	406	107	0.88	36	16,270
Heavy Duty Vehicles	19	126	560	2.41	52	53,078
Total	217	7,661	1,369	11	1,681	202,618

Source: Emission Inventory of Major Air Pollutants in CdO City (2015)

Table 4.3 shows the percentage breakdown of the road transport emissions by vehicle type (2010). Motorcycle and motorelas contribute mostly to Co emissions, while motorelas also have high UFP and NMVOC emissions that may be attributed to two stroke engines. Jeepneys and heavy duty vehicle (HDV) on the other hand contributed largely to NO_x and SO_x emissions. The SO_x emissions come mostly from diesel engine vehicles.

4.3 Web Design

4.3.1 Logical Diagrams

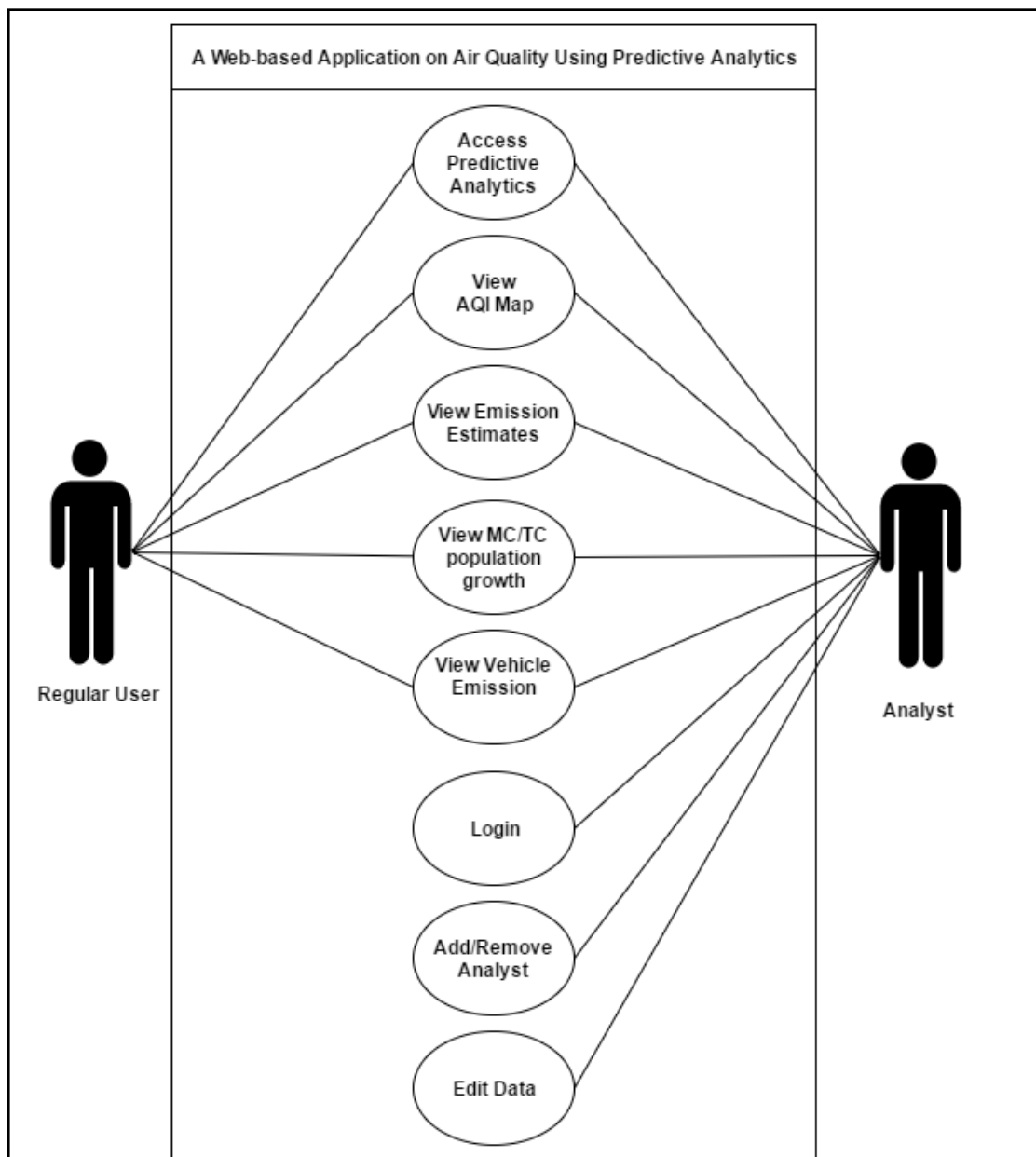


Fig 4.4 Use-Case Diagram for a Web Based Application On Air Quality Using Predictive Analytics

The application identifies two main users namely the Regular User and the Analyst. The Regular User can be anyone who can access the application through the web. The Regular User can access the Predictive Analytics, view the AQI Map of the application, Emission Estimates, MC/TC population growth, and Vehicle Emission.

The Analyst can be personnel from the Government Office or private sectors such as XUERC who are concerned with the Environmental impact of vehicles. The Analyst can access the Predictive Analytics, view the AQI Map of the application, Emission Estimates, MC/TC population growth, and Vehicle Emission. The Analyst has the privilege to edit the data that are used in the application. The Analyst can also add or remove other Analyst accounts. Before they can edit data and add or remove analyst accounts, they should first log in as Analysts.

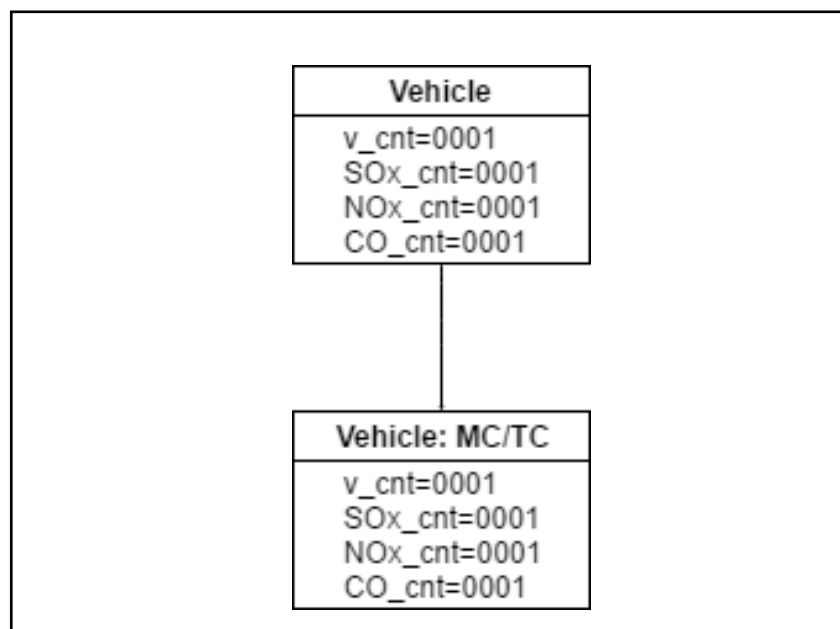


Fig 4.5 Object diagram for the input requirement of the system

The vehicle class is composed of v_count, SOx_cnt, NOx_cnt, and CO_cnt. v_count represents the total registered vehicles in Cagayan de Oro City. SOx_cnt, NOx_cnt, and CO represent the total Sulfur Oxide, Nitrogen Oxide and Carbon emission due to all the vehicles in the city. Vehicle: MC/TC is an object of vehicle class which represents motorcycles and tricycles. This is composed of v_count, SOx_cnt, NOx_cnt, and CO_cnt. v_cnt represents the number of registered motorcycles and tricycles in Cagayan de Oro City. SOx_cnt, NOx_cnt, and CO

represent Sulfur Oxide, Nitrogen Oxide and Carbon emission due to motorcycles and tricycles in the city.

Fig 4.6 is the Deployment Diagram of the application. The Deployment Diagram describes the physical deployment of information generated by the software program on hardware components.

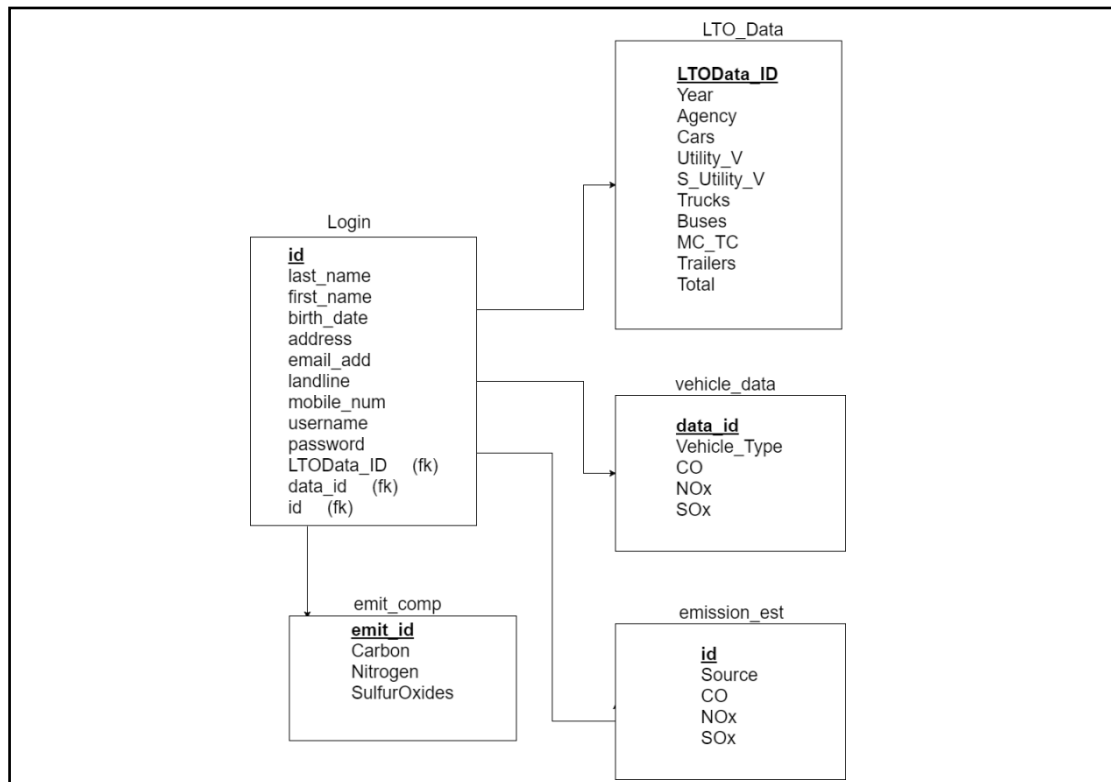


Fig 4.6 Database Physical Data Model

The entity Login represents the information of the Analyst who is required to login the system before being able to access the functionalities. The information that are needed for the analyst are found on Figure 4.6 and 4.7. The analyst can update the LTO Data and vehicle data. The Analyst can also view the Emission Estimates and Emission Composition. (See Appendix E)

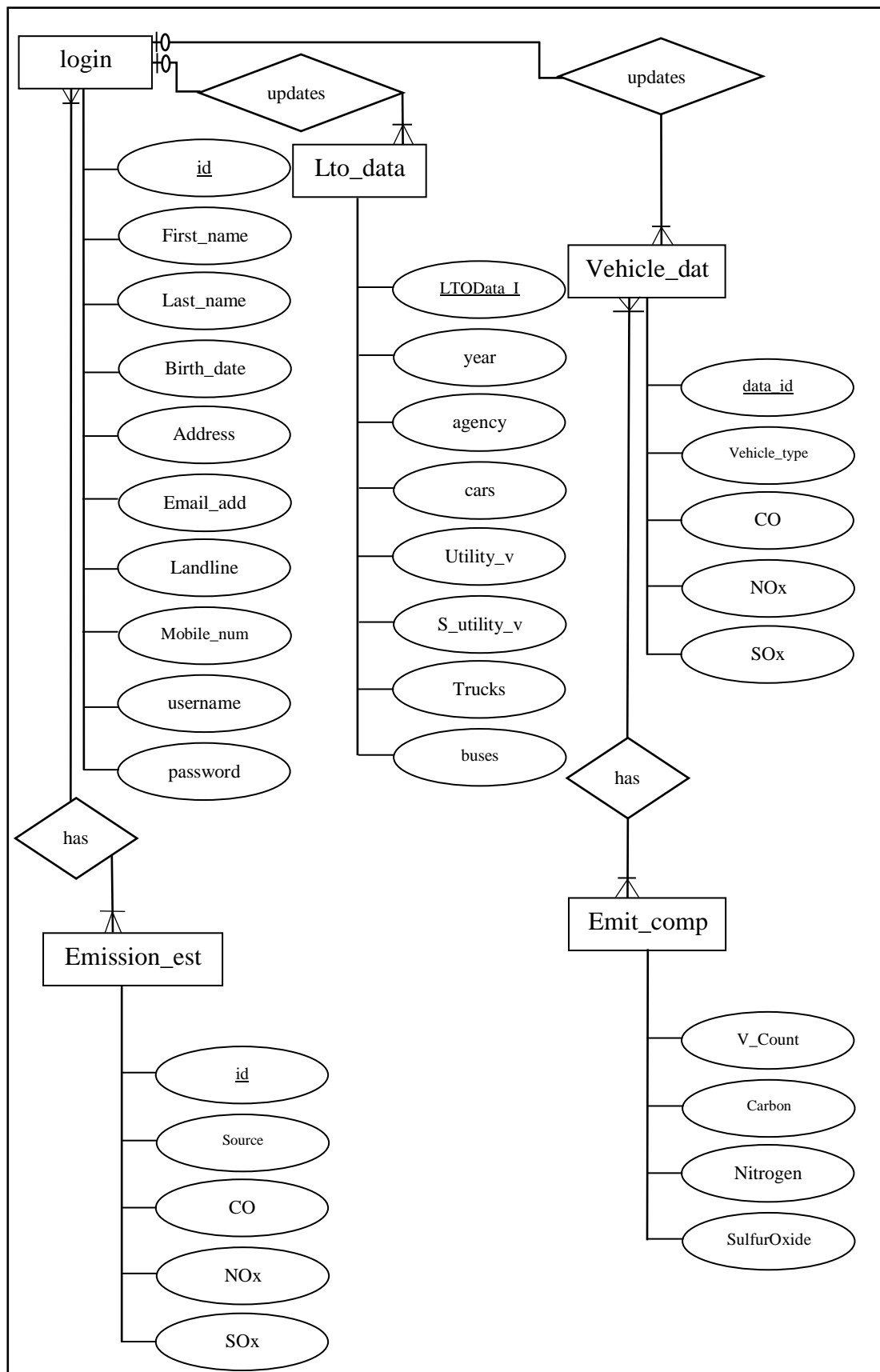


Fig 4.7 Database Entity Relationship Diagram

4.4 Web Application

4.4.1 PHP



Figure 4.8 Air CDO Dashboard

The researchers used bootstrap for the front-end framework, and PHP for as the scripting language. When Regular Users access the application, the first interface is the dashboard. On the left side of the dashboard, the Navigation Pane can be found. The Navigation Pane is composed of different responsive buttons; Dashboard and Statistics. The Login can be found after pressing the ‘Welcome Guest’ on the upper right of the Dashboard. On the main panel of the screen, the logo of the system and a brief introduction of the system can be seen.

4.4.2 Source Code

The source codes used to develop the web pages are written to suffice the web application’s functionalities. (See Appendix F)

Login Code

```
<?php
include("db.php");
$error="";
if(isset($_SESSION['login_user'])){
header("location: index.php"); }
session_start();
if($_SERVER["REQUEST_METHOD"] == "POST"){
$username=$_POST['username'];
$password=$_POST['password'];
$password=md5($password); // Encrypted Password
$connection = mysqli_connect("localhost", "root", "");
$username = stripslashes($username);
$password = stripslashes($password);
```

```

$username = mysql_real_escape_string($username);
$password = mysql_real_escape_string($password);
$sql="SELECT id FROM login WHERE username='$username' and password='$password'";
$result=mysqli_query($db,$sql);
$count=mysqli_num_rows($result);
if($count==1) {
$_SESSION['login_user']=$username; header("location: index.php");}
else {
$error=" <div id='msg_1' class='error_msg_003'><div id='image' class='msg_003_image'><img
src='assets/img/loading.gif' style='vertical-align:middle;'/> </div> Wrong username or
password</div>";}
mysqli_close($connection); }
?>

```

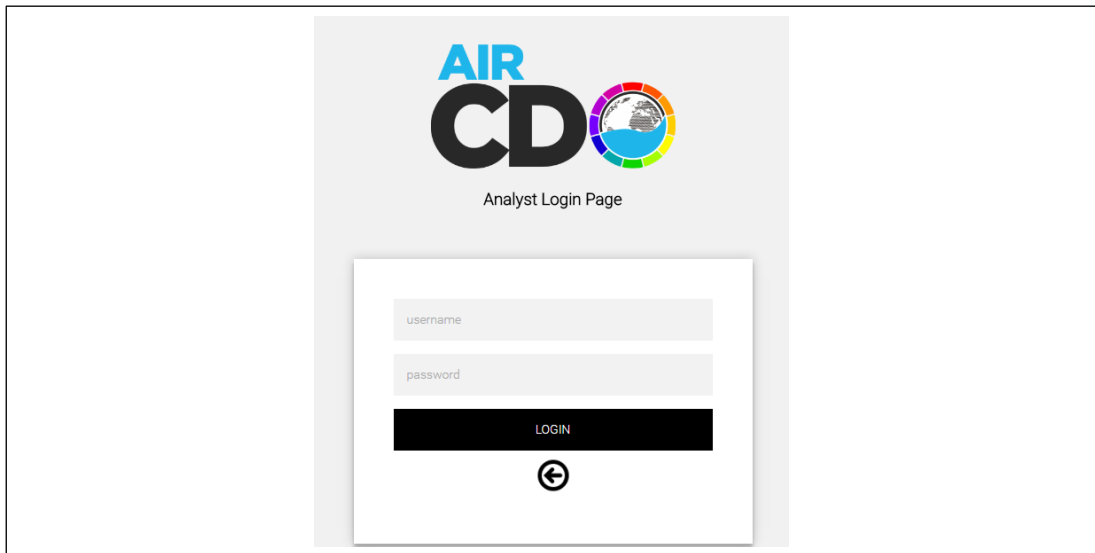


Figure 4.9 Air CDO Login

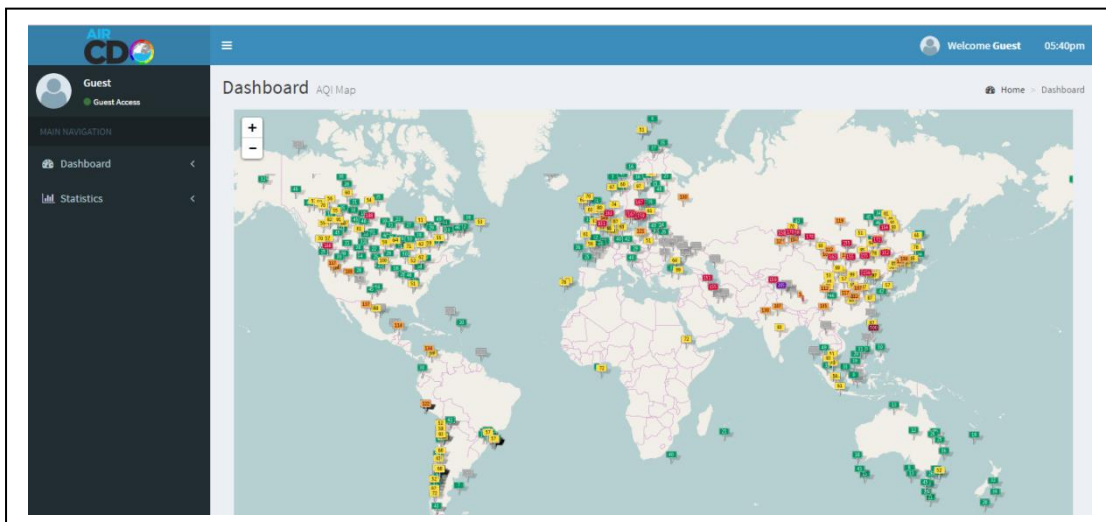
The Login page authenticates the information that is loaded in by the user. The required inputs of the Login page are username and password. As the users type in the password, the password is encrypted for privacy purposes. The researchers also added a function that makes sure the data that is loaded by the user is safe before sending a query to MySQL through ‘mysql_real_escape_string’. The function prevents SQL Injections.

