UTILIZATION OF BIG DATA ANALYTICS FOR INTELLIGENT TRAFFIC SOLUTION USING SMART CITY SET-UP

A Project Proposal Presented to the Faculty of

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In Partial Fulfilment of the Subject Requirements for the Degree of

Bachelor of Science in Electronics Engineering

Balano, John Michael Z.

Bernardo, Keren Agape D.

De Guzman, John Dereck A.

Juaniza, Aaron Erville B.

Pablo, Renniel L.

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APPROVAL SHEET

This project study entitled "**UTILIZATION OF BIG DATA ANALYTICS FOR INTELLIGENT TRAFFIC SOLUTION USING SMART CITY SET-UP"**, has been prepared and submitted by the following proponents:

BALANO, JOHN MICHAEL Z.

BERNARDO, KEREN AGAPE D.

DE GUZMAN, JOHN DERECK A.

JUANIZA, AARON ERVILLE B.

PABLO, RENNIEL L.

In partial fulfillment of the requirements for the degree of **Bachelor of Science in Electronics Engineering** is hereby recommended for approval.

ENGR. TIMOTHY M. AMADO
Project Adviser

ENGR. ROMEO L. JORDA, Jr.
Panel Member

ENGR. GILFRED ALLEN M. MADRIGAL
Panel Member

08/13/20

ENGR. CHERRY G. PASCION
Panel Member

DR. IRA C. VALENZUELA
Panel Member

Accepted and approved in partial fulfillment of the course requirements for the degree of **Bachelor of Science in Electronics Engineering.**

ENGR. EDMON O. FERNANDEZ
Head, ECE Department

ENGR. BENEDICTO N. FORTALEZA
Dean, College of Engineering

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ABSTRACT

Intelligent traffic management system is the development trend today for the future smart city. Intelligent traffic system offers an effective way to facilitate traffic and improve traffic effectiveness. This study aims to develop a future low-cost Intelligent Traffic Management system to deliver better service by deploying real-time traffic updates in a small-scale city setup. This uses big data analysis technology to create a large data analysis system of smart transportations.

The process starts with the acquired vehicle detection from several sensors fixed in the roadside. Internet of things (IoT) is use to collect public traffic data quickly from the sensors and send information to the system for data processing and predictions. The system can analyze the traffic density, analysis and provide traffic information service to the public through predictive analytics.

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CHAPTER 1

This chapter presents the introduction, background of the study, statement of the problem, objectives, significance of study, and the scope and limitation of the study.

1.1 Introduction

Driving has become one of everyday stress's critical variables. While riding should be an easy experience as personal transportation, it turns out that, owing to elevated traffic congestion, everyday riders face not only adverse emotions, but also disappointment and annoyance.

Heavy traffic is a major concern in cities. Traffic generally occurs in urban areas because of high population and this population leads to increased traffic congestion dues to a large number of vehicle in urban/metro cities used by daily people. Therefore, improving the capacity of road services and achieving scientific management of road conditions is very urgent. Cities need to use technology and more advanced analytical tools to develop a more People-oriented approach to services where people need to be at the center of change.

1.2 Background of the Study

Traffic management system is regarded as one of a smart city's major dimensions. Traffic congestion is often seen on roads with rapid population growth and urban mobility in metropolitan cities. A smart traffic management

system using the Internet of Things (IoT) is proposed in this paper to address various issues related to road traffic management and to assist authorities in proper planning. (., 2016)

Smart City is a combination of computational Big Data, complex and comprehensive. Smart city goals are highly dependent on heterogeneous collection of data. Data collection, however, is challenged by rapid data generation growth. Large numbers of low-cost sensors deployed in urban areas increase the ability to acquire data, leading to a more intelligent city. Sensors collect real-time data from the deployed environment and different types of data from the installed environment. (Silva et al., 2019)

In both academia and industry, Big Data has become a hot topic. It represents large and complex data sets from all sources. Big Data techniques include many of the most popular techniques for data processing, including data mining, machine learning, artificial intelligence, data fusion, social networking, etc. Many people use Big Data analytics in different fields and have been successful.(Wang, Ning, Tang, Zhu, & Yu, 2018)

Big data isn't solely big volumes of data, however, information and data that may not be processed or analyzed by traditional tools and processes.(Ismail, 2016) Big data analytics platforms allow users to gather, organize and analyze large data sets for patterns and other useful information to be discovered. Big data platforms focus on large data processing and do not support user collaboration so that users can develop services that include data

collection, data pre-processing, data analysis, and development of algorithms. (Park, Nguyen, & Won, 2015)

1.3 Statement of the Problem

Each electronic device generates data in today's world, whether it's cell phones, built-in sensors, or fitness wrist bands. This increasing amount of data gave rise to the concept of Big Data. The advent of Big Data, IoT and Smart Environments has enabled us to gain in real time useful insights into the data.