Map Code

```

<div id='map' style='height:680px;' />
<link rel="stylesheet" href="http://cdn.leafletjs.com/leaflet-0.7.5/leaflet.css" />
<script src="http://cdn.leafletjs.com/leaflet-0.7.5/leaflet.js"></script>
<script>
var OSM_URL = 'http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png';
var OSM_ATTRIBUTION = '&copy; <a href="http://openstreetmap.org/copyright">OpenStreetMap</a> contributors';
var osmLayer = L.tileLayer(OSM_URL, {attribution: OSM_ATTRIBUTION});
var WAQI_URL = "http://tiles.aqicn.org/tiles/usepa-aqi/{z}/{x}/{y}.png?token=_TOKEN_ID_";
var WAQI_ATTR = 'Air Quality Tiles &copy; <a href="http://waqi.info">waqi.info</a>';
var waqiLayer = L.tileLayer(WAQI_URL, {attribution: WAQI_ATTR}); var map =
L.map('map').setView([51.505, -0.09], 2);
map.addLayer(osmLayer).addLayer(waqiLayer);
</script>
<script type="text/javascript" charset="utf-8">
(function(w,d,t,f){ w[f]=w[f]||function(c,k,n){s=w[f],k=s['k']=(s['k']|||(k?('&k='+k):''));s['c']=
c=(c instanceof Array)?c:[c];s['n']=n=n||0;L=d.createElement(t),e=d.getElementsByTagName(t)[0];
L.async=I;L.src='//feed.aqicn.org/feed/'+(c[n].city)+'/'+(c[n].lang||'')+'/feed.vI.js?n='+n+k;
e.parentNode.insertBefore(L,e); }})( window,document,'script','_aqiFeed' );
</script>

```



An Application Program Interface (API) for mapping ‘World Air Quality Index’ is embedded in the application for the users to be able to view the AQI levels of more than 9,000 known air quality monitoring stations in the world. ‘World Air Quality Index’ is a project of Environmental Protection Agencies (EPA). The data published in the World Air Quality Index is real-time and reflected on the map.

Session.php

```
session_start();
$user_check=$_SESSION['login_user'];
$ses_sql=mysql_query("select username from login where username='$user_check'", $connection);
$row = mysql_fetch_assoc($ses_sql);
$login_session =$row['username'];
if(!isset($login_session)){
mysql_close($connection); // Closing Connection
header('Location: login.php'); // Redirecting To Home Page }
?>
```

Sessions are used to make sure that the users can only access the application's pages when they are logged in as a valid user.

Logout.php

```
<?php
session_start();
if(session_destroy()){
header("Location: ../index.php");
}
?>
```

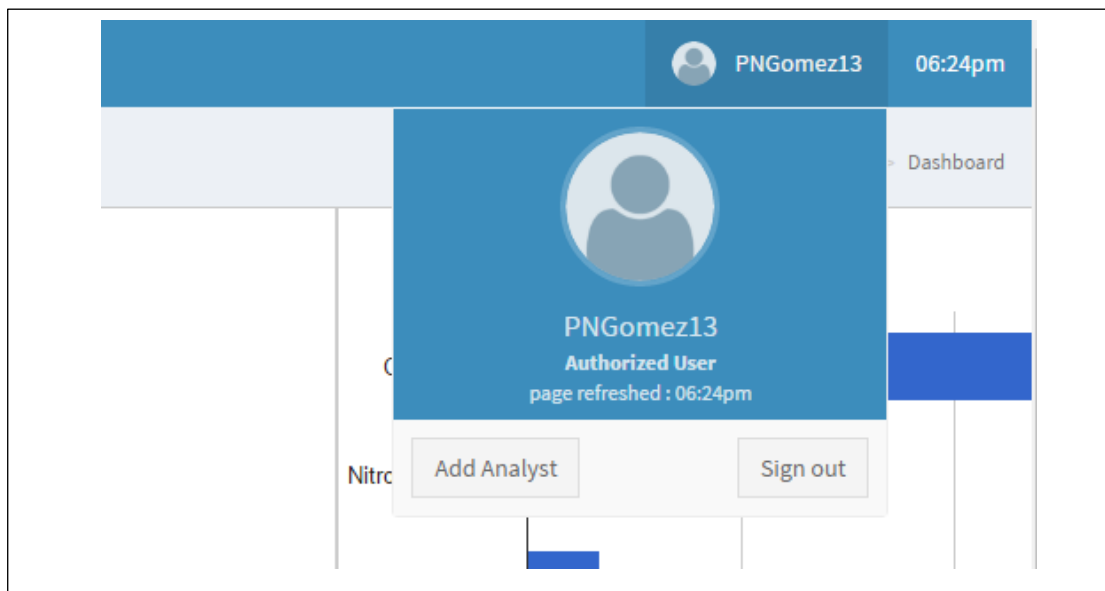


Figure 4.11 Air CDO Logout

Logout is a mode of redirecting back to the login page of the application; it is also used to terminate sessions to prevent unauthorized entry to the application.

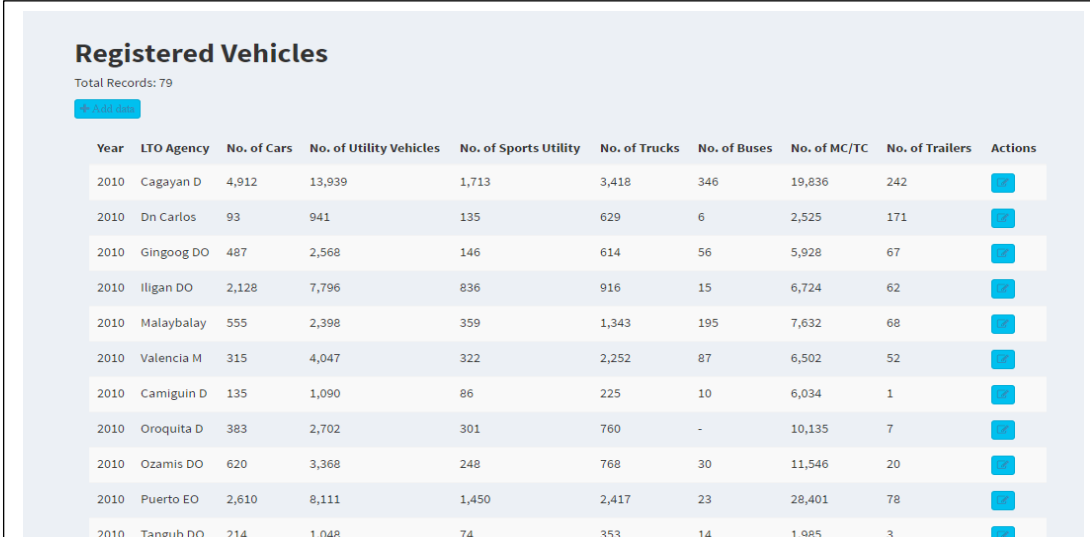
Viewing Data in tables

```

$start_from = ($page-1) * $num_rec_per_page;
$sql = "SELECT * FROM lto_data LIMIT $start_from, $num_rec_per_page";
$rs_result = mysql_query($sql);
$query = "SELECT LTOData_ID, Year, Agency, Cars, Utility_V, S_Utility_V, Trucks, Buses,
MC_TC, Trailers FROM lto_data LIMIT $start_from, $num_rec_per_page";
$result = mysql_query($query);
$queryI = "SELECT LTOData_ID, Year, Agency, Cars, Utility_V, S_Utility_V, Trucks,
Buses, MC_TC, Trailers FROM lto_data";
$resultI = mysql_query($queryI);
$countI = mysql_num_rows($resultI); echo "</div>
<div class=\"content table-responsive table-full-width\">
<table class=\"table table-hover table-striped\">
<thead>
<th>Year</th>
<th>LTO Agency</th>
<th>No. of Cars</th>
<th>No. of Utility Vehicles</th>
<th>No. of Sports Utility</th>
<th>No. of Trucks</th>
<th>No. of Buses</th>
<th>No. of MC/TC</th>
<th>No. of Trailers</th>

```

The previous snippet of codes allows the user of the system to view data from MySQL database. This establishes a connection to the database using PHP scripts in order to fetch data from the database. (See Figure 4.12)














Year	LTO Agency	No. of Cars	No. of Utility Vehicles	No. of Sports Utility	No. of Trucks	No. of Buses	No. of MC/TC	No. of Trailers	Actions
2010	Cagayan D	4,912	13,939	1,713	3,418	346	19,836	242	
2010	Dn Carlos	93	941	135	629	6	2,525	171	
2010	Gingoog DO	487	2,568	146	614	56	5,928	67	
2010	Iligan DO	2,128	7,796	836	916	15	6,724	62	
2010	Malaybalay	555	2,398	359	1,343	195	7,632	68	
2010	Valencia M	315	4,047	322	2,252	87	6,502	52	
2010	Camiguin D	135	1,090	86	225	10	6,034	1	
2010	Oroquita D	383	2,702	301	760	-	10,135	7	
2010	Ozamis DO	620	3,368	248	768	30	11,546	20	
2010	Puerto EO	2,610	8,111	1,450	2,417	23	28,401	78	
2010	Tangub DO	214	1,048	74	353	14	1,985	3	

Figure 4.12 Air CDO Tables for Registered Vehicles Data

Figure 4.12 is the output of the given snippet above. It outputs all the registered vehicles including the year of registry and different types of the vehicles.

Edit Data

```
<?php
    $connection = mysql_connect('localhost','root','');
    mysql_select_db('db-air');

    $dbApp_id = $_POST['dbApp_ID'];
    $CO = $_POST['CO'];
    $NOx = $_POST['NOx'];
    $SOx=$_POST['SOx'];
    $query = " UPDATE vehicle_data SET CO = '$CO',NOx = '$NOx',SOx = '$SOx' WHERE
    data_id = '$dbApp_id'";
```

This code snippet allows the user to update data from the MySQL database. Edit page allows the application to reflect present data stored in the database. After updating the data, the page immediately loads the updated data. (See Figure 4.13)

No. of MC/TC	No. of Trailers	Actions
19,836	242	
2,525	171	

Vehicle Emission

Year
2010

Agency
Cagayan D

Cars
4,912

Utility_V
13,939

Figure 4.13 Air CDO Edit Data

Adding Data Functionalities

```
<?php
    $connection = mysql_connect('localhost','root','');
    mysql_select_db('db-air');
    if(isset($_POST['submit'])) {
        $Year = $_POST['Year'];
        $Agency = $_POST['Agency'];
        $Cars = $_POST['Cars'];
        $Utility_V = $_POST['Utility_V'];
        $S_Utility_V = $_POST['S_Utility_V'];
        $Trucks = $_POST['Trucks'];
        $Buses = $_POST['Buses'];
        $MC_TC = $_POST['MC_TC'];
        $Trailers = $_POST['Trailers'];
        $query = "INSERT INTO lto_data
        (Year,Agency,Cars,Utility_V,S_Utility_V,Trucks,Buses,MC_TC,Trailers)
        VALUES('$Year','$Agency','$Cars','$Utility_V','$S_Utility_V','$Trucks','$Buses','$MC_TC','$Trailers)";
        $result = mysql_query($query);
    }
```


Add Registered Vehicle

Year

LTO Agency

No. of Cars

No. of Utility Vehicles

No. of Sport Utility Vehicles

No. of Trucks

No. of Buses

No. of MC/TC

Figure 4.14 Air CDO Add Data

Adding data functionalities to the application allows the user to add data from the gathered data to the application. Added data is stored immediately to the database once the submit button was clicked.

CSV Import

```
if(isset($_POST['Import'])) {
    if($_FILES['csv_data']['name']) {
        $arrFileName = explode('.', $_FILES['csv_data']['name']);
        if($arrFileName[1] == 'csv') {
            $handle = fopen($_FILES['csv_data']['tmp_name'], "r");
            while (($data = fgetcsv($handle, 10000, ",")) !== FALSE) {
                $item1 = mysqli_real_escape_string($db, $data[0]);
                $item2 = mysqli_real_escape_string($db, $data[1]);
                $item3 = mysqli_real_escape_string($db, $data[2]);
                $item4 = mysqli_real_escape_string($db, $data[3]);
                $item5 = mysqli_real_escape_string($db, $data[4]);
                $item6 = mysqli_real_escape_string($db, $data[5]);
                $item7 = mysqli_real_escape_string($db, $data[6]);
                $item8 = mysqli_real_escape_string($db, $data[7]);
                $item9 = mysqli_real_escape_string($db, $data[8]);
                $item10 = mysqli_real_escape_string($db, $data[9]);
                $import = "INSERT into lto_data
                (Year, Agency, Cars, Utility_V, S_Utility_V, Trucks, Buses, MC_TC, Trailers, Total)
                values('$item1', '$item2', '$item3', '$item4', '$item5', '$item6', '$item7', '$item8', '$item9', '$item10')";
                ini_set('max_execution_time', 60);
            }
        }
    }
}
```

The web application has the import functionality. The application can import data from Comma Separated Value files (CSV). The data that is found on the CSV file is inserted in the database. Data that is not matched to the variable type of the database is not accepted by the application.

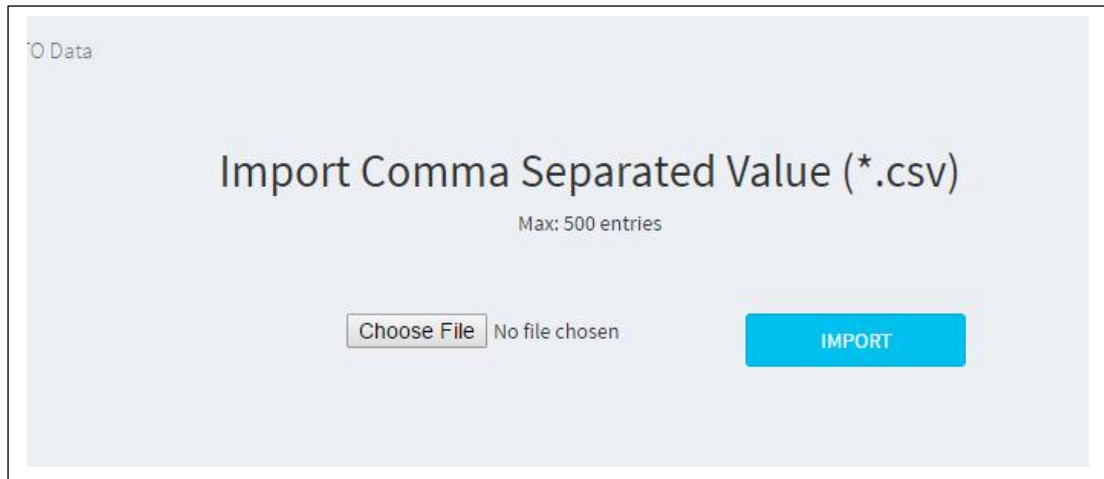


Figure 4.15 Air CDO Import Data

4.4.3 Website Component

Air Quality Data Inputs

The researchers used data present in XUERC where data is imported to the system.

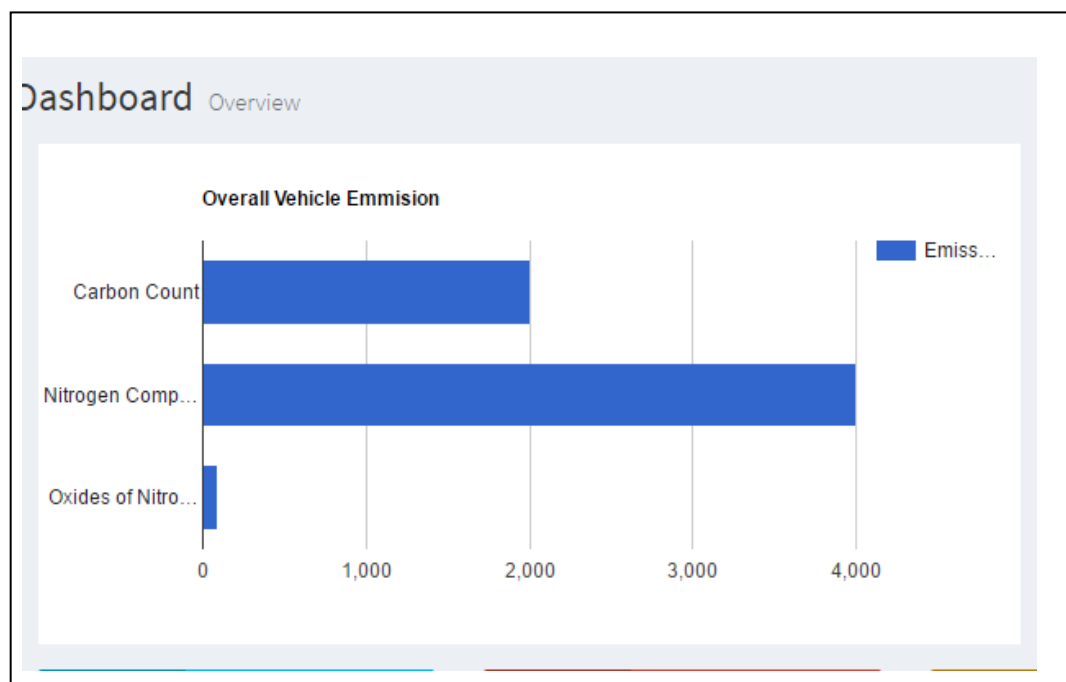


Fig 4.16 Overall Carbon Emissions

Dashboard overview shows the overall vehicle emission for the CO, NOx, and SOx.

Dashboard Vehicle Data

Registered Vehicles

Total Records: 79

Year	LTO Agency	No. of Cars	No. of Utility Vehicles	No. of Sports Utility	No. of Trucks	No. of Buses	No. of MC/TC	No. of Trailers	Actions
2010	Cagayan D	4,912	13,939	1,713	3,418	346	19,836	242	View Download
2010	Dn Carlos	93	941	135	629	6	2,525	171	View Download
2010	Gingoog DO	487	2,568	146	614	56	5,928	67	View Download
2010	Iligan DO	2,128	7,796	836	916	15	6,724	62	View Download
2010	Malaybalay	555	2,398	359	1,343	195	7,632	68	View Download
2010	Valencia M	315	4,047	322	2,252	87	6,502	52	View Download
2010	Camiguin D	135	1,090	86	225	10	6,034	1	View Download
2010	Oroquieta D	383	2,702	301	760	-	10,135	7	View Download
2010	Ozamis DO	620	3,368	248	768	30	11,546	20	View Download
2010	Puerto EO	2,610	8,111	1,450	2,417	23	28,401	78	View Download
2010	Tangub DO	214	1,048	74	353	14	1,985	3	View Download
2010	Tubod EO	202	1,244	145	380	-	2,255	12	View Download
2010	E-Patrol X	64	705	117	325	1	2,144	2	View Download
2011	Cagayan D	5,432	15,274	1,998	3,826	191	24,304	296	View Download
2011	Dn Carlos	172	1,835	243	1,150	12	4,983	186	View Download
2011	Gingoog DO	297	1,908	344	353	30	4,519	47	View Download

Fig 4.17 Registered Vehicle per vehicle type from the year 2010 to year 2015

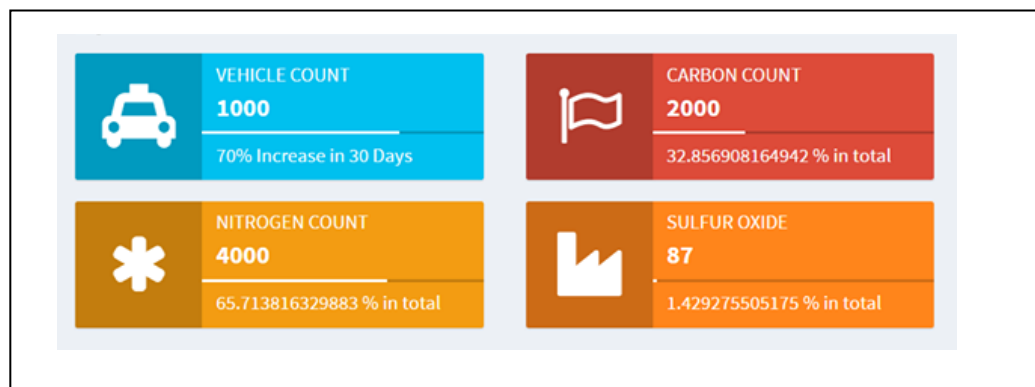


Fig 4.18 Overall Vehicle Count, NOx, SOx, and CO count

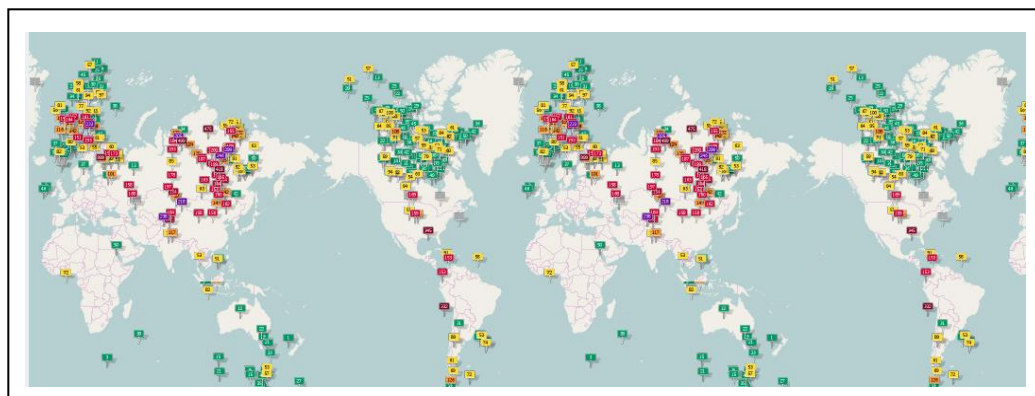


Figure 4.19 Map of the countries that monitors Air Quality Index.

The researchers attached a leaflet-API-developed mapping of a Real-time Air

Quality Index in the world. This can help the users and Analysts have a wider perspective of air quality.

4.5 Testing

The application's functionalities are alpha tested by the researchers. Testing is done to maintain a standard for the application. These tests can be referred to ensure common issues are fixed. The results of the testing are shown in Table 4.4.

Table 4.4. Functional Requirement Testing for the web based application

Req. ID	Requirement Description	Status	Remarks
1.1	Analyst can create new accounts for other Analysts	Passed	Functional
1.2	Analyst can update data from the database	Passed	Functional
1.3	Analyst can delete accounts of other analysts	Passed	Functional
1.4	Analyst can insert data into the database	Passed	Functional

The researchers also tested the application's compatibility with well-known web browsers like Mozilla Firefox, Google Chromes and Internet Explorer. The result of the evaluation is shown in Table 4.5.

Table 4.5. Web browsers compatibility test

Browser	Compatibility		Remarks
	Yes	NO	
Mozilla Firefox	✓		Functional
Google Chrome	✓		Functional
Internet Explorer	✓		Functional

The application is also tested on mobile devices with android and iOS operating systems. The mobile web browsers that were tested were Google Chrome mobile, Firefox mobile, Safari Mobile, and Opera Mini Mobile. The result of the evaluation is shown in Table 4.6.

Table 4.6. Mobile web browsers compatibility test

Browser	Compatibility		Remarks
	Yes	NO	
Mozilla Firefox Mobile	✓		Functional
Google Chrome Mobile	✓		Functional
Safari Mobile	✓		Functional
Opera Mini	✓		Functional

Functionalities are tested to ensure that the application is working properly. The result of the tests showed that the functionalities of the system are working and no functionality is missing in the application.

4.5.1 Graphical User Interface (GUI) Testing

Table 4.7. Administrator Log in GUI Testing

Input Element	Element Label	Acceptable	Required Output	Remarks
Text Area	Username	Any Characters	Displays Text	Passed
Text Area	Password	At least 8 characters and no more than 20, contain one number from [0-9], contain one lower case letter [a-z], contain one upper case letter [A-Z], contain of these special symbols: ! @ # \$ % ^ & * () + ?	Hides characters by bullet sign (•)	Passed
Button	Log in	None	Logs in to the specified account destination if no errors are found. Displays any errors if there are any.	Passed

The test shows that the log in form is working properly.

Table 4.8. Creating new analyzer account from GUI testing

Input Element	Element Label	Required Output	Required Output	Remarks
Text Area	First Name	Any characters	Displays text	Passed
Text Area	Last Name	Any characters	Displays text	Passed
Text Area	Username	Any characters	Displays text	Passed
Text Area	Password	At least 8 characters and no more than 20, contain one number from [0-9], contain one lower case letter [a-z], contain one upper case letter [A-Z], contain of these special symbols: ! @ # \$ % ^ & * () + ?	Hides characters by bullet sign (•)	Passed

The table 4.8 shows that the web application's input elements for creating new accounts for Analyst is functioning as expected.

4.5.2 Functionality Testing

Functional Testing is a testing technique that is used to test the features and functionalities of the system. It should cover all the scenarios including failure paths and boundary cases. The functionalities of the web application are tested using test cases to make sure all the functionalities are working properly. Table 4.9 shows the

test case result used for the log in page.

Table 4.9 Log in page Test Case

ID	Test Case Description	Test Case Procedure	Required Output	Result	Test Date
	Log in				
	Steps 1. Access the Air quality web application 2. Input admin username and password 3. Click the log in button				
1.1	Log in as Administrator	Input username and password	If login successful, redirect to Administrator's account page	Passed	2/7/2017
1.2	Log in as Analyzer	Input username and password	If login successful, redirect to Analyzer's account page	Passed	2/7/2017

Table 4.10 User View form test case

ID	Test Case Description	Test Case Procedure	Required Output	Result	Test Date
	User View				
	Steps 1. Access the Air quality web application 2. View Air Quality report				
1.1	View the real-time report of the Air Quality	View graphs of trend of the Air Quality	Air quality status are viewable	Passed	2/7/2017

Table 4.10 shows the result of the test case for viewing the current Air Quality status. The test case was successful in making the graphs viewable to the user.

Chapter 5

Conclusions and Recommendations

5.1 Conclusions

The researchers were able to develop a Web Based Application on Air Quality Using Predictive Analytics with the help of the sets of data and information provided by a local office of Land Transportation Office (LTO) in Cagayan de Oro City, and one of the offices of Xavier University, namely Xavier University Engineering Resource Center (XUERC).

Multiple Unified Modeling Language (UML) are made to visualize, specify, construct, and document the different parts of the web application. This enables the application to be scalable, secure, and robust in execution. Entity-Relationship Diagrams (ERD) are also made to illustrate the web application's entities and relationships between the entities. These diagrams are helpful in developing conceptual design for databases.

In the development of the application, the researchers used bootstrap for the front-end framework of the web application. The researchers decided to use bootstrap as the front-end framework for a faster and easier way to develop the application. Bootstrap also makes the GUI of the application to be responsive in mobile devices. The application used HTML and CSS based designs for typography, buttons, forms, image, navigations, tables, and many others. The researchers decided to use PHP as the scripting language since it can be easily embedded in HTML. For the graphing of data in the application, Google Chart API tool was used. Google Chart supports a wide variety of chart formatting and this can easily be embedded in the application. The Researchers also attached a leaflet-API-developed mapping of a Real-time Air

Quality Index in the world. This can help the users and Analysts have a wider perspective of air quality.

The application that was developed was alpha tested by the researchers. The Web Application used test cases to make sure all the functionalities are working properly. The tests showed that the application runs on various web and mobile browsers, the GUI is working properly according to the set functions, and the other functionalities of the programs are working as expected.

The aim of the researchers is to raise awareness amongst the community of Cagayan de Oro City of the effects of the vehicle count of Motorcycle and Tricycle (MC/TC) within the city to the air quality. The researchers also aimed to create an application with the use of predictive analytics which will predict and show the effect of a certain number of MC/TC to the air quality of the city. The system made by the researchers is the platform to make the Kagay-anons aware of the effects of vehicle count to the air quality of the city. The web-based application was successfully made with complete functionalities and a user-friendly interface.

5.2 Recommendation

The researchers recommend broadening the scope of the study. The study only caters to one vehicle type, namely Motorcycles and Tricycles (MC/TC). For future studies, other vehicle types can also be included. This current study is limited only to Cagayan de Oro City, the researchers recommend that the study can also include different cities for comparisons of air quality. In addition to that, the researchers recommend having more data sources for the vehicle emission reading, because the office that the researchers approached only has one year of data reference for the vehicle emission reading.

References

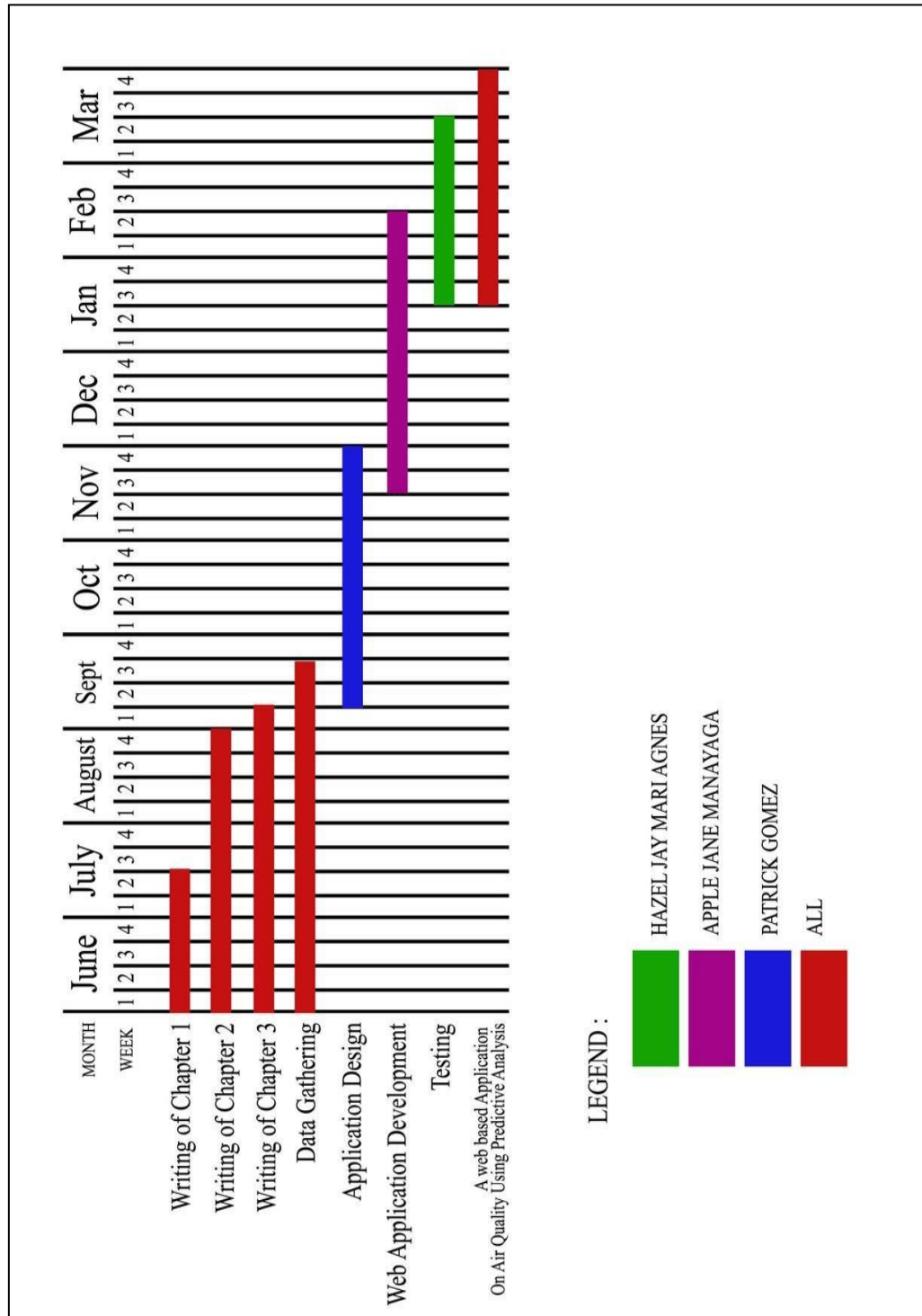
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Appendix A

THESIS IMPLEMENTATION SCHEDULE

The Thesis Implementation schedule of the researchers. The Researchers used Gantt chart to illustrate the timeline of the target start and end dates.



Appendix B

LETTERS TO AUTHORITIES FOR THE DATA GATHERING



Xavier University - Ateneo de Cagayan
COLLEGE OF COMPUTER STUDIES
DEPARTMENT OF COMPUTER SCIENCE

ENGR. JEFFERSON VALLENTE JR.

Xavier University Engineering Resource Center
3/L College of Engineering Bldg. Xavier University
Corrales Ave., Cagayan de Oro City

Dear Engr. **Vallente**,

Greetings!

We the Senior Students of College of Computer Studies taking up Bachelor of Science in Computer Science, currently enrolled to the course of CS 52.1 – Thesis 2.

CS52.1 is intended to verify the student's ability to conceive, plan and execute a body of work appropriate for the degree of computer science. This is a continuation of the students' work in CS 51.1 which is the thesis proposal.

Our thesis proposal submitted to Department of Computer Science is entitled "A web based Application on Air Quality Using Predicted Analysis" this Thesis proposal aims to raise awareness of the effects of the vehicle count within the city to the air quality, the researchers aim to create an application with the use of predictive analytics which will predict and show the cause of a certain number of vehicles to the air quality of the city.


In order to come up with a good thesis paper. We humbly request in your good office a copy of data' of the following component:

1. Carbon Monoxide (CO)
2. Sulfur Oxides (SOx)
3. Oxides of Nitrogen (NOx)
4. Present $\mu\text{g}/\text{Nm}^3$
5. Vehicle Emission per vehicle type (tons/year)

Should you have any question, please contact **HAZEL JAY MARI AGNES** through **0926 738 5401** or email **hazel0211@gmail.com**.

We look forward to receiving favorable response.


Sincerely,


HAZEL JAY MARI AGNES
BS Computer Science


PATRIEK GOMEZ
BS Computer Science


APPLE JANE MANAYAGA
BS Computer Science

Noted by:


RHEA SUZETTE HAGUISAN, MBA
DCS Chairperson/Thesis Adviser



Xavier University - Ateneo de Cagayan
COLLEGE OF COMPUTER STUDIES
DEPARTMENT OF COMPUTER SCIENCE

MR. OSCAR SALCEDO

Regional Director
Land Transportation Office Region Office No.10
N. Reyes Ave., Bulua Cagayan de Oro City

Dear Mr. **Salcedo**,

Greetings!

We the Senior Students of College of Computer Studies taking up Bachelor of Science in Computer Science, currently enrolled to the course of CS 52.1 – Thesis 2.

CS52.1 is intended to verify the student's ability to conceive, plan and execute a body of work appropriate for the degree of computer science. This is a continuation of the students' work in CS 51.1 which is the thesis proposal.

Our thesis proposal submitted to Department of Computer Science is entitled "A web based Application on Air Quality Using Predicted Analysis" this Thesis proposal aims to raise awareness of the effects of the vehicle count within the city to the air quality, the researchers aim to create an application with the use of predictive analytics which will predict and show the cause of a certain number of vehicles to the air quality of the city.

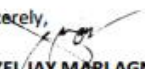
In order to come up with a good thesis paper. We humbly request in your good office a copy of data' of the following component:

1. Register vehicles according to vehicle type, per year from 2010 to 2015

Should you have any question, please contact **HAZEL JAY MARI AGNES** through **0926 738 5401** or email **hazel0211@gmail.com**.

We look forward to receiving favorable response.