Real-time or near-real-time analytics are data analyzes as soon as they arrive or are generated. There are many applications where analyzing the data in real time is not very critical in order to be able to do batch processing. But there are different applications where this data analysis is very critical in real time or near real time, as in the case of disaster management. In other words, the term "real-time" means that data will be used as soon as it arrives, rather than first being stored and then processed in the future.

Many related studies on the traffic system have been done with the emerging technology from different countries. However, in the Philippines it is a novel project that requires the researcher to develop a complex algorithm using different programming language that is not yet used in other countries.

1.4 Objectives

The overall objective of the study is to use big data analytics with smart city set-up for intelligent traffic solution.

The study aims to meet the following specific objectives for the development of the proposal:

1.) To establish a big data product capable of recognizing, classifying and categorizing traffic activities for urban development purposes.

2.) To design a big data product capable of detecting environmental conditions that can provide route passability information to the commuters.

3.) To formulate a predictive model that can analyze data from multiple sources and provide qualitative traffic information.

4.) To deploy the predictive models in a small-scale set-up.

1.5 Significance of Study

Even though our research is being done in other countries, there is no such study for this research in the Philippines yet to improve the urban traffic solution. This topic will be deployed to resolve the traffic jam in the Philippines in the urban and rural areas.

This study was to establish a data-based approach that could send a particular type of information to a web that could assist drivers in their daily lives. In case of a traffic jam, this project is designed to inform all drivers, it gives real-time image of the road and in the event of flooding, this project warns

all drivers that flooding is taking place and provides information about what kind of vehicles can go through the flood and vehicles that cannot go.

1.6 Scope and Limitations

The main focus of this study will be situated in Ayala Blvd., Ermita, Manila, Philippines, providing real-time qualitative traffic information, detecting environmental conditions that can provide traffic information on passable routes, identifying, classifying, and categorizing traffic activities for urban development. This study will run only throughout this school year 2019 – 2020, it had started this May 2019 and will anticipated to finish on May 2020.

This study identifies three limitations:

1.) The first limitation is the unusual activities of people around the area. The system cannot identify the individual's unusual activities that will result to heavy traffic build up on the streets that is being monitored.

2.) The second limitation on the road is stray animals. Animals that may cause disturbances to the vehicles.

3.) The third limitation is determining the traffic violation done by the drivers.

1.7 Definition of Terms

Algorithm - is a procedure or formula for solving a problem, based on conducting a sequence of specified actions.

synonyms: method, result, design, conclusion, innovation

Big Data Analytics - is the process of extracting useful information by analyzing different types of big data sets. Used to discover hidden patterns, market trends and consumer preferences, for the benefit of organizational decision making.

synonyms: data modeling, data mining, process of transforming data

Big Data - extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.

synonyms: macro data, massive data, lots of data, large amount of data

Database – a comprehensive collection of related data organize for convenient access.

synonyms: directory, table, index

Data Acquisition - is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer.

synonyms: data gaining, data purchase

Internet of Things (IoT) - is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

synonyms: emerging technology

Predictive model - is a process that uses data mining and probability to forecast outcomes.

Synonyms: forecasting model, estimation model

Sensor - a device which detects or measures a physical property and records, indicates, or otherwise responds to it.

synonyms: detector, detecting device, scanner, finder

Smart Environment - a small world where different kinds of smart device are continuously working to make inhabitants' lives more comfortable.

Qualitative - relating to, measuring, or measured by the quality of something rather than its quantity.

synonyms: in quality, build quality, high-quality, in terms of quality

Traffic congestion - is a condition on transport that as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing.

synonyms: heavy traffic, gridlock, crowding, bottleneck

Traffic Jam - a line of road traffic at or near a standstill because of road construction, an accident, or heavy congestion.

synonyms: stopple, cover, rush hour, logjam

Rural Areas - relating to, or characteristic of the countryside rather than the town.

synonyms: countryside, villages, country, land

Urban Areas - relating to, or characteristic of a town or city.

synonyms: cities, towns, metropolitan areas, urban centers

CHAPTER 2

This chapter presents the review of related literature and other important details relevant to the studies. The information of this chapter serves as basis in the project's conceptual model. This includes the conceptual model of the study and the operational definition of terms.