Sincerely,


HAZEL JAY MARI AGNES
BS Computer Science


PATRICK GOMEZ
BS Computer Science


APPLE JANE MANAYAGA
BS Computer Science

Noted by:


RHEA SUZETTE HAGUISAN, MBA
DCS Chairperson/Thesis Adviser

Appendix C

LIST OF POLLUTANTS

Table 1. Annual Average Pollutant Concentrations in CdO City, 2005-2011 ($\mu\text{g}/\text{Nm}^3$)

Year	SO ₂	NO ₂	O ₃	Benzene	Toluene	p-Xylene	PM ₁₀
2005	4.79	16.19	39.13	0.86	3.21	0.48	44.48
2006	4.98	17.56	39.85	1.00	3.20	0.57	38.43
2007	3.60	9.10	1.44	0.03	2.81	0.34	1.23
2008	4.44	12.06	0.66	0.65	2.87	0.16	-
2009	3.56	9.28	6.10	0.74	0.76	0.20	-
2010	5.23	14.98	29.96	1.57	2.48	0.49	-
2011	7.96	10.91	83.49	3.56	1.72	2.23	49.52**
NAAQGVs	80	150	60	-	-	-	60

Source: EMB Region X, Unpublished report, "Evaluation of Ambient Air Quality (Telemetry Station)"

NAAQGVs = National Ambient Air Quality Guideline Values

**From MiniVol sampling collected at Gusa, City Hall, Xavier University and Tablon during August 28 and 31, 2011

Table 3. Daily PM₁₀ concentration of monitoring sites

Site	PM ₁₀ Concentration ($\mu\text{g}/\text{m}^3$)	
	August 28, 2011 (Saturday)	August 31, 2011 (Tuesday)
Gusa	60	61
City Hall	43	37
Xavier University	52	35
Tablon	62	47
NAAQGVs	150	150
WHO AQGs	50	50

NAAQGVs = National Ambient Air Quality Guideline Values; WHO = World Health Organization; AQG = air quality guidelines

Table 4. Emission Estimates in CdO City, 2011 (tons/year)

Source	PM		CO	NO _x	SO _x	NMVOC	CO ₂
	PM ₁₀	UFP					
Mobile	21	217	7,699	1,744	164	1,701	223,604
Point	283	-	2,068	210	851	161	41,571
Area	433	-	846	16	13	425	96,901
Total	737	217	10,613	1,970	1,028	2,287	362,076

Source: Emission Inventory of Major Air Pollutants in CdO City (2015)

Source	PM ₁₀	UFP	CO	NO _x	SO _x	NMVOC	CO ₂
Mobile	21	217	7,699	1,744	164	1,701	223,604
Point	283	-	2,068	210	851	161	41,571
Area	433	-	846	16	13	425	96,901
Total	737	217	10,613	1,970	1,028	2,287	362,076

Table 5. Breakdown for Mobile Sources (in tons/yr)

Mobile Emissions	PM		CO	NO _x	SO _x	NMVOC	CO ₂
	PM ₁₀	UFP					
Road Mobile	-	217	7,661	1,369	11	1,681	202,618
Non-Road Mobile	2	-	12	48	2	3	5,573
Ocean Vessels	19	-	26	327	151	17	15,413
Total	21	217	7,699	1,744	164	1,701	223,604

Source: Emission Inventory of Major Air Pollutants in CdO City (2015)

Vehicle	UFP	CO	NO _x	SO _x	NM VOC	CO ₂
Jeepneys	53	503	257	3.29	81	35,950
Taxi	6	69	52	0.78	8	14,501
Passenger Car	6	149	42	0.76	20	14,286
Sports Utility Vehicles	11	65	97	0.85	10	15,802
Buses	21	102	178	0.69	52	17,645
Other Light Duty vehicles	11	406	107	0.88	36	16,270
Heavy Duty Vehicles	19	126	560	2.41	52	53,078
Total	217	7,661	1,369	11	1,681	202,618

Source: Emission Inventory of Major Air Pollutants in CdO City (2015)

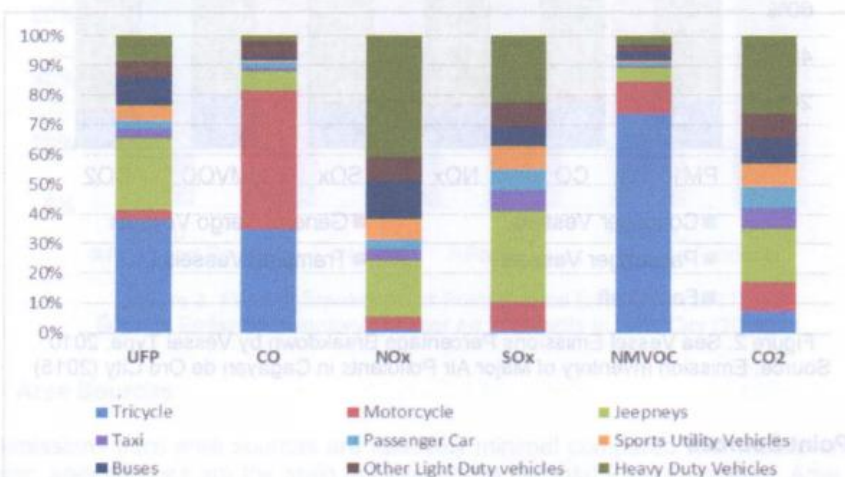


Figure 1. Road Transport Emissions Percentage Breakdown by Vehicle Type (2010)

Source: Emission Inventory of Major Air Pollutants in CdO City (2015)

Appendix D

REGISTERED VEHICLES ACCORDING TO VEHICLE TYPE PER YEAR

Figure 1. Data from LTO

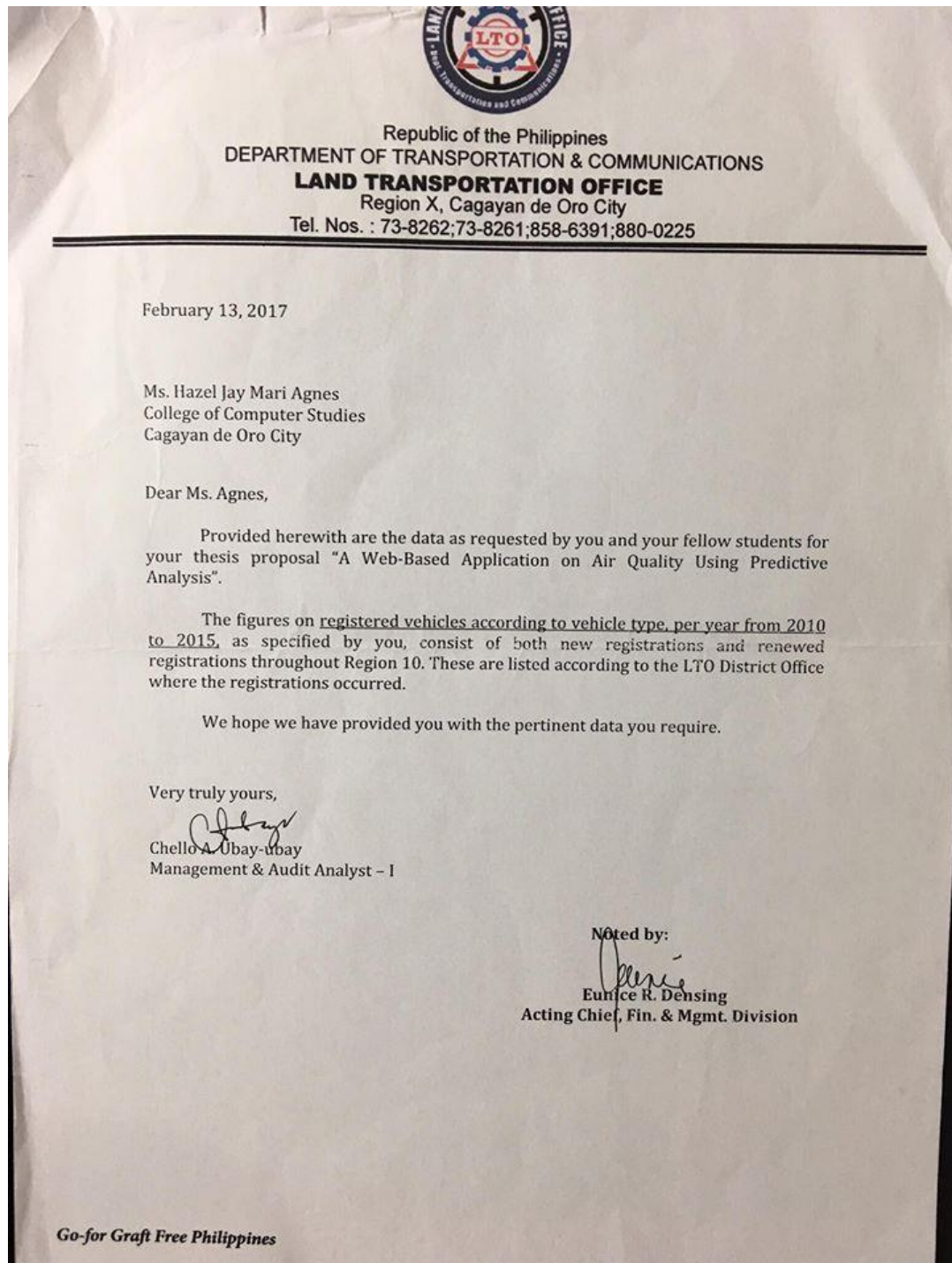


Figure 2. Number of Motor Vehicles Registered by the year 2010

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
LAND TRANSPORTATION OFFICE
REGIONAL OFFICE NO. X
MANAGEMENT REPORT FOR THE YEAR 2012

NUMBER OF MOTOR VEHICLES REGISTERED BY TYPE AND BY AGENCY

A G E N C Y	T Y P E O F M O T O R V E H I C L E							T O T A L
	CARS	UTILITY V	S UTILITY V	TRUCKS	BUSES	MC/TC	TRAILERS	
Cagayan D DO	5,402	16,431	2,180	4,287	115	28,593	293	57,509
Dn Carlos EO	207	2,589	337	1,693	14	9,876	104	14,820
Gingoog DO	204	1,856	331	405	48	8,960	56	11,868
Iligan DO	2,517	8,955	1,141	1,140	14	8,490	55	22,312
Malaybalay D	561	2,760	425	1,423	228	7,072	87	12,556
Valencia MU	127	2,740	180	1,663	37	2,984	22	7,753
Caniguin DO	155	1,337	119	346	8	10,478	4	12,447
Oroquieta DO	411	2,936	232	754	0	9,667	7	14,007
Ozamis DO	665	2,691	347	763	20	10,342	36	14,864
Puerto EO	2,740	9,145	1,809	3,033	46	25,588	165	42,526
Tanub DO	186	1,172	100	341	7	2,458	5	4,269
Tubod EO	247	1,433	154	704	87	2,839	38	5,502
E-Patrol X	220	1,460	236	802	10	3,149	36	5,921
T O T A L	13,842	55,513	7,599	17,354	634	130,504	900	226,354

PREPARED BY:
[Signature]
CHELLO A. URAY-UBAY
MGT. & AUDIT ANALYST I

Figure 3. Number of Motor Vehicles Registered by the year 2011

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
LAND TRANSPORTATION OFFICE
REGIONAL OFFICE NO. X
MANAGEMENT REPORT FOR THE YEAR 2013

NUMBER OF MOTOR VEHICLES REGISTERED BY TYPE AND BY AGENCY

A G E N C Y	T Y P E O F M O T O R V E H I C L E							T O T A L
	CARS	UTILITY V	S UTILITY V	TRUCKS	BUSES	MC/TC	TRAILERS	
Cagayan D DO	6,335	18,233	2,283	4,883	155	27,776	384	60,049
Dn Carlos EO	234	2,891	382	1,870	19	10,209	14	15,619
Gingoog DO	297	1,892	358	496	28	7,573	47	10,691
Iligan DO	3,012	10,986	1,393	1,365	16	9,438	126	26,336
Malaybalay D	526	3,005	425	1,280	248	7,805	61	13,350
Valencia MU	100	2,382	178	1,486	5	2,072	29	6,252
Caniguin DO	165	1,254	119	281	5	7,498	8	9,330
Oroquieta DO	437	3,077	251	776	0	10,990	12	15,343
Ozamis DO	720	2,881	336	842	8	11,944	29	16,760
Puerto EO	3,362	10,444	2,026	3,441	86	33,117	206	52,682
Tanub DO	243	1,249	128	362	3	2,834	4	4,823
Tubod EO	210	1,229	151	594	104	5,001	16	7,305
E-Patrol X	227	2,083	374	1,340	30	3,907	179	8,140
T O T A L	15,868	61,606	8,404	19,016	707	140,164	1,115	246,880

PREPARED BY:
[Signature]
CHELLO A. URAY-UBAY
MGT. & AUDIT ANALYST I

Figure 4. Number of Motor Vehicles Registered by the year 2014

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
LAND TRANSPORTATION OFFICE
REGIONAL OFFICE NO. X
MANAGEMENT REPORT FOR THE YEAR 2014

NUMBER OF MOTOR VEHICLES REGISTERED BY TYPE AND BY AGENCY

A G E N C Y	T Y P E O F M O T O R V E H I C L E							T O T A L
	CARS	UTILITY V	S UTILITY V	TRUCKS	BUSES	MC/TC	TRAILERS	
R10 New RegU	1,130	1,492	892	51	1	27,117	0	30,683
Caayan D DO	7,294	20,601	2,782	5,945	155	34,502	464	71,943
De Carlos EO	339	3,736	488	2,231	19	9,273	46	16,132
Ginooon DO	459	2,441	307	752	29	7,045	77	11,110
Iligan DO	2,989	10,753	1,461	1,552	14	10,137	101	27,007
Malaybalay D	695	3,517	548	1,578	264	7,350	88	14,040
Valencia MU	78	2,136	145	1,245	0	1,783	27	5,414
Caniquin DO	248	1,554	141	445	2	6,754	10	9,174
Oroquieta DO	447	3,077	296	770	0	9,721	14	14,325
Oranis DO	804	2,913	392	950	3	8,837	25	13,924
Puerto EO	1,871	5,249	983	1,744	26	19,153	124	29,150
Tanub DO	215	1,149	119	343	1	2,511	8	4,246
Tubod EO	240	1,433	198	640	122	3,651	26	6,310

PREPARED BY:
[Signature]
CHELLO A. UBAY-UBAY
MGT. & AUDIT ANALYST I

Figure 5. Number of Motor Vehicles Registered by the year 2015

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
LAND TRANSPORTATION OFFICE
REGIONAL OFFICE NO. X
MANAGEMENT REPORT FOR THE YEAR 2015

NUMBER OF MOTOR VEHICLES REGISTERED BY TYPE AND BY AGENCY

A G E N C Y	T Y P E O F M O T O R V E H I C L E							T O T A L
	CARS	UTILITY V	S UTILITY V	TRUCKS	BUSES	MC/TC	TRAILERS	
R10 New RegU	2,290	3,493	2,176	89	3	51,579	10	59,040
Caayan D DO	7,302	20,318	3,275	5,183	291	33,439	501	70,219
De Carlos EO	472	4,769	703	2,724	135	10,308	57	19,168
Ginooon DO	290	1,737	176	528	37	5,244	74	8,086
Iligan DO	2,824	10,885	1,613	1,839	25	10,598	83	27,067
Malaybalay D	771	4,076	823	2,431	144	9,276	324	18,845
Valencia MU	78	1,873	144	1,066	12	1,441	27	4,639
Caniquin DO	142	1,041	118	172	0	5,430	2	6,925
Oroquieta DO	427	2,587	302	748	0	10,266	17	14,347
Oranis DO	765	2,830	433	1,088	3	8,285	50	13,454
Tanub DO	185	881	111	280	1	2,273	5	3,736
Tubod EO	266	1,562	224	768	139	3,535	59	6,563
E-Patrol X	1,586	5,155	813	1,520	37	15,229	87	24,427
T O T A L	17,396	62,227	10,921	18,456	737	166,903	1,296	278,136

PREPARED BY:
[Signature]
CHELLO A. UBAY-UBAY
MGT. & AUDIT ANALYST I

Appendix E

DATA DICTIONARY

login				
Field Name	Data Type	Field Length	Constraint	Description
Id	Integer	10	Primary Key	Log-in ID, Auto Generated
last_name	Varchar	20	Not Null	Last Name of the Administrator/Analyst
Fist_name	Varchar	20	Not Null	First name of the Administrator/Analyst
Birth_date	Varchar	10	Not Null	Birthdate of the Administrator/Analyst
Address	Varchar	50	Not Null	Address of the Administrator/Analyst
Email_add	Varchar	30	Not Null	Email Address of the Administrator/Analyst
Landline	Integer	10	Not Null	Landline number of the Administrator/Analyst
mobile_num	Integer	12	Not Null	Mobile number of the Administrator/Analyst
Username	Varchar	225	Not Null	Username of the Administrator/Analyst
Password	Varchar	225	Not Null	Password of the Administrator/Analyst

Lto_data				
Field Name	Data Type	Field Length	Constraint	Description
LTOData_ID	Integer	20	Primary Key	LTO DATA, Auto Generated
Year	Year	4	Not Null	Year of the data collected
Agency	Varchar	10	Not Null	The agency where the data is being collected
Cars	Varchar	10	Not Bull	self-powered motor vehicle used for transportation and a product of the automotive industry
Utility_V	Varchar	10	Not Null	Is designed to carry out a specific task with more efficacy than a general-purpose vehicle.
Trucks	Varchar	10	Not Null	Is a motor vehicle designed to transport cargo
Buses	Varchar	10	Not Null	Is a road vehicle designed to carry many passengers
MC_TC	Varchar	10	Not Null	Motorcycle and tricycle is a two or three wheeled motor vehicle
Trailers	Varchar	10	Not Null	Commonly used to transport of goods and materials.
Total	Varchar	10	Not Null	The total count of the different types of vehicles

Vehicle_data				
Field Name	Data Type	Field Length	Constraint	Description
Data_id	Integer	11	Primary Key	Vehicle data id, Auto Generated
Vehicle_Type	Varchar	30	Not Null	Vehicle types
CO	Varchar	30	Not Null	Carbon Monoxide
NOx	Varchar	30	Not Null	Oxides of Nitrogen
SOx	Varchar	30	Not Null	Oxides of Sulfur

Emit_comp				
Field Name	Data Type	Field Length	Constraint	Description
Carbon	Integer	20	Not Null	Carbon Monoxide Counts
Nitrogen	Integer	20	Not Null	Oxides of Nitrogen Counts
SulfurOxide	Integer	20	Not Null	Oxides of Sulfur Counts
V_Count	Integer	20	Not Null	Vehicle Counts

Appendix F

APPLICATION SOURCE CODE

Predictive Analysis Page (Predictive.php)

```
<?php include('db.php') ; ?>
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <link rel="icon" type="image/png" href="assets/img/cdo.png">
  <title>Predictive Analysis | Vehicle Emission </title>
  <meta content="width=device-width, initial-scale=1, maximum-scale=1, user-
scalable=no" name="viewport">
  <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
  <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.css">
  <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
  <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
  <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
  <link rel="stylesheet" href="plugins/morris/morris.css">
  <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-1.2.2.css">
  <link rel="stylesheet" href="plugins/datepicker/datepicker3.css">
  <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-bs3.css">
  <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">
  <header class="main-header">
    <a href="index.php" class="logo">
      <span class="logo-mini"></span>
      <span class="logo-lg"></span>
    </a>
    <nav class="navbar navbar-static-top" role="navigation">
      <a href="#" class="sidebar-toggle" data-toggle="offcanvas" role="button">
        <span class="sr-only">Toggle navigation</span>
      </a>
      <div class="navbar-custom-menu">
        <ul class="nav navbar-nav">
          <li class="dropdown messages-menu">
            </li>
          <li class="dropdown tasks-menu">
            </li>
          <li class="dropdown user user-menu">
            <a href="#" class="dropdown-toggle" data-toggle="dropdown">
              
              <span class="hidden-xs">Welcome Guest</span>
```

```

        </a>
        <ul class="dropdown-menu">
          <li class="user-header">
            
            <p>
              Guest
            </p>
          </li>
          <li>
            <li class="user-footer">
              <div class="pull-right">
                <a href="pages/login.php" class="btn btn-default btn-
flat">Log In</a>
              </div>
            </li>
          </ul>
        </li>
        <li>
          <a><?php date_default_timezone_set("Asia/Manila");
            echo date("h:ia");?></a>
        </li>
      </ul>
    </div>
  </nav>
</header>
<aside class="main-sidebar">
  <section class="sidebar">
    <div class="user-panel">
      <div class="pull-left image">
        
      </div>
      <div class="pull-left info">
        <p>Guest</p>
        <a href="#"><i class="fa fa-circle text-success"></i> Guest
Access</a>
      </div>
    </div>
    <ul class="sidebar-menu">
      <li class="header">MAIN NAVIGATION</li>
      <li class="treeview">
        <ul class="treeview-menu">
          <li><a href="pages/layout/top-nav.html"><i class="fa fa-circle-o"></i> Top
Navigation</a></li>
          <li><a href="pages/layout/boxed.html"><i class="fa fa-circle-
o"></i> Boxed</a></li>
          <li><a href="pages/layout/fixed.html"><i class="fa fa-circle-
o"></i> Fixed</a></li>
          <li><a href="pages/layout/collapsed-sidebar.html"><i class="fa fa-
circle-o"></i> Collapsed Sidebar</a></li>
        </ul>
      </li>
      <li class="treeview">
        <a href="index.php">

```

```

        <i class="fa fa-angle-left pull-right"></i>
    </a>
    <ul class="treeview-menu">
        <li><a href="Overview.php"><i class="fa fa-circle-o"></i>Overview
Report</a></li>
        <li><a href="vehicle_data.php"><i class="fa fa-circle-o"></i>Vehicle
Data</a></li>
        <li><a href="emission_est.php"><i class="fa fa-circle-o"></i>
Emission Inventory</a></li>
        <li><a href="map.php"><i class="fa fa-circle-o"></i> AQI
MAP</a></li>
    </ul>
</li>
    <li class="treeview">
    <a href="#">
        <i class="fa fa-bar-chart"></i>
        <span>Statistics</span>
        <i class="fa fa-angle-left pull-right"></i>
    </a>
    <ul class="treeview-menu">
        <li><a href="predictive.php"><i class="fa fa-circle-
o"></i>Predictive Analysis</a></li>
    </ul>
</li>
</ul>
</section>
</aside>
<div class="content-wrapper">
    <section class="content-header">
        <h1>
            Statistics
            <small>Predictive Analytics Data</small>
        </h1>
        <ol class="breadcrumb">
            <li><a href="#"><i class="fa fa-dashboard"></i> Home</a></li>
            <li class="active">Dashboard</li>
        </ol>
        <section class="content">
            <h1><center> Predictive Analysis on Vehicle Emission Quality <br>
</center></h1>
            <div class="col-md-4 col-sm-6 col-xs-12">
                <div class="info-box bg-blue">
                    <span class="info-box-icon"><i class="fa fa-taxi"></i></span>

                    <div class="info-box-content">
                        <span class="info-box-text">Carbon Count</span>
                        <span class="info-box-number">6201.97</span>
                        <div class="progress">
                            <div class="progress-bar" style="width: 100%"></div>
                        </div>
                        <span class="progress-description">
                            in 24152 MC/TC Vehicle count
                        </span>
                    </div>
                </div>
            </div>
        </section>
    </div>

```



```

        </div>
    </div>
</div>
<div class="col-md-4 col-sm-6 col-xs-12">
    <div class="info-box bg-red">
        <span class="info-box-icon"><i class="fa fa-taxi"></i></span>
        <div class="info-box-content">
            <span class="info-box-text">Nitrogen Oxides Count</span>
            <span class="info-box-number">75.52</span>
            <div class="progress">
                <div class="progress-bar" style="width: 100%"></div>
            </div>
            <span class="progress-description">
                in 24152 MC/TC Vehicle count
            </span>
        </div>
    </div>
</div>
<div class="col-md-4 col-sm-6 col-xs-12">
    <div class="info-box bg-green">
        <span class="info-box-icon"><i class="fa fa-taxi"></i></span>
        <div class="info-box-content">
            <span class="info-box-text">Sulfur Oxides Count</span>
            <span class="info-box-number">1.12</span>
            <div class="progress">
                <div class="progress-bar" style="width: 100%"></div>
            </div>
            <span class="progress-description">
                in 24152 MC/TC Vehicle count
            </span>
        </div>
    </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
<body>
</body>
</html>
</div>
</section>
<div class="col-md-3 col-sm-6 col-xs-12">
    <label> Vehicle Count</label>
    <br>
    <span id="range">24304</span>
    <script type="text/javascript">
        function showValue(newValue)
        {
            document.getElementById("range").innerHTML=newValue;
        }
    </script>
<form action="predictive1.php" method="POST">
    <input type="range" min="12152" max="48608" step="1000" value="24304"
    id="foo" name="vehiclecount" onchange='document.getElementById("bar").value =
    document.getElementById("foo").value,showValue(this.value);'/>
    <span type="text" name="bar" id="bar" value="24304" disabled />

```

```

        <br />
        <input type=submit value=Submit />
    </form>
    <?php
    if(isset($_POST["vehiclecount"])){
        echo "current data : ".$_POST["vehiclecount"];
    } else{
        Echo "current data : 24304";
    }
    ?>

    </div>
    <div class="col-md-3 col-sm-6 col-xs-12">
        <script type="text/javascript"
src="https://www.gstatic.com/charts/loader.js"></script>
        <table class="columns">
            <tr>
                <td><div id="piechart_div" style="border: 1px solid #ccc"></div></td>
                <td><div id="barchart_div" style="border: 1px solid #ccc"></div></td>
            </tr>
        </table>
        <script>
            google.charts.load('current', {'packages':['corechart']});
            google.charts.setOnLoadCallback(drawChart);

            function drawChart() {

                var data = new google.visualization.DataTable();
                data.addColumn('string', 'Topping');
                data.addColumn('number', 'Slices');
                data.addRows([
                    ['Carbon Count', <?php echo $_POST["vehiclecount"]*0.2567890059;?>],
                    ['Nitrogen Count', <?php echo
$_POST["vehiclecount"]*0.00312705727;?>],
                    ['Sulfur', <?php echo $_POST["vehiclecount"]*0.0000464944;?>],
                ]);
                var piechart_options = {title:'MC/TC Emission',
                    width:400,
                    height:200};
                var piechart = new
google.visualization.PieChart(document.getElementById('piechart_div'));
                piechart.draw(data, piechart_options);

                var barchart_options = {title:'MC/TC Emission',
                    width:400,
                    height:200,
                    legend: 'none'};
                var barchart = new
google.visualization.BarChart(document.getElementById('barchart_div'));
                barchart.draw(data, barchart_options);
            }
        </script>
    </body>
    <table class="columns">
        <tr>
            <td><div id="piechart_div" style="border: 1px solid #ccc"></div></td>
            <td><div id="barchart_div" style="border: 1px solid #ccc"></div></td>
        </tr>
    </table>

```

```

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

<footer class="main-footer">

    <div class="pull-right hidden-xs">
        <b>Xavier University-Ateneo de Cagayan - College of Computer Studies </b>
2016
    </div>
    <strong>Copyright &copy; <?php echo date('Y'); ?>.</strong> All rights
    reserved.

</footer>

<script src="plugins/jquery/jquery-2.2.0.min.js"></script>
<script src="https://code.jquery.com/ui/1.11.4/jquery-ui.min.js"></script>

<script>
    $.widget.bridge('uibutton', $.ui.button);
</script>

<script src="bootstrap/js/bootstrap.min.js"></script>
<script src="https://cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-
min.js"></script>

<script src="plugins/morris/morris.min.js"></script>
<script src="plugins/sparkline/jquery.sparkline.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-1.2.2.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-world-mill-en.js"></script>
<script src="plugins/knob/jquery.knob.js"></script>
<script

src="https://cdnjs.cloudflare.com/ajax/libs/moment.js/2.10.6/moment.min.js"></sc
ript>

<script src="plugins/daterangepicker/daterangepicker.js"></script>
<script src="plugins/datepicker/bootstrap-datepicker.js"></script>
<script src="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.all.min.js"></script>
<script src="plugins/slimScroll/jquery.slimscroll.min.js"></script>
<script src="plugins/fastclick/fastclick.js"></script>
<script src="dist/js/app.min.js"></script>
<script src="dist/js/pages/dashboard.js"></script>
<script src="dist/js/demo.js"></script>
<script src="../../plugins/flot/jquery.flot.min.js"></script>
<script src="../../plugins/flot/jquery.flot.resize.min.js"></script>
<script src="../../plugins/flot/jquery.flot.pie.min.js"></script>
<script src="../../plugins/flot/jquery.flot.categories.min.js"></script>

</body>
</html>

```

Figure E1 Predictive Analysis Page (predictive.php)

Vehicle Count Page (Vehicle_data.php)

```

<?php
$connection = mysql_connect("localhost", "root", "");
$db = mysql_select_db("db-air", $connection);
?>
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <link rel="icon" type="image/png" href="assets/img/cdo.png">
  <title>Air Cagayan de Oro City</title>
  <meta content="width=device-width, initial-scale=1, maximum-scale=1, user-
scalable=no" name="viewport">
  <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">\
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
  <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.css">
  <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
  <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
  <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
  <link rel="stylesheet" href="plugins/morris/morris.css">
  <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-1.2.2.css">
  <link rel="stylesheet" href="plugins/date picker/date picker3.css">\
  <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-bs3.css">
  <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">
  <header class="main-header">
    <a href="index.php" class="logo">
      <span class="logo-mini"></span>
      <span class="logo-lg"></span>
    </a>
    <nav class="navbar navbar-static-top" role="navigation">
      <a href="#" class="sidebar-toggle" data-toggle="offcanvas" role="button">
        <span class="sr-only">Toggle navigation</span>
      </a>
      <div class="navbar-custom-menu">
        <ul class="nav navbar-nav">
          <li class="dropdown messages-menu">
            </li>
          <li class="dropdown tasks-menu">
            </li>
          <li class="dropdown user user-menu">
            <a href="#" class="dropdown-toggle" data-toggle="dropdown">
              
              <span class="hidden-xs"> Welcome <b>Guest </b></span>
            </a>
            <ul class="dropdown-menu">
              <li class="user-header">
                
                <p>
                  Guest
                </p>
              </li>
            </ul>
          </li>
        </ul>
      </div>
    </nav>
  </header>

```

```

        <li class="treeview">
            <a href="#">
                <i class="fa fa-bar-chart"></i>
                <span>Statistics</span>
                <i class="fa fa-angle-left pull-right"></i>
            </a>
            <ul class="treeview-menu">
                <li><a href="predictive.php"><i class="fa fa-circle-o"></i>Predictive
Analysis</a></li>
            </ul>
        </li>
    </ul>
</section>
</aside>
<div class="content-wrapper">
    <section class="content-header">
        <h1>
            Dashboard
            <small>Vehicle Data</small>
        </h1>
        <ol class="breadcrumb">
            <li><a href="#"><i class="fa fa-dashboard"></i> Home</a></li>
            <li class="active">Dashboard</li>
        </ol>
        <section class="content">
            <h1><center>Department of Transportation and Communications <br> Land
Transportation Office Region 10 Registered Vehicles 2010-2015</center></h1>
            <div class="col-md-3 col-sm-6 col-xs-12">
<body>
    </body>
</html>
        </div>
        </section>
        <div class="col-md-3 col-sm-6 col-xs-12">
            <div class="info-box bg-aqua">
                <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>

                <div class="info-box-content">
                    <span class="info-box-text">2010 MC/TC Count </span>
                    <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2010' && Agency='Cagayan D'";
                                $query_run =
mysql_query($query);

                                $qtye= 0;
                                while ($num =
mysql_fetch_assoc ($query_run)){
                                    $qtye =
$num['MC_TC'];
                                }

                                echo
$qtye; ?></span>
                    <div class="progress">
                        <div class="progress-bar" style="width: <?php $query = "SELECT
Total FROM lto_data WHERE Year='2010' && Agency='Cagayan D'";
                            $query_run = mysql_query($query);
                            $pera= 0;
                            while ($num = mysql_fetch_assoc ($query_run)){
                                $pera = $qtye / $num['Total'] * 100; }

```

```

        </div>
        <span class="progress-description">
            <?php echo round($pera,2);?> % in overall vehicle count
        </span>
    </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-red">
        <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>

        <div class="info-box-content">
            <span class="info-box-text">2011 MC/TC Count </span>
            <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2011' && Agency='Cagayan D'";

                                $query_run =
mysql_query($query);

                                $qtyf= 0;
                                while ($num =
mysql_fetch_assoc ($query_run)){

                                $qtyf =
$num['MC_TC'];

                                }

                                echo $qtyf; ?>

        </span>

        <div class="progress">
            <div class="progress-bar" style="width: <?php $query = "SELECT
Total FROM lto_data WHERE Year='2011' && Agency='Cagayan D'";

                                $query_run =
mysql_query($query);

                                while ($num =
mysql_fetch_assoc ($query_run)){

                                $perb =
$qtyf/$num['Total'] * 100;

                                }

                                echo
$perb."%"; ?>"></div>
        </div>
        <span class="progress-description">
            <?php echo round($perb,2);?> % in overall vehicle count
        </span>
    </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-yellow">
        <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>

        <div class="info-box-content">
            <span class="info-box-text">2012 MC/TC Count </span>
            <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2012' && Agency='Cagayan D'";

                                $query_run =
mysql_query($query);

```

```

mysql_fetch_assoc ($query_run)){
    $num['MC_TC'];

    $qtya= 0;
    while ($num =
        $qtya =
    }

    echo $qtya; ?>

</span>

    <div class="progress">
        <div class="progress-bar" style="width: <?php $query = "SELECT
Total FROM lto_data WHERE Year='2012' && Agency='Cagayan D'";
        $query_run = mysql_query($query);
        while ($num = mysql_fetch_assoc ($query_run)){
            $perc = $qtya/$num['Total']*100; }
            echo $perc."%"; ?>"></div>
        </div>
        <span class="progress-description">
            <?php echo round($perc,2);?> % in overall vehicle count
        </span>
    </div>
</div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-orange">
        <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>

        <div class="info-box-content">
            <span class="info-box-text">2013 MC/TC Count </span>
            <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2013' && Agency='Cagayan D'";
            $query_run =
            mysql_query($query);

            $qtyb= 0;
            while ($num =
                $qtyb =
            }

            echo
            $qtyb; ?></span>
            <div class="progress">
                <div class="progress-bar" style="width: <?php $query = "SELECT
Total FROM lto_data WHERE Year='2013' && Agency='Cagayan D'";
                $query_run = mysql_query($query);
                while ($num = mysql_fetch_assoc ($query_run)){
                    $perd = $qtyb/$num['Total']*100; }

                    echo $perd."%"; ?>"></div>
                </div>
                <span class="progress-description">
                    <?php echo round($perd,2);?> % in overall vehicle count
                </span>
            </div>
        </div>
    </div>
</div>

```

```

<div class="col-md-3 col-sm-6 col-xs-12">
  <div class="info-box bg-green">
    <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>
    <div class="info-box-content">
      <span class="info-box-text">2014 MC/TC Count </span>
      <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2014' && Agency='Cagayan D'";
      $query_run = mysql_query($query);
      $qtyc= 0;
      while ($num = mysql_fetch_assoc ($query_run)){
        $qtyc = $num['MC_TC'];
      }
      echo $qtyc; ?></span>

      <div class="progress">
        <div class="progress-bar" style="width: <?php $query = "SELECT
Total FROM lto_data WHERE Year='2014' && Agency='Cagayan D'";
        $query_run = mysql_query($query);
        while ($num = mysql_fetch_assoc ($query_run)){
          $pere = $qtyc/$num['Total']*100;
        }

        echo $pere."%"; ?>></div>
      </div>
      <span class="progress-description">
        <?php echo round($pere,2);?> % in overall vehicle count
      </span>
    </div>
  </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
  <div class="info-box bg-purple">
    <span class="info-box-icon"><i class="fa fa-motorcycle"></i></span>

    <div class="info-box-content">
      <span class="info-box-text">2015 MC/TC Count </span>
      <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2015' && Agency='Cagayan D'";
      $query_run =
mysql_query($query);

      $qtyd= 0;
      while ($num =
mysql_fetch_assoc ($query_run)){
        $qtyd =
$num['MC_TC'];
      }

      echo
$qtyd; ?></span>
      <div class="progress">
        <div class="progress-bar" style="width: <?php $query = "SELECT Total FROM
lto_data WHERE Year='2015' && Agency='Cagayan D'";
        $query_run = mysql_query($query);
        while ($num = mysql_fetch_assoc ($query_run)){
          $perf = $qtyd/$num['Total']*100;
        }

        echo $perf."%"; ?>></div>

```



```

        </div>
        <span class="progress-description">
            <?php echo round($perf,2);?> % in overall vehicle
count
        </span>
    </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-black">
        <span class="info-box-icon"><i class="fa fa-
motorcycle"></i></span>
        <div class="info-box-content">
            <span class="info-box-text">2015 Overall Vehicle Count
</span>
            <span class="info-box-number"><?php $queryx = "SELECT
Total FROM lto_data WHERE Year='2015' && Agency='Cagayan D'";
$query_run = mysql_query($queryx);
$qtye= 0;
while ($num = mysql_fetch_assoc ($query_run)){
    $qtye = $num['Total'];
    }

            echo $qtye; ?></span>

            <div class="progress">
            <div class="progress-bar" style="width: <?php $x=33439-
19836;
                                                    $y=$x/19836
*100;
                                                    $pr=$y/6;
                                                    echo
$pr."%";
                ?>"></div>
            </div>
            <span class="progress-description">
                <?php echo round($pr,2) ;?> % Growth Rate from 2010
to 2015
            </span>
        </div>
    </div>
</div>
</div>
<?php

    $connection = mysql_connect('localhost','root','');
    mysql_select_db('db-air');

    $num_rec_per_page=13;

    if (isset($_GET["page"])) {
        $page = $_GET["page"];
    } else {
        $page=1;
    };

    $start_from = ($page-1) * $num_rec_per_page;

    $sql = "SELECT * FROM lto_data LIMIT $start_from,
$num_rec_per_page";
    $rs_result = mysql_query ($sql);

```

```

        echo"
        <div class=\"content\">
            <div class=\"container-fluid\">
                <div class=\"row\">
                    <div class=\"col-md-12\">
                        <div class=\"card\">
                            <div class=\"header\">
                                <h2 class=\"title text-
left\"><b>Registered Vehicles</b></h2>";
                                echo "<h5 class=\"text-
left\">Total Records: $count1</h5>";

                                echo "</div>
                                <div class=\"content table-
responsive table-full-width\">
                                    <table class=\"table table-
hover table-striped\">
                                        <thead>
                                            <th>Year</th>
                                            <th>LTO Agency</th>
                                            <th>No. of Cars</th>
                                            <th>No. of Utility
Vehicles</th>
                                            <th>No. of Sports
Utility</th>
                                            <th>No. of
Trucks</th>
                                            <th>No. of Buses</th>
                                            <th>No. of MC/TC</th>
                                            <th>No. of
Trailers</th>
                                        </thead>
                                        <tbody>";
                                            while ($row =
mysql_fetch_row($result)) {
                                                $bp_id = $row[0];
                                                ?>
                                                <tr>
                                                    <td><?php echo
$row[1]; ?></td>
                                                    <td><?php echo
$row[2]; ?></td>
                                                    <td><?php echo
$row[3]; ?></td>
                                                    <td><?php echo
$row[4]; ?></td>
                                                    <td><?php echo
$row[5]; ?></td>
                                                    <td><?php echo
$row[6]; ?></td>
                                                    <td><?php echo
$row[7]; ?></td>
                                                    <td><?php echo
$row[8]; ?></td>
                                                    <td><?php echo
$row[9]; ?></td>
                                                </tr>
                                                <?php ?> ?
                                            </tbody>
                                        </table>
                                    <?php
                                        $sql = "SELECT * FROM lto_data";
                                        $rs_result = mysql_query($sql);
                                        $total_records = mysql_num_rows($rs_result);
                                        $total_pages = ceil($total_records / $num_rec_per_page);