2.1 Conceptual Literature

2.1.1 Big Data

Big data is a general term refers to a data set, which is either very large or very complex that traditional data processing applications are inefficient. For handling and processing, these data require much higher powerful tools. Everything around us generates big data at all times via telecommunications and the Internet. It is produced by every digital device or social media, most of which are system sensors, mobile devices and social networking sites.

Data analytics is the science of raw data analysis in order to draw conclusions about the information. Many companies practice it to make better business decisions.

The definition of Big Data is evolving or changes as times go by. Advancement of technology maybe triggers the changes of Big Data spectrum. Right now, Big Data definition generally related to the Internet of Things and Machine to Machine communication. The vast collection of structured and

unstructured data in a short time is the result of technology advancement within communication devices, which allowed fast interconnection via the Internet of computing devices, embedded in every tool that enabled sending and receiving data. Various definitions of Big Data can be depicted from an online survey, carried out by Harris Interactive.

Figure 2.1 Big Data & Big Data Analytics (https://www.entrepreneuryork.com/technology/big-data/big-data-analyticsinsight-how-to-make-data-a-real-growth-driver/)

2.1.2 R Tool

R tool frame work is used for analyzing big data in cloud computing. The aim is to identify the challenges for analyzing big data. R is a statistical programming language which is behind statistics, analytics and visualization. Today's data scientist and business leader uses R to make power business decisions. The R Framework is open source and flexible. R includes different packages which are useful in analysis of data. R Framework contains Deploy R server, Deploy R repository and Deploy R API's which are used to upload

and verily data. In R we can write our scripts and we can also upload different format files. We can also link R Framework with other languages such as java, .NET. R is a flexible framework and it is capable for analyzing various types of data which is available on cloud.

Figure 2.2 R Project for Statistical Computing (https://www.rproject.org/logo/Rlogo.png)

2.1.3 Internet of Things (IoT)

The Internet of Things is a combination of interrelated registration gadgets, computer and mechanical machines, objects, creatures, or people with individual identification data and the ability, without expecting human-to-human or human to-PC cooperation in the exchange of information through a system. An IoT biological system includes web-enabled brilliant gadgets to collect, send and track information from their environment using implanted processors, sensors and correspondence equipment. The Internet of Things (IoT) arranges for a variety of applications, including brilliant city, shrewd agribusiness, smart home, smart transportation, and various businesses.

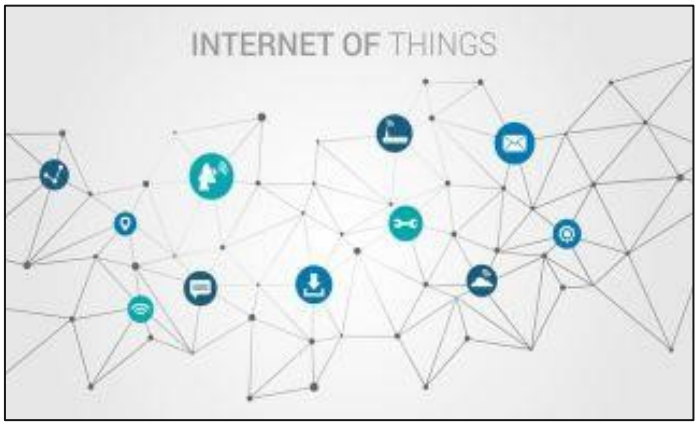

Figure 2.3 Internet of Things (https://www.itproportal.com/features/nextbig-things-in-iot-predictions-for-2020/)

2.1.3.1 ThingSpeak

ThingSpeak is a platform IoT analytics service that enables to aggregate, view and analyze live cloud data streams. Using web services like Twitter and Twilio, it can send data from devices to ThingSpeak, create instant visualizations of live data and send alerts. With ThingSpeak's MATLAB analytics, it can write and execute MATLAB code to perform preprocessing, visualization, and analysis. ThingSpeak allows engineers and scientists, without setting up servers or developing web software, to prototype and build IoT systems.

Figure 2.4 ThingSpeak (https://learn.sparkfun.com/tutorials/internet-of-things-experimentguide/configure-thingspeak)

2.1.4 Python

Python is a high-level language that is used by scientists for numeric computations. It is an efficient scripting language including the main concepts of object programming and providing compact, readable and portable code. It is easy to use and available in open source environment. Furthermore, a large set of libraries developed by a dynamic programming community is available in Python.

Figure 2.5 Python (https://www.python.org)

2.1.5 Raspberry Pi

The Raspberry Pi is a low-cost, credit-card-sized computer that connects to a computer monitor or TV, using a standard mouse and keyboard. It is a small capable device that allows people of all ages to explore computing and learn how to program in languages such as Scratch and Python. It's capable of doing all expect from a desktop computer, from browsing the internet and playing high-definition video, making spreadsheets, word processing, and playing games.