```

```

                                echo "<div class=\"container\"> ";
                                echo "<ul class=\"pagination\"> ";
                                echo "<li><a
href='Vehicle_Data.php?page=1'>".'|<'."</a></li> ";
                                for ($i=1; $i<=$total_pages; $i++) {
                                    echo "<li><a
href='Vehicle_Data.php?page=". $i. "'>". $i. "</a></li> ";
                                };
                                echo "<li><a
href='Vehicle_Data.php?page=$total_pages'>".'|<'."</a></li> ";
                                echo" </div>
                                </div>";
                                mysql_free_result($result);
                                mysql_close($connection);
                            ?>
                        </section>
                    </div>
                <footer class="main-footer">
                    <div class="pull-right hidden-xs">
                        <b>Xavier University-Ateneo de Cagayan - College of Computer
Studies </b> 2016
                    </div>
                    <strong>Copyright &copy; <?php echo date('Y'); ?>.</strong> All
rights
                    reserved.
                </footer>
                <script src="plugins/jquery/jquery-2.2.0.min.js"></script>
                <script src="https://code.jquery.com/ui/1.11.4/jquery-
ui.min.js"></script>
                <script>
                    $.widget.bridge('uibutton', $.ui.button);
                <script src="bootstrap/js/bootstrap.min.js"></script>
                <script
src="https://cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-
min.js"></script>
                <script src="plugins/morris/morris.min.js"></script>
                <script src="plugins/sparkline/jquery.sparkline.min.js"></script>
                <script src="plugins/jvectormap/jquery-jvectormap-1.2.2.min.js"></script>
                <script src="plugins/jvectormap/jquery-jvectormap-world-mill-
en.js"></script>
                <script src="plugins/knob/jquery.knob.js"></script>
                <script
src="https://cdnjs.cloudflare.com/ajax/libs/moment.js/2.10.6/moment.min.js"></sc
ript>
                <script src="plugins/daterangepicker/daterangepicker.js"></script>
                <script src="plugins/datepicker/bootstrap-datepicker.js"></script>
                <script src="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.all.min.js"></script>
                <script src="plugins/slimScroll/jquery.slimscroll.min.js"></script>
                <script src="plugins/fastclick/fastclick.js"></script>
                <script src="dist/js/app.min.js"></script>
                <script src="dist/js/pages/dashboard.js"></script>
                <script src="dist/js/demo.js"></script>
                <script src=".../plugins/flot/jquery.flot.min.js"></script>
                <script src=".../plugins/flot/jquery.flot.resize.min.js"></script>
                <script src=".../plugins/flot/jquery.flot.pie.min.js"></script>
                <script src=".../plugins/flot/jquery.flot.categories.min.js"></script>
            </body>
        </html>

```

Figure E2 Vehicle Count page (vehicle_data.php)

Connect to “db-air” Database (db.php)

```

<?php
define('DB_SERVER', 'localhost');
define('DB_USERNAME', 'root');
define('DB_PASSWORD', '');
define('DB_DATABASE', 'db-air');
$db = mysqli_connect(DB_SERVER,DB_USERNAME,DB_PASSWORD,DB_DATABASE);

    function make_safe($variable) {
        $variable = strip_tags(htmlentities(trim($variable)));
        return $variable;
    }

?>

```

*Figure E3 Connect to database (db.php)***Mobile Emission Inventory Page (emit_est.php)**

```

<?php include('db.php') ; ?>

<!DOCTYPE html>
<html>
<head>
    <meta charset="utf-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <link rel="icon" type="image/png" href="assets/img/cdo.png">
    <title>Air Cagayan de Oro City</title>

    <meta content="width=device-width, initial-scale=1, maximum-scale=1, user-
scalable=no" name="viewport">
    <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">
    <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
    <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.css">
    <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
        folder instead of downloading all of them to reduce the load. -->
    <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
    <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
    <link rel="stylesheet" href="plugins/morris/morris.css">
    <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-1.2.2.css">
    <link rel="stylesheet" href="plugins/date picker/date picker3.css">
    <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-bs3.css">
    <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">
    <header class="main-header">
        <a href="index.php" class="logo">
            <span class="logo-mini"></span>
            <span class="logo-lg"></span>
        </a>
    <nav class="navbar navbar-static-top" role="navigation">
        <a href="#" class="sidebar-toggle" data-toggle="offcanvas" role="button">

```

```

<span class="sr-only">Toggle navigation</span>
</a>

<div class="navbar-custom-menu">
  <ul class="nav navbar-nav">
    <li class="dropdown messages-menu">
      </li>
    <li class="dropdown tasks-menu">
      </li>
    <li class="dropdown user user-menu">
      <a href="#" class="dropdown-toggle" data-toggle="dropdown">
        
        <span class="hidden-xs">Welcome Guest</span>
      </a>
      <ul class="dropdown-menu">
        <li class="user-header">
          
          <p>
            Guest
          </p>
        </li>
        <li class="user-footer">
          <div class="pull-right">
            <a href="pages/login.php" class="btn btn-default btn-
flat">Log In</a>
          </div>
        </li>
      </ul>
    </li>
    <!-- Control Sidebar Toggle Button -->
    <li>
      <a><?php date_default_timezone_set("Asia/Manila");
echo date("h:ia");?></a>
    </li>
  </ul>
</div>
</nav>
</header>
<aside class="main-sidebar">
  <section class="sidebar">
    <div class="user-panel">
      <div class="pull-left image">
        
      </div>
      <div class="pull-left info">
        <p>Guest</p>
        <a href="#"><i class="fa fa-circle text-success"></i> Guest
Access</a>
      </div>
    </div>
  </div>

```

```

        <ul class="sidebar-menu">
        <li class="header">MAIN NAVIGATION</li>
        <li class="treeview">
            <ul class="treeview-menu">
                <li><a href="pages/layout/top-nav.html"><i class="fa fa-circle-o"></i> Top Navigation</a></li>
                <li><a href="pages/layout/boxed.html"><i class="fa fa-circle-o"></i> Boxed</a></li>
                <li><a href="pages/layout/fixed.html"><i class="fa fa-circle-o"></i> Fixed</a></li>
                <li><a href="pages/layout/collapsed-sidebar.html"><i class="fa fa-circle-o"></i> Collapsed Sidebar</a></li>
            </ul>
        </li>
        <li class="treeview">
            <a href="index.php">
                <i class="fa fa-dashboard"></i>
                <span>Dashboard</span>
                <i class="fa fa-angle-left pull-right"></i>
            </a>
            <ul class="treeview-menu">
                <li><a href="Overview.php"><i class="fa fa-circle-o"></i>Overview Report</a></li>
                <li><a href="vehicle_data.php"><i class="fa fa-circle-o"></i>Vehicle Data</a></li>
                <li><a href="emission_est.php"><i class="fa fa-circle-o"></i>Emission Inventory</a></li>
                <li><a href="map.php"><i class="fa fa-circle-o"></i> AQI MAP</a></li>
            </ul>
        </li>
        <li class="treeview">
            <a href="#">
                <i class="fa fa-bar-chart"></i>
                <span>Statistics</span>
                <i class="fa fa-angle-left pull-right"></i>
            </a>
            <ul class="treeview-menu">
                <li><a href="predictive.php"><i class="fa fa-circle-o"></i>Predictive Analysis</a></li>
            </ul>
        </li>
        </ul>
    </section>
</aside>
<div class="content-wrapper">
    <section class="content-header">
        <h1>Dashboard</h1>
        <small>Emission Inventory</small>
    </h1>
    <ol class="breadcrumb">
        <li><a href="#"><i class="fa fa-dashboard"></i> Home</a></li>
        <li class="active">Dashboard</li>
    </ol>

```

```

        var piechart = new
google.visualization.PieChart(document.getElementById('piechart_div'));
        piechart.draw(data, piechart_options);

        var barchart_options = {title:'Mobile Emission Inventory of 2011
(Tons/Year)',
                                width:695,
                                height:300,
                                legend: 'Emission'};
        var barchart = new
google.visualization.BarChart(document.getElementById('barchart_div'));
        barchart.draw(data, barchart_options);
    }
</script>
<body>
    <table class="columns">
        <tr>
            <td><div id="piechart_div" style="border: 1px solid
#ccc"></div></td>
            <td><div id="barchart_div" style="border: 1px solid
#ccc"></div></td>
        </tr>
    </table>
</body>
</html>
</div>
    <div class="col-md-3 col-sm-6 col-xs-12">
    </div>
</section>
<?php

    $connection = mysql_connect('localhost','root','');
    mysql_select_db('db-air');
    $num_rec_per_page=100;
    if (isset($_GET["page"])) {
        $page = $_GET["page"];
    } else {
        $page=1;
    };
    $start_from = ($page-1) * $num_rec_per_page;
    $sql = "SELECT * FROM emission_est LIMIT $start_from,
$num_rec_per_page";
    $rs_result = mysql_query ($sql); //run the query

    $query = "SELECT Source, CO, NOx, SOx FROM emission_est LIMIT
$start_from, $num_rec_per_page";
    $result = mysql_query($query);

    $query1 = "SELECT Source, CO, NOx, SOx FROM emission_est";
    $result1 = mysql_query($query1);
    $count1 = mysql_num_rows($result1);
    echo"

        <div class=\"content\">
            <div class=\"container-fluid\">
                <div class=\"row\">
                    <div class=\"col-md-12\">

```

```

                                <div class=\"card\">
                                    <div class=\"header\">
                                        <h2 class=\"title text-
left\"><b>Emission Inventory</b><i> in 2011</i></h2>;
                                        echo \"<h5 class=\"text-
left\">Total Records: $count1</h5>\";

                                    echo \"</div>
                                    <div class=\"content table-
responsive table-full-width\">
                                        <table class=\"table table-
hover table-striped\">
                                            <thead>
                                                <th>Source</th>
                                                <th>Carbon Monoxide
                                                <th>Nitrogen
                                                <th>Sulfur
                                            </thead>
                                            <tbody>;
                                                while ($row =
mysql_fetch_row($result)) {
                                                    ?>
                                                    <tr>
                                                        <td><?php
echo $row[0]; ?></td>
                                                        <td><?php
echo $row[1]; ?> tons/year </td>
                                                        <td><?php
echo $row[2]; ?> tons/year </td>
                                                        <td><?php
echo $row[3]; ?> tons/year </td>
                                                    </tr>
                                                    <?php }; ?>
                                                </table>
                                                <?php
$mysql = \"SELECT * FROM
emission_est\";
$mysql_result =
mysql_query($mysql); //run the query
$mysql_num_rows($mysql_result); //count number of records
$mysql_total_records =
ceil($mysql_total_records / $mysql_num_rec_per_page);
                                                echo\"</tbody>
                                                </table>
                                                </div>
                                                </div>
                                                </div>
                                                </div> \";
echo\" </div>
                                </div>
                                ";

```



```

        mysql_free_result($result);
        mysql_close($connection);
    ?>
</section>
</div>
<footer class="main-footer">
    <div class="pull-right hidden-xs">
        <b>Xavier University-Ateneo de Cagayan - College of Computer
Studies </b> 2016
    </div>
    <strong>Copyright &copy; <?php echo date('Y'); ?>.</strong> All
rights
    reserved.
</footer>
<script src="plugins/jquery/jquery-2.2.0.min.js"></script>
<script src="https://code.jquery.com/ui/1.11.4/jquery-
ui.min.js"></script>
<script>
    $.widget.bridge('uibutton', $.ui.button);
</script>
<script src="bootstrap/js/bootstrap.min.js"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-
min.js"></script>
<script src="plugins/morris/morris.min.js"></script>
<script src="plugins/sparkline/jquery.sparkline.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-
1.2.2.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-world-mill-
en.js"></script>
<script src="plugins/knob/jquery.knob.js"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/moment.js/2.10.6/moment.min.
js"></script>
<script src="plugins/daterangepicker/daterangepicker.js"></script>
<script src="plugins/datepicker/bootstrap-datepicker.js"></script>
<script src="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.all.min.js"></script>
<script src="plugins/slimScroll/jquery.slimscroll.min.js"></script>
<script src="plugins/fastclick/fastclick.js"></script>
<script src="dist/js/app.min.js"></script>
<script src="dist/js/pages/dashboard.js"></script>
<script src="dist/js/demo.js"></script>

<script src="../../../plugins/flot/jquery.flot.min.js"></script>
<script src="../../../plugins/flot/jquery.flot.resize.min.js"></script>
<!-- FLOT PIE PLUGIN - also used to draw donut charts -->
<script src="../../../plugins/flot/jquery.flot.pie.min.js"></script>
<!-- FLOT CATEGORIES PLUGIN - Used to draw bar charts -->
<script src="../../../plugins/flot/iaquerv.flot.categories.min.js"></script>

```

Figure E4 Mobile Emission Inventory Page (emit_est.php)

Guest Access (Index.php)

```

<?php include('db.php') ; ?>
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <link rel="icon" type="image/png" href="assets/img/cdo.png">
  <title>Air Cagayan de Oro City</title>
  <meta content="width=device-width, initial-scale=1, maximum-scale=1, user-
scalable=no" name="viewport">
  <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
  <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.css">
  <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
  <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
  <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
  <link rel="stylesheet" href="plugins/morris/morris.css">
  <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-1.2.2.css">
  <link rel="stylesheet" href="plugins/datepicker/datepicker3.css">
  <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-bs3.css">
  <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">

  <header class="main-header">
    <a href="index.php" class="logo">
      <span class="logo-mini"></span>
      <span class="logo-lg"></span>
    </a>
    <nav class="navbar navbar-static-top" role="navigation">
      <a href="#" class="sidebar-toggle" data-toggle="offcanvas" role="button">
        <span class="sr-only">Toggle navigation</span>
      </a>
    <div class="navbar-custom-menu">
      <ul class="nav navbar-nav">
        <li class="dropdown messages-menu">
          </li>
        <!-- Tasks: style can be found in dropdown.less -->
        <li class="dropdown tasks-menu">
          </li>
        <li class="dropdown user user-menu">
          <a href="#" class="dropdown-toggle" data-toggle="dropdown">
            
            <span class="hidden-xs"> Welcome <b>Guest </b></span>
          </a>

```

```

<ul class="dropdown-menu">
    <li class="user-header">
        
        <p>
            Guest
        </p>
    </li>
    </li>
    <li class="user-footer">
        <div class="pull-right">
            <a href="pages/login.php" class="btn btn-default btn-
flat">Login</a>
        </div>
    </li>
</ul>
</li>
<li>
    <a><?php echo date("H:m:a"); ?></a>
</li>
</ul>
</div>
</nav>
</header>
<aside class="main-sidebar">
    <section class="sidebar">
        <div class="user-panel">
            <div class="pull-left image">
                
            </div>
            <div class="pull-left info">
                <p>Guest</p>
                <a href="#"><i class="fa fa-circle text-success"></i>Guest
Access</a>
            </div>
        </div>
        <ul class="sidebar-menu">
            <li class="header">MAIN NAVIGATION</li>
            <li class="treeview">
                <ul class="treeview-menu">
                    <li><a href="pages/layout/top-nav.html"><i class="fa fa-
circle-o"></i> Top Navigation</a></li>
                    <li><a href="pages/layout/boxed.html"><i class="fa fa-circle-
o"></i> Boxed</a></li>
                    <li><a href="pages/layout/fixed.html"><i class="fa fa-circle-
o"></i> Fixed</a></li>
                    <li><a href="pages/layout/collapsed-sidebar.html"><i
class="fa fa-circle-o"></i> Collapsed Sidebar</a></li>
                </ul>
            </li>
            <li class="treeview">
                <a href="index.php">
                    <i class="fa fa-dashboard"></i>

```

```

<i class="fa fa-angle-left pull-right"></i>
    </a>
    <ul class="treeview-menu">
        <li><a href="overview.php"><i class="fa fa-circle-
o"></i>Overview Report</a></li>
        <li><a href="vehicle_Data.php"><i class="fa fa-circle-
o"></i>Vehicle Data</a></li>
        <li><a href="pages/charts/flot.html"><i class="fa fa-circle-
o"></i>Emission Data</a></li>
        <li><a href="map.php"><i class="fa fa-circle-o"></i> AQI
MAP</a></li>
    </ul>
</li>

    <li class="treeview">
    <a href="#">
        <i class="fa fa-bar-chart"></i>
        <span>Statistics</span>
        <i class="fa fa-angle-left pull-right"></i>
    </a>
    <ul class="treeview-menu">
        <li><a href="index.php"><i class="fa fa-circle-
o"></i>Descriptive Analysis</a></li>
        <li><a href="pages/charts/morris.html"><i class="fa fa-
circle-o"></i>Predictive Analysis</a></li>
    </ul>

    </li>

</ul>

</section>
</aside>
<div class="content-wrapper">
<br>
<br>
<br>
<center>
    
    <br>
    <br>
    <h1><b>AIR Cagayan de Oro</b></h1>
    <h3> A thesis presented to Department of Computer Science</h3>
    <h3>College of Computer Studies in collaboration with </h3>
    <h3>Land Transportation Office Region 10 and </h3>
    <h3>Xavier University Engineering Resource Center</h3>
    <br>
    <br>
    <br>
    <p><b>in cooperation with :</b></p>
    <p></p>

```

```

        <br>
        <br>
        <p><b>reference documents : </b></p>
        <p><b> Clear Air Plan of Cagayan de Oro City</b></p>
        <p></p>
        <br>
        <br>
    </center>
</div>
<footer class="main-footer">
    <div class="pull-right hidden-xs">
        <b>Xavier University-Ateneo de Cagayan - College of Computer
Studies </b> 2016
    </div>
    <strong>Copyright &copy; <?php echo date('Y'); ?>.</strong> All
rights
    reserved.
</footer>
<script src="plugins/jquery/jquery-2.2.0.min.js"></script>
<script src="https://code.jquery.com/ui/1.11.4/jquery-
ui.min.js"></script>
<script>
    $.widget.bridge('uibutton', $.ui.button);
</script>
<script src="bootstrap/js/bootstrap.min.js"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-
min.js"></script>
<script src="plugins/morris/morris.min.js"></script>
<script src="plugins/sparkline/jquery.sparkline.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-1.2.2.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-world-mill-
en.js"></script>
<script src="plugins/knob/jquery.knob.js"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/moment.js/2.10.6/moment.min.j
s"></script>
<script src="plugins/daterangepicker/daterangepicker.js"></script>
<script src="plugins/datepicker/bootstrap-datepicker.js"></script>
<script src="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.all.min.js"></script>
<script src="plugins/slimScroll/jquery.slimscroll.min.js"></script>
<script src="plugins/fastclick/fastclick.js"></script>
<script src="dist/js/app.min.js"></script>
<script src="dist/js/pages/dashboard.js"></script>
<script src="dist/js/demo.js"></script>
<script src="../../plugins/flot/jquery.flot.min.js"></script>
<script src="../../plugins/flot/jquery.flot.resize.min.js"></script>
<script src="../../plugins/flot/jquery.flot.pie.min.js"></script>
<script src="../../plugins/flot/jquery.flot.categories.min.js"></script>
</body>

```

Figure E5 Guest Access (index.php)

Guest Access (Map.php)

```

<?php include('pages/db.php') ; ?>
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <link rel="icon" type="image/png" href="assets/img/cdo.png">
  <title>Air Cagayan de Oro City</title>
  <meta content="width=device-width, initial-scale=1, maximum-scale=1,
user-scalable=no" name="viewport">
  <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
  <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.cs
s">
  <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
  <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
  <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
  <link rel="stylesheet" href="plugins/morris/morris.css">
  <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-
1.2.2.css">
  <link rel="stylesheet" href="plugins/datepicker/datepicker3.css">
  <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-
bs3.css">
  <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">

  <header class="main-header">
    <a href="index.php" class="logo">
      <span class="logo-mini"></span>
      <span class="logo-lg"></span>
    </a>
    <nav class="navbar navbar-static-top" role="navigation">
      <a href="#" class="sidebar-toggle" data-toggle="offcanvas"
role="button">
        <span class="sr-only">Toggle navigation</span>
      </a>

      <div class="navbar-custom-menu">
        <ul class="nav navbar-nav">
          <li class="dropdown messages-menu">
          </li>
          <li class="dropdown tasks-menu">
          </li>
          <li class="dropdown user user-menu">
            <a href="#" class="dropdown-toggle" data-toggle="dropdown">
              
              <span class="hidden-xs"> Welcome <b>Guest </b></span>
            </a>
            <ul class="dropdown-menu">

```

```

        <li class="user-header">
            
            <p>
                Guest
            </p>
        </li>
        </li>
        <li class="user-footer">
            <div class="pull-right">
                <a href="pages/login.php" class="btn btn-default btn-
flat">Login</a>
            </div>
        </li>
    </ul>
</li>
<li>
    <a><?php date_default_timezone_set("Asia/Manila");
echo date("h:ia");?></a>
</li>
</ul>
</div>
</nav>
</header>
<aside class="main-sidebar">
<!-- sidebar: style can be found in sidebar.less -->
<section class="sidebar">
    <!-- Sidebar user panel -->
    <div class="user-panel">
        <div class="pull-left image">
            
        </div>
        <div class="pull-left info">
            <p>Guest</p>
            <a href="#"><i class="fa fa-circle text-success"></i>Guest
Access</a>
        </div>
    </div>
    <ul class="sidebar-menu">
        <li class="header">MAIN NAVIGATION</li>
        <li class="treeview">
            <ul class="treeview-menu">
                <li><a href="pages/layout/top-nav.html"><i class="fa fa-
circle-o"></i> Top Navigation</a></li>
                <li><a href="pages/layout/boxed.html"><i class="fa fa-
circle-o"></i> Boxed</a></li>
                <li><a href="pages/layout/fixed.html"><i class="fa fa-
circle-o"></i> Fixed</a></li>
                <li><a href="pages/layout/collapsed-sidebar.html"><i
class="fa fa-circle-o"></i> Collapsed Sidebar</a></li>
            </ul>
        </li>
    </ul>

```

```

        <li class="treeview">
            <a href="index.php">
                <i class="fa fa-dashboard"></i>
                <span>Dashboard</span>
                <i class="fa fa-angle-left pull-right"></i>
            </a>
            <ul class="treeview-menu">
                <li><a href="overview.php"><i class="fa fa-circle-
o"></i>Overview Report</a></li>
                <li><a href="Vehicle_Data.php"><i class="fa fa-circle-
o"></i>Vehicle Data</a></li>
                <li><a href="emission_est.php"><i class="fa fa-circle-
o"></i>Emission Data</a></li>
                <li><a href="map.php"><i class="fa fa-circle-o"></i> AQI
MAP</a></li>
            </ul>
        </li>
        <li class="treeview">
            <a href="#">
                <i class="fa fa-bar-chart"></i>
                <span>Statistics</span>
                <i class="fa fa-angle-left pull-right"></i>
            </a>
            <ul class="treeview-menu">
                <li><a href="predictive.php"><i class="fa fa-circle-
o"></i>Predictive Analysis</a></li>
            </ul>
        </li>
    </ul>
</section>
</aside>
<div class="content-wrapper">
    <section class="content-header">
        <h1>
            Dashboard
            <small>AQI Map</small>
        </h1>
        <ol class="breadcrumb">
            <li><a href="#"><i class="fa fa-dashboard"></i> Home</a></li>
            <li class="active">Dashboard</li>
        </ol>
        <section class="content">

            <div id='map' style='height:680px;' />
            <link rel="stylesheet" href="http://cdn.leafletjs.com/leaflet-
0.7.5/leaflet.css" />
            <script src="http://cdn.leafletjs.com/leaflet-
0.7.5/leaflet.js"></script>
            <script>

```



```

var OSM_URL = 'http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png';
var OSM_ATTRIB = '&copy; <a
href="http://openstreetmap.org/copyright">OpenStreetMap</a> contributors';
var osmLayer = L.tileLayer(OSM_URL, {attribution: OSM_ATTRIB});
var WAQI_URL = "http://tiles.aqicn.org/tiles/usepa-
aqi/{z}/{x}/{y}.png?token=_TOKEN_ID_";
var WAQI_ATTR = 'Air Quality Tiles &copy; <a
href="http://waqi.info">waqi.info</a>';
var waqilayer = L.tileLayer(WAQI_URL, {attribution: WAQI_ATTR});
var map = L.map('map').setView([51.505, -0.09], 2);
map.addLayer(osmLayer).addLayer(waqilayer);
</script>
<script type="text/javascript" charset="utf-8">

(function(w,d,t,f){ w[f]=w[f]||function(c,k,n){s=w[f],k=s['k']=(s['k']||(k?('&k=
'+k):''));s['c']=
c=(c instanceof
Array)?c:[c];s['n']=n=n||0;L=d.createElement(t),e=d.getElementsByTagName(t)[0];

L.async=1;L.src='//feed.aqicn.org/feed/'+(c[n].city)+'/'+(c[n].lang||'')+ '/feed.v
1.js?n='+n+k;

e.parentNode.insertBefore(L,e); }); })( window,document,'script','_aqiFeed' );
</script>

</section>
</div>
<footer class="main-footer">
<div class="pull-right hidden-xs">
<b>Xavier University-Ateneo de Cagayan - College of Computer Studies </b>
2016
</div>
<strong>Copyright &copy; <?php echo date('Y'); ?>.</strong> All rights
reserved.
</footer>
<script src="plugins/jquery/jquery-2.2.0.min.js"></script>
<script src="https://code.jquery.com/ui/1.11.4/jquery-ui.min.js"></script>
<script>
$.widget.bridge('uibutton', $.ui.button);
</script>
<script src="bootstrap/js/bootstrap.min.js"></script>
<script src="https://cdnjs.cloudflare.com/ajax/libs/raphael/2.1.0/raphael-
min.js"></script>
<script src="plugins/morris/morris.min.js"></script>
<script src="plugins/sparkline/jquery.sparkline.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-1.2.2.min.js"></script>
<script src="plugins/jvectormap/jquery-jvectormap-world-mill-en.js"></script>
<script src="plugins/knob/jquery.knob.js"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/moment.js/2.10.6/moment.min.js"></scr
ipt>
<script src="plugins/daterangepicker/daterangepicker.js"></script>
<script src="plugins/datepicker/bootstrap-datepicker.js"></script>
<script src="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.all.min.js"></script>
<script src="plugins/slimScroll/jquery.slimscroll.min.js"></script>
<script src="plugins/fastclick/fastclick.js"></script>

```

Figure E6 Guest Access (map.php)

```

<script src="../../../plugins/flot/jquery.flot.min.js"></script>
<script src="../../../plugins/flot/jquery.flot.resize.min.js"></script>
<script src="../../../plugins/flot/jquery.flot.pie.min.js"></script>
<script src="../../../plugins/flot/jquery.flot.categories.min.js"></script>

</body>
</html>

```

Figure E6 Guest Access (map.php)

Guest Access (Overview.php)

```

<?php include('db.php') ; ?>
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <link rel="icon" type="image/png" href="assets/img/cdo.png">
  <title>Air Cagayan de Oro City</title>
  <!-- Tell the browser to be responsive to screen width -->
  <meta content="width=device-width, initial-scale=1, maximum-scale=1, user-
scalable=no" name="viewport">
  <link rel="stylesheet" href="bootstrap/css/bootstrap.min.css">
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/font-
awesome/4.4.0/css/font-awesome.min.css">
  <link rel="stylesheet"
href="https://code.ionicframework.com/ionicons/2.0.1/css/ionicons.min.css">
  <link rel="stylesheet" href="dist/css/AdminLTE.min.css">
  <link rel="stylesheet" href="dist/css/skins/_all-skins.min.css">
  <link rel="stylesheet" href="plugins/iCheck/flat/blue.css">
  <link rel="stylesheet" href="plugins/morris/morris.css">
  <link rel="stylesheet" href="plugins/jvectormap/jquery-jvectormap-1.2.2.css">
  <link rel="stylesheet" href="plugins/datepicker/datepicker3.css">
  <link rel="stylesheet" href="plugins/daterangepicker/daterangepicker-bs3.css">
  <link rel="stylesheet" href="plugins/bootstrap-wysihtml5/bootstrap3-
wysihtml5.min.css">
</head>
<body class="hold-transition skin-blue sidebar-mini">
<div class="wrapper">
  <header class="main-header">
    <a href="index.php" class="logo">
      <span class="logo-mini"></span>
      <span class="logo-lg"></span>
    </a>
    <nav class="navbar navbar-static-top" role="navigation">
      <a href="#" class="sidebar-toggle" data-toggle="offcanvas" role="button">
        <span class="sr-only">Toggle navigation</span>
      </a>
      <div class="navbar-custom-menu">
        <ul class="nav navbar-nav">

```

```

        <li class="dropdown messages-menu">
        </li>
        <li class="dropdown tasks-menu">
        </li>
        <li class="dropdown user user-menu">
        <a href="#" class="dropdown-toggle" data-toggle="dropdown">
        
        <span class="hidden-xs"> Welcome <b>Guest </b></span>
        </a>
        <ul class="dropdown-menu">
        <li class="user-header">
        
        <p>
        Guest
        </p>
        </li>
        </li>
        <li class="user-footer">
        <div class="pull-right">
        <a href="pages/login.php" class="btn btn-default btn-
flat">Login</a>
        </div>
        </li>
        </ul>
        </li>
        <li>
        <a><?php date_default_timezone_set("Asia/Manila");
        echo date("h:ia");?></a>
        </li>
        </ul>
        </div>
        </nav>
        </header>
        <aside class="main-sidebar">
        <section class="sidebar">
        <div class="user-panel">
        <div class="pull-left image">
        
        </div>
        <div class="pull-left info">
        <p>Guest</p>
        <a href="#"><i class="fa fa-circle text-success"></i>Guest Access</a>
        </div>
        </div>
        <ul class="sidebar-menu">
        <li class="header">MAIN NAVIGATION</li>
        <li class="treeview">
        <ul class="treeview-menu">
        <li><a href="pages/layout/top-nav.html"><i class="fa fa-circle-
o"></i> Top Navigation</a></li>
        <li><a href="pages/layout/boxed.html"><i class="fa fa-circle-o"></i>
Boxed</a></li>
        <li><a href="pages/layout/fixed.html"><i class="fa fa-circle-o"></i>
Fixed</a></li>

```

```

        <li><a href="pages/layout/collapsed-sidebar.html"><i class="fa fa-circle-o"></i> Collapsed Sidebar</a></li>
    </ul>

</li>

    <li class="treeview">
        <a href="index.php">
            <i class="fa fa-dashboard"></i>
            <span>Dashboard</span>
            <i class="fa fa-angle-left pull-right"></i>
        </a>
        <ul class="treeview-menu">
            <li><a href="overview.php"><i class="fa fa-circle-o"></i>Overview
Report</a></li>
            <li><a href="vehicle_data.php"><i class="fa fa-circle-o"></i>Vehicle
Data</a></li>
            <li><a href="emission_est.php"><i class="fa fa-circle-o"></i>Emission
Data</a></li>
            <li><a href="map.php"><i class="fa fa-circle-o"></i> AQI MAP</a></li>
        </ul>
    </li>
    <li class="treeview">
        <a href="#">
            <i class="fa fa-bar-chart"></i>
            <span>Statistics</span>
            <i class="fa fa-angle-left pull-right"></i>
        </a>
        <ul class="treeview-menu">
            <li><a href="predictive.php"><i class="fa fa-circle-o"></i>Predictive
Analysis</a></li>
        </ul>
    </li>
</ul>
</section>
</aside>
<div class="content-wrapper">
    <section class="content-header">
        <h1>
            Dashboard
            <small>Overview</small>
        </h1>
        <ol class="breadcrumb">
            <li><a href="#"><i class="fa fa-dashboard"></i> Home</a></li>
            <li class="active">Dashboard</li>
        </ol>
        <section class="content">
            <script type="text/javascript"
src="https://www.gstatic.com/charts/loader.js"></script>
            <table class="columns">
                <tr>
                    <td><div id="piechart_div" style="border: 1px solid #ccc"></div></td>
                    <td><div id="barchart_div" style="border: 1px solid #ccc"></div></td>
                </tr>
            </table>
        </section>
    </div>

```

```

</table>
<div class="col-md-3 col-sm-6 col-xs-12">
<script>
    <?php    $connection = mysql_connect('localhost','root','');
            mysql_select_db('db-air');
?>

    google.charts.load('current', {'packages':['corechart']});
    google.charts.setOnLoadCallback(drawChart);
    function drawChart() {

        var data = new google.visualization.DataTable();
        data.addColumn('string', 'Component');
        data.addColumn('number', 'Emission');
        data.addRows([
            ['Carbon Count',    <?php    $query = mysql_query("SELECT Carbon FROM
emit_comp");
            while ($rows = mysql_fetch_array($query)) {
                                $carbon =
$rows["Carbon"];
                                }
                                echo $carbon; ?>],
            ['Nitrogen Component', <?php    $query = mysql_query("SELECT Nitrogen FROM
emit_comp");
            while ($rows = mysql_fetch_array($query)) {
                                $nitrogen =
$rows["Nitrogen"];
                                }
                                echo $nitrogen; ?>],
            ['Oxides of Nitrogen', <?php    $query = mysql_query("SELECT SulfurOxide FROM
emit_comp");
            while ($rows = mysql_fetch_array($query)) {
                                $SulfurOxide =
$rows["SulfurOxide"];
                                }
                                echo $SulfurOxide; ?>],]);

        var piechart_options = {title:'Overall Emission',
                                width:695,
                                height:300};
        var piechart = new
google.visualization.PieChart(document.getElementById('piechart_div'));
        piechart.draw(data, piechart_options);

        var barchart_options = {title:'Overall Emission',
                                width:695,
                                height:300,
                                legend: 'Emission'};
        var barchart = new
google.visualization.BarChart(document.getElementById('barchart_div'));
        barchart.draw(data, barchart_options);
    }
</script>
<body>
    <table class="columns">
        <tr>
            <td><div id="piechart_div" style="border: 1px solid #ccc"></div></td>
            <td><div id="barchart_div" style="border: 1px solid #ccc"></div></td>
        </tr>
    </table>
</body>
</html>

```

```

    </div>
    <div class="col-md-3 col-sm-6 col-xs-12">
    </div>
</section>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-aqua">
        <span class="info-box-icon"><i class="fa fa-taxi"></i></span>
        <div class="info-box-content">
            <span class="info-box-text">Vehicle Count</span>
            <span class="info-box-number"><?php $query = "SELECT * FROM
lto_data WHERE Year='2011'&& Agency='Cagayan D'";
$query_run = mysql_query($query);
$qty= 0;
while ($num = mysql_fetch_assoc ($query_run)) {
                                $qty =
$num['Total'];
                                }
                                echo
$qty; ?></span>
            <div class="progress">
                <div class="progress-bar" style="width: 70%"></div>
            </div>
            <span class="progress-description">
                as of Dec 31 2011
            </span>
        </div>
    </div>
</div>
<div class="col-md-3 col-sm-6 col-xs-12">
    <div class="info-box bg-red">
        <span class="info-box-icon"><i class="fa fa-flag-o"></i></span>
        <div class="info-box-content">
            <span class="info-box-text">Carbon Count</span>
            <span class="info-box-number"><?php $query = mysql_query("SELECT
Carbon FROM emit_comp");

            while ($rows = mysql_fetch_array($query)) {
                                $carbon = $rows["Carbon"];
                                }
                                echo $carbon; ?>

            </span>
            <div class="progress">
                <div class="progress-bar" style="width: <?php $totalCarbon =
$carbon + $nitrogen + $SulfurOxide;
$percentage = ( $carbon / $totalCarbon ) * 100;
echo $percentage."%";
?>"></div>
            </div>
            <span class="progress-description">
                <?php echo $percentage;?> % in total
            </span>
        </div>
    </div>
</div>
</div>

```

```

        <div class="col-md-3 col-sm-6 col-xs-12">
            <div class="info-box bg-yellow">
                <span class="info-box-icon"><i class="fa fa-
asterisk"></i></span>
                <div class="info-box-content">
                    <span class="info-box-text">Nitrogen Count</span>
                    <span class="info-box-number"><?php $query =
mysql_query("SELECT Nitrogen FROM emit_comp");
                    while ($rows = mysql_fetch_array($query)) {
                        $nitrogen =
$rows["Nitrogen"];
                    }
                    echo
$nitrogen; ?>
                </span>
                <div class="progress">
                    <div class="progress-bar" style="width: <?php $totalCarbon
= $carbon + $nitrogen + $SulfurOxide;
                    $percentage = ( $nitrogen / $totalCarbon ) * 100;
                    echo $percentage."%";?>"></div>
                </div>
                <span class="progress-description">
                    <?php echo $percentage;?> % in total
                </span>
            </div>
        </div>
    </div>
    <div class="col-md-3 col-sm-6 col-xs-12">
        <div class="info-box bg-orange">
            <span class="info-box-icon"><i class="fa fa-
industry"></i></span>
            <div class="info-box-content">
                <span class="info-box-text">Sulfur Oxide</span>
                <span class="info-box-number"><?php $query =
mysql_query("SELECT SulfurOxide FROM emit_comp");

                while ($rows = mysql_fetch_array($query)) {
                    $SulfurOxide = $rows["SulfurOxide"];
                }
                echo $SulfurOxide; ?></span>
                <div class="progress">
                    <div class="progress-bar" style="width: <?php $totalCarbon
= $carbon + $nitrogen + $SulfurOxide;
                    $percentage = ( $SulfurOxide / $totalCarbon ) * 100;
                    echo $percentage."%";?>"></div>
                </div>
                <span class="progress-description">
                    <?php echo $percentage;?> % in total
                </span>
            </div>
        </div>
    </div>
<?php
    $connection = mysql_connect('localhost','root','');
    mysql_select_db('db-air');
    $num_rec_per_page=100;

```

```

        if (isset($_GET["page"])) {
            $page = $_GET["page"];
        } else {
            $page=1;
        };
        $start_from = ($page-1) * $num_rec_per_page;
        $sql = "SELECT * FROM Vehicle_data LIMIT $start_from,
$num_rec_per_page";
        $rs_result = mysql_query ($sql);
        $query = "SELECT Vehicle_Type, CO, NOx, SOx FROM Vehicle_data LIMIT
$start_from, $num_rec_per_page";
        $result = mysql_query($query);
        $query1 = "SELECT Vehicle_Type, CO, NOx, SOx FROM Vehicle_data";
        $result1 = mysql_query($query1);
        $count1 = mysql_num_rows($result1);
        echo"
            <div class=\"content\">
                <div class=\"container-fluid\">
                    <div class=\"row\">
                        <div class=\"col-md-12\">
                            <div class=\"card\">
                                <div class=\"header\">
                                    <h2 class=\"title text-
left\"><b>Vehicle Emission</b><i>(tons/year) in 2011</i></h2>";
                                    echo "<h5 class=\"text-left\">Total
Records: $count1</h5>";
                                </div>
                                <div class=\"content table-responsive table-full-width\">
                                    <table class=\"table table-hover
table-striped\">
                                        <thead>
                                            <th>Vehicle Type</th>
                                            <th>Carbon Monoxide </th>
                                            <th>Nitrogen Component</th>
                                            <th>Oxides</th>
                                        </thead>
                                        <tbody>";
                                        while ($row = mysql_fetch_row($result)) {
                                            $bp_id = $row[0];?>
                                            <tr>
                                                <td><?php echo
$?row[0]; ?></td>
                                                <td><?php echo
$?row[1]; ?></td>
                                                <td><?php echo
$?row[2]; ?></td>
                                                <td><?php echo
$?row[3]; ?></td>
                                            </tr>
                                        <?php ?>
                                        </tbody>
                                    </table>
                                    <?php
$?sql = "SELECT * FROM
Vehicle_data";
                                    $rs_result =
mysql_query($sql);
                                    $total_records =
mysql_num_rows($rs_result);
                                    $total_pages = ceil($total_records /
$num_rec_per_page);
                                </div>
                            </div>
                        </div>
                    </div>
                </div>
            </div>

```

Figure E7 Guest Access (overview.php)

Figure E7 Guest Access (Overview.php)

Appendix G

USER MANUAL

1.0 GENERAL INFORMATION

1.1 System Overview

Air CDO is a Web based Application that provides graphs showing the contribution of Vehicle emission to the overall Emission Inventory through the Web Application and allows users to adjust the levels of Vehicle count for the user to see the effects of Vehicles to the overall Emission Inventory.