Raspberry Pi has the ability to interact with the outside world and has been used in a wide range of digital maker projects, ranging from music machines and parent detectors to weather stations and birdhouses tweeting with infrared cameras.

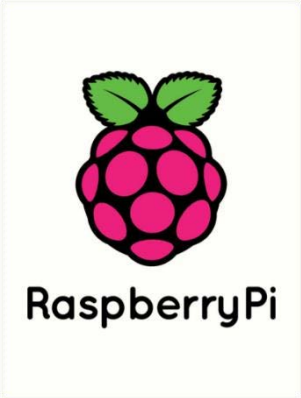

Figure 2.6 Raspberry Pi **(**https://www.raspberrypi.org/)

2.1.6 Shiny

Shiny is a R package that facilitates the creation of interactive web apps directly from R. It can host standalone apps on a webpage or embed them in documents from R Markdown or create dashboards. It can also add CSS themes, html widgets, and JavaScript actions to Shiny apps.

Figure 2.7 Shiny
(https://www.analyticsvidhya.com/blog/2016/10/creatinginteractive-data-visualization-using-shiny-app-in-r-with-examples/)

2.1.7 PyCharm

PyCharm provides smart code completion, code inspections, on-the-fly error highlighting and quick-fixes, along with automated code refactoring and rich navigation capabilities.

Figure 2.8 PyCharm (www.jetbrains.com/pycharm/features)

2.1.8 Cascade Trainer GUI

Cascade Trainer GUI is a software that can be used to practice, evaluate, and refine models for the classification of cascades. This uses a graphical interface to set the parameters and make it easy to use OpenCV tools for the classification training and testing.

Figure 2.9 Cascade Trainer GUI
(http://www.amin-ahmadi.com/cascade-trainer-gui/)

2.2 Related Literature

2.2.1 Traffic Information System using Text Analysis

This research aims to develop an information system for real-time road traffic using text analysis on the busiest road in Metro Manila, Philippines. The researchers used ten (10) fold cross-validation to evaluate four machine learning algorithms to find the best learning algorithm for real-time classification of traffic related tweets. As for the supervised traffic information dataset, the k-Nearest Neighbor algorithm generated the highest percentage of performance using the identified significant features generated from traffic-related tweets by implementing the Latent Dirichlet Allocation (LDA). The experimental results showed that with 84.00 percent of classification accuracy, 85.00 percent of classification accuracy, and 83.00 percent of classification recall, the k-NN algorithm produced the best performance among other algorithms. The researchers observed that using Latent Dirichlet Allocation (LDA) results in an easier way to produce significant parameters to have an effective set of data for model classification. The amount of data also affects the performance of the model's learning process, so the researchers will identify the other twitter accounts of the different city's traffic management center to produce a larger number of instances for the model's classification method. (Bondoc, Caparas, MacIas, Naculangga, &

Estrada, 2019)

2.2.2 Traffic Management using IOT

This research presents an effective solution for rapidly growing traffic flow, especially in big cities, which is increasing day by day, and traditional systems have some limitations as they fail to effectively manage current traffic. Taking into account the state-of - the-art approach to traffic management systems, a smart traffic management system is proposed to more efficiently and effectively control road traffic situations. It intelligently changes the signal timing according to the density of traffic on the particular roadside and regulates traffic flow by communicating more effectively than ever before with the local server. The decentralized approach makes it optimized and effective, even if a local server or centralized server has crashed, as the system works. In case of an emergency situation that provides timely human safety, the centralized server communicates the nearest rescue department. In addition, a user may ask about future level of traffic on a particular road, thus avoiding wasting time in traffic jams. The system also provides higher authorities with useful information that can be used in road planning to help optimize resource utilization. (., 2016)

2.2.3 Classification of Vehicles using Image Processing

The classification system for vehicles has been implemented and tested against various vehicle sizes and conditions. Different image processing techniques affect classification accuracy. Using detection of canny edge results better. For a total of 14 images (nine tests, five conditional), an accuracy of

87.5 percent was achieved. The characteristic extraction techniques based on vehicle dimensionality can be used to distinguish between heavy and small vehicles and can therefore be used for group categorization. The accuracy of the system changes with the number of vehicles: for 40 vehicles, for smaller vehicles, the accuracy drops to 85 percent. The accuracy remains unchanged for heavy vehicles. It takes less than 5 secs to classify the system speed and indicate fitness to the park. Adding additional features such as the perimeter or car shape can increase the system's accuracy. The current system is not rotation-invariant and it may also be possible to design a rotation invariant system. Testing the results for different weather and environmental conditions is also recommended. The image processing depends on the weather conditions. (Kumar et al., 2015)