1.1.1 Major function of the System

Air CDO uses the CRUD system, to Create Data, read data, Update and Delete files from the system. it also has the import and Export functionalities that let the user import CSV files directly to the database and to export data from database to CSV file format, it has also Google chart functionalities that allows data converted into graphs.

1.1.3 Graphical User Interface

Air CDO has a user-friendly GUI. The Graphical user interface of the system provides the easy access navigation tab for the user to have easy access to the system.

1.1.4 System Name

The name of the system is entitled “Air CDO” CDO is the abbreviation of the city “Cagayan de Oro” thus, Air CDO was the name to the web based application.

1.1.5 System Code

For the system code please see the developer of the Application.

1.1.6 Operational Status

Currently, the application is operational. It can also operate functionalities that is intended to do. It can also be developed for more future works.

1.1.7 General Description

Air CDO is a web based application that helps the analyst for visualize the effect of Vehicle emission to the overall air quality of Cagayan de Oro City.

2.0 GETTING STARTED

The server must install XAMPP for the user to view the page. Once the XAMPP was installed server. Open XAMPP ControlPanel and click “**Start**” for both Apache and MySQL.

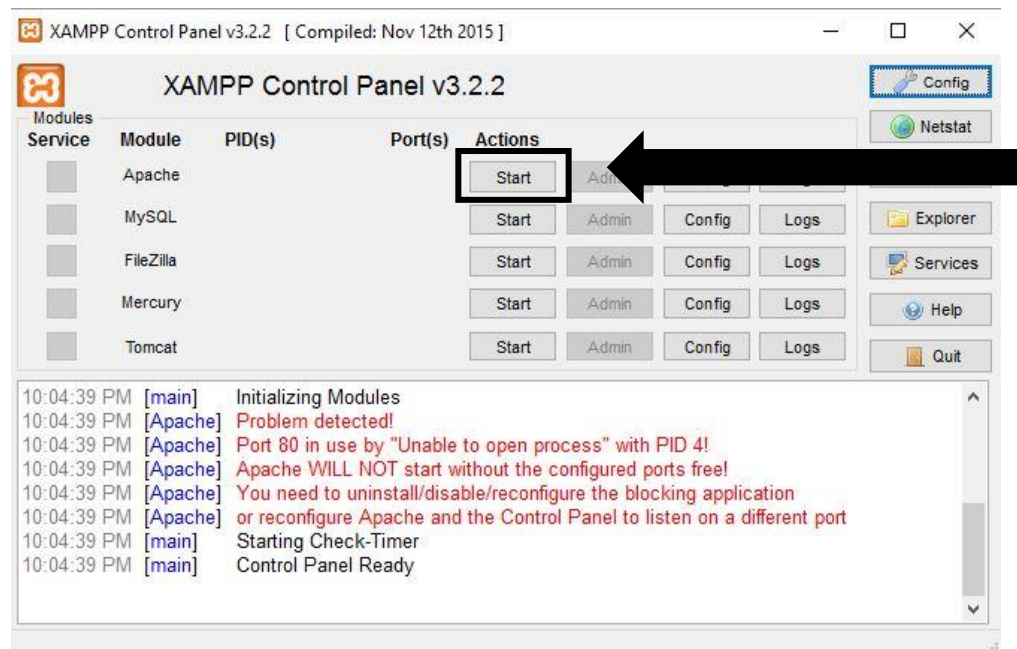


Figure 1. Xampp Control Panel

Install the Application and place the folder name “**AirCDO**” to htdocs located at **C:/XAMPP/htdocs**

for importing database please see the developers for more concrete details, some format of the SQL Format may have confidential details.



Figure 2. Dashboard

To use the system you'll need to type the assigned domain of the system to the Address bar. *(For more concrete details, please see the networking administrator.)*

For clients: you can access the data using the guest account. Guest account can access the following:

1. Overview report
2. Vehicle Emission Data (Tons/Year)
3. Registered Vehicle Count
4. Predictive Analysis measures
5. Global AQI Map
6. Export Data Features

For Analyst: You can access the application using your Analyst Mode Account.

You need to have authentication details for you to proceed.

Login Button is located at the left most part of the system. Click on GUEST button.



Figure 3. Log in page

Once you have done with this security process the page will redirect the system to the home page .



Figure 4. Log in Page

LOGIN PAGE for ANALYSTS

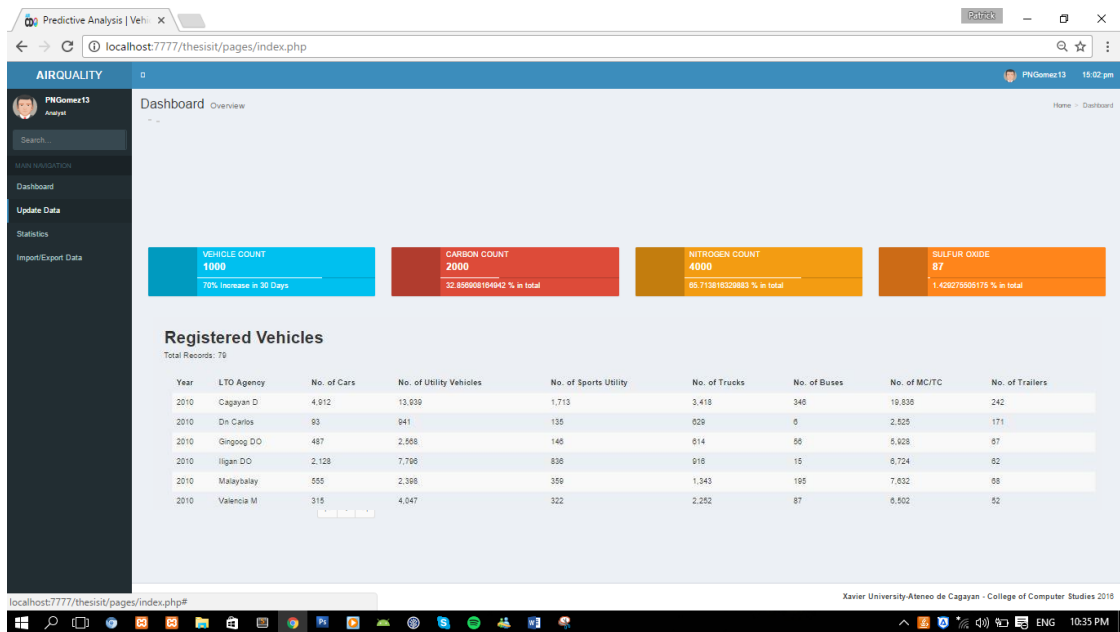


Figure 5. User Dashboard

2.1 System Navigation Tab

The nine tabs on the figure above are the functions of the application.

These functions are:

- a. Dashboard
 - i. Overview Report
 - ii. Registered Vehicle Data
 - iii. Vehicle Emission Data (Tons/Year)
 - iv. Global AQI Maps
- b. Update Data
 - i. Edit Registered Vehicle Data
 - ii. Edit Vehicle Emission Data
- c. Statistics
 - i. Descriptive Analysis
 - ii. Predictive Analysis
- d. Import and Export Data

2.2 Application Exit

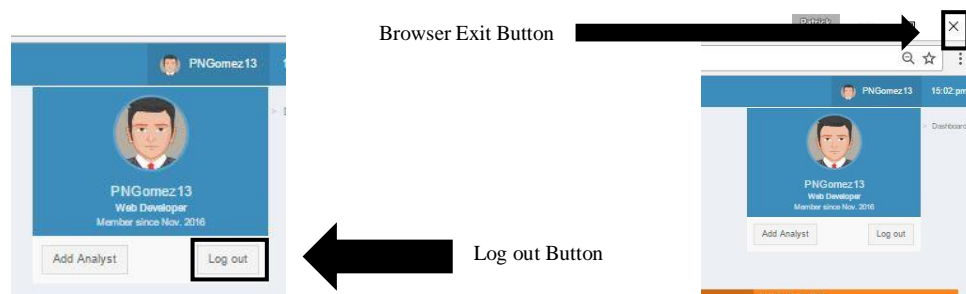


Figure 6. Log out Page

To properly exit the system, just click on the ‘X’ mark on the top corner right of the application.

The AIR CDO Application Navigation Bar:

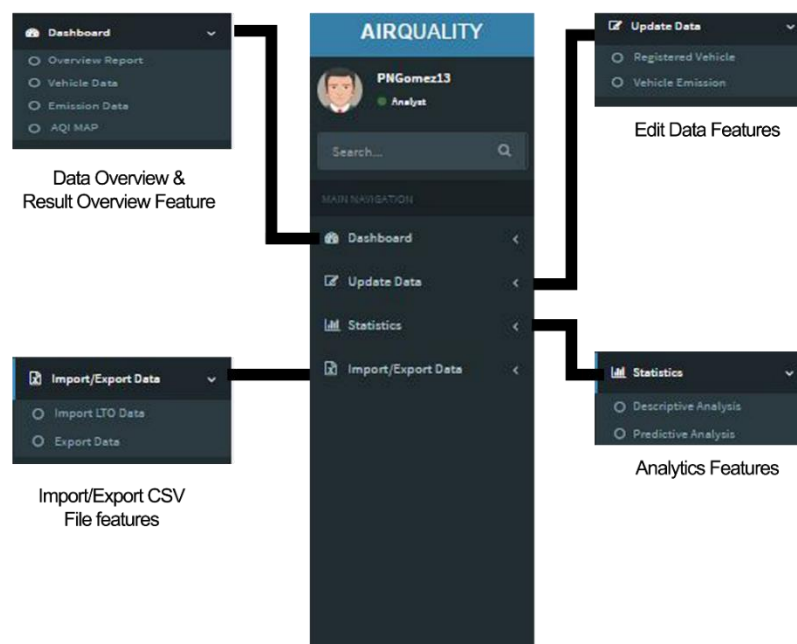


Figure7. Navigation Bar

The Air CDO Action Icons:

1. Edit – when you click this icon , this icon redirects you to the edit page wherein you can update the applicants information .
2. Delete – When you click this icon, this icon simply delete the selected data.

CURRICULUM VITAE

HAZEL JAY MARI A. AGNES

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EDUCATIONAL ATTAINMENT

Bachelor of Science in Computer Science
Xavier University-Ateneo de Cagayan
Corrales Ave., Cagayan de Oro City
SY. 2016-2017

SKILLS

- Knowledge in Microsoft Office (word, excel, powerpoint, access, etc)
- Knowledge in Search Engine Optimization.
- Programming skills in PHP, HTML and CSS.
- Knowledge in Web Programming
- Knowledge in Database Management System
- Knowledge in Game Development in Unity
- Knowledge in Analytics in RStudio and Shiny
- Experienced in Computer Troubleshooting
- Experienced in Virtual Assistant
- Knowledge in Photo Editing
- Good oral and written communication in English
- Flexible as a team or an individual player
- Good in Leadership
- Good strategic skill

WORK EXPERIENCE

POSITION	COMPANY NAME	COMPANY ADDRESS	INCLUSIVE DATES
SEO (Search Engine Optimizer)	URLlab	Malasag Cagayan de Oro City	2009 - 2010
SEO Team Leader	URLlab	Malasag Cagayan de Oro City	2010 - 2014
Freelancer	Odesk/Upwork	Online	2010 – 2015

RELATED EXPERIENCE

POSITION	COMPANY NAME	COMPANY ADDRESS	INCLUSIVE DATES
On-the-Job Trainee	CNC Construction And Development Corporation	19 Quezon Avenue Corner D. Tuazon Street Brgy. Lourdes Quezon City	April 11-May 20,2016

SEMINARS ATTENDED

TITLE OF SEMINAR	ORGANIZING BODY	INCLUSIVE DATES
Basic Orientation and Leadership Training Seminar	Xavier Computer Enthusiasts' League	June 2015
Java Seminar 1	Xavier Computer Enthusiasts' League	August 2015
Basic Orientation and Leadership Training Seminar with Community Building	Computer Studies Students Council	June 2016
Google IO	GDG Cagayan de Oro	July 2016
First Aid Basics Seminar	SACDEV	July 2016
Java Seminar Part 1	Xavier Computer Enthusiasts' League	August 2016
Game Art Seminar	Xavier Computer Enthusiasts' League	August 2016
Java Seminar Part 2	Xavier Computer Enthusiasts' League	September 2016
AppTown Mobile Application Exhibit	Xavier Computer Enthusiasts' League	September 2016

ORGANIZATIONS POSITION	NAME OF ORGANIZATION	INCLUSIVE DATES
Volunteer	Xavier Computer Enthusiasts' League	June 2014- March 2015
Electoral Committee Head	Xavier Computer Enthusiasts' League	June 2015- March 2016
Electoral Committee Head	Xavier Computer Enthusiasts' League	June 2016- November 2017

Reference available upon request

CURRICULUM VITAE

PATRICK N. GOMEZ

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09067178645



EDUCATIONAL ATTAINMENT

Bachelor of Science in Computer Science

Xavier University-Ateneo de Cagayan
Corrales Avenue, Cagayan de Oro City
SY. 2016-2017

SKILLS

- A Team Leader and Individual player.
- Fluent in English both in written and oral.
- Knowledgeable in Microsoft Offices.
- Knowledgeable in Adobe Photoshop and Corel Draw Applications.
- General Ability to write software in Java and C Programming.
- Knowledgeable in Laravel, CakePHP and WordPress Framework
- Able to write in HTML/HTML5, PHP, CSS and JavaScript.
- Knowledgeable in Data Analysis using RStudio and Shiny Framework.
- Programming skills in Android Mobile Applications.
- Knowledgeable in Game Development using Unity.
- Knowledgeable in Database Management and Web Programming
- Able to work under pressure.

RELATED EXPERIENCE

POSITION	COMPANY NAME	COMPANY ADDRESS	INCLUSIVE DATES
On-the-Job Trainee	Office of the Building Official: CDO	Burgos-Hayes : Cagayan de Oro City	April 11- May 20, 2016

AWARDS

NAME/TYPE OF AWARD	AWARD GIVING BODY	DATE AWARDED
Dean's Lister	College of Computer Studies – Xavier University	1 st Semester SY 2016-2017
2 nd Placer	Apptown – Mobile Application Exhibit & Seminar	September 2016

ORGANIZATIONS

POSITION	NAME OF ORGANIZATION	INCLUSIVE DATES
Member	Xavier Computer Enthusiasts' League	2014 - 2015
Staff- Dept of Communications	Computer Studies Student Council	2014 - 2016
Member- Formation Committee	XCEL	Jun 2015- Nov 2015
Head- Formation Committee	XCEL	Nov 2015- Mar 2016
Project Head- Game Dev StartUp	XCEL	Sept 2016
Student Service Committee Moderator	XCEL	2016 - 2017
Executive Treasurer Chairman	XCEL QISC	2016 - 2017 2016 - 2017

SEMINARS ATTENDED

Seminars	Organizer	Date
Campus DevCon	DevCon Philippines	June 2013
Basic Orientation Leadership Training Seminar (BOLTS)	CSSC	June 2013
BOLTS IT Seminar : Java	XCEL XCEL	June 2015
BOLTS and Community Building	CSSC	June 2016
Change Leadership: Asset-Based Seminar	XU-SACDEV	June 2016
Change Leadership: Branding Seminar	XU-SACDEV	July 2016
Google I/O Extended	GDG CDO	Aug 2016
Apptown-Mobile Application Seminar	XCEL	Sept 2016

Reference available upon request

CURRICULUM VITAE

APPLE JANE MANAYAGA

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EDUCATIONAL ATTAINMENT

Bachelor of Science in Computer Science

Xavier University-Ateneo de Cagayar
Corrales Ave., Cagayan de Oro City
SY. 2016-2017

SKILLS

- Knowledgeable in Programming languages: JAVA, C, C++, Python, Prolog, PHP
- Web Development skills: HTML5, CSS, jQuery, Javascript
- Knowledgeable in CakePHP web framework, and Bootstrapping for front-end framework
- Knowledgeable in MySQL Database
- Knowledgeable in GITHUB repository
- Knowledgeable in Unity; multi-platform game development
- Content Management Skills (CMS): Data Analysis, Google Analytics, Project Management
- Knowledgeable in Microsoft Offices: MS Excel, MS Word, MS PowerPoint
- Team Leader and can work under pressure.
- Fluent in English both in written and oral.

RELATED EXPERIENCE

POSITION	COMPANY NAME	COMPANY ADDRESS	INCLUSIVE DATES
On-the-Job Trainee	Office of the Building Officials CDO	Burgos-Hayes St. Cagayan de Oro City	April 11-May 20, 2016

ORGANIZATIONS

POSITION	NAME OF ORGANIZATION	INCLUSIVE DATES
Member	Xavier Computer Enthusiasts' League	June 2014-March 2015
Treasurer	Xavier Computer Enthusiasts' League	May 2015-May 2016
JAVA Seminar Project Head	Xavier Computer Enthusiasts' League	
Quiz Bowl Committee Head	Quantum Interschool Competition	January 2017
Board of Director	Computer Studies Student Council	May 2016- May 2017
President	Xavier Computer Enthusiasts' League	May 2016- May 2017

SEMINARS ATTENDED

Title of Seminar	Organizing Body	INCLUSIVE DATES
Basic Orientation and Leadership Training Seminar (BOLTS)	Xavier Computer Enthusiasts' League	June 2015
XU Change Leadership Summer Camp 2016	SACDEV- Student Activities and Leadership Development	May 2016
Basic Orientation and Leadership Training Seminar Community Building (BOLTSCB)	CSSC- Computer Studies Student Council	June 2016
Google I/O	Google Developer's Group CDO	July 2016
JAVA Seminar	Xavier Computer Enthusiasts' League	August 2015
JAVA Seminar part 1	Xavier Computer Enthusiasts' League	August 2016
JAVA Seminar part 2	Xavier Computer Enthusiasts' League	September 2016
Game Art Seminar	Xavier Computer Enthusiasts' League	August 2016
AppTown Mobile Exhibit 2016	Xavier Computer Enthusiasts' League	September 2016

Reference available upon request