2.2.4 Real-Time Traffic Congestion Detection System Using On-Line Images

A real-time traffic congestion detection system has been proposed using online images for narrow streets from different camera locations. The detection system for traffic congestion consists of detecting vehicles using online images and estimating the degree of traffic congestion based on the estimated number of vehicles. We studied the method of using the signs on the road for the detection of vehicles and experimented with the technique of using the Haar-like features, which was then selected for the proposed congestion detection system. The Haar-like features can be used for vehicle detection using different kinds of images from different locations based on the experimental results.

A threshold for the image correlation coefficient of consecutive images, along with a threshold for the number of vehicles detected, was used for the traffic congestion estimation. Two different congestion levels are considered, namely NORMAL and CONGESTED, although it is easy to extend the number of congestion levels. Compared to traditional traffic congestion estimation systems, this system provides a more economical solution for local residents of Macao and tourists with potential commercial applications. (Lam, Gao, & Ng, 2018)

2.2.5 Real-time link travel time based on traffic big data

In this paper, for real-time link travel time, a dynamic prediction algorithm is proposed based on large data analysis. This paper proposes a dynamic prediction algorithm based on traffic large data analysis based on real-time link travel time. Based on the results of traffic big data analysis, according to the principle component feature extraction of traffic big data in the traffic information platform, the real-time traffic condition monitoring and travel time prediction is carried out and the real-time travel time dynamic prediction is carried out on the traffic information platform. The simulation results show that the proposed method is more accurate, and by using the method to predict the dynamic travel time of the real-time section of the traffic information platform, the anti-congestion and traffic capacity of the traffic network is improved. (Yang & Zhu, 2019)

Table 1. Summary of Related Studies

Title	Author/Year	Methodology	Recommendation
An Intelligent Road Traffic Information System using Text Analysis in the Most Congested Roads in Metro Manila	Erika Ritzelle P. Bondoc, Francis Percival M. Caparas, John Eddie D. Macias, Vileser T. Naculangga, Jheanel E. Estrada (2018)	To identify each topic per tweet, the Latent Dirichlet Allocation (LDA) algorithm used the specific word bag. The characteristics extracted will be the final set of data to be observed using the four algorithms of machine learning.	Further research is needed to investigate the appropriate approach for better classification regardless of the amount of mined Twitter data.
Smart Traffic Management System Using Internet of Things	Sabeen Javaid, Ali Sufian, Saima Pervaiz, Mehak Tanveer (2016)	Using ultrasonic sensors, this system improves the accuracy. Sensors are an integral part of traffic density detection in many applications for traffic management systems. It measures distance by sending out a frequency sound wave and listening to bounce back for that sound wave.	Create an environment detection program for all users to be informed

Image Processing Based System for Classification of Vehicles for Parking Purposes	Amit Kumar, Mansour H. Assaf, Sunil R. Das, Satyendra N. Biswas, Emil M. Petriu, Voicu Groza (2015)	Vehicle image processing for vehicle recognition and parking system design can be implemented in several ways. Vehicle image processing of illegally parked vehicles and moving vehicle detection has many applications in traffic control and law enforcement.	Eliminate the effect of data collection from the images are environment conditions such as light and presence of impurities in the object used for the classification.
A Real-Time Traffic Congestion Detection System Using On-Line Images	Chan-Tong Lam, Hanyang Gao, Benjamin Ng (2017)	Haar-like features consist of rectangle sums and differences over an image patch. Highly efficient to calculate using integral image, haarlike features are sensitive to vertical, horizontal, and symmetrical structures, making them suitable for vehicle or vehicle parts detection in real time.	To increase the quality of camera and specifications used for more precise real-time detection of vehicles.

A Dynamic prediction model of real-time link travel time based on traffic big data	Yang Zhao-xia, Zhu Ming-hua (2019)	The linear programming algorithm is used to predict the travel time of the real-time traffic information platform section dynamically. The analytical model uses microscopic traffic simulators, such as METANET, to predict travel time. The dynamic OD matrix is generally used as input, and the predicted results are evolved by simulation	

CHAPTER 3

This chapter presents the methodology in developing the machine based on the data gathered, trials and experiments needed for the base parameter basis of the design of the machine. Conferring the data gathered analysis would be made to determine the expected output.

3.1 Theoretical Framework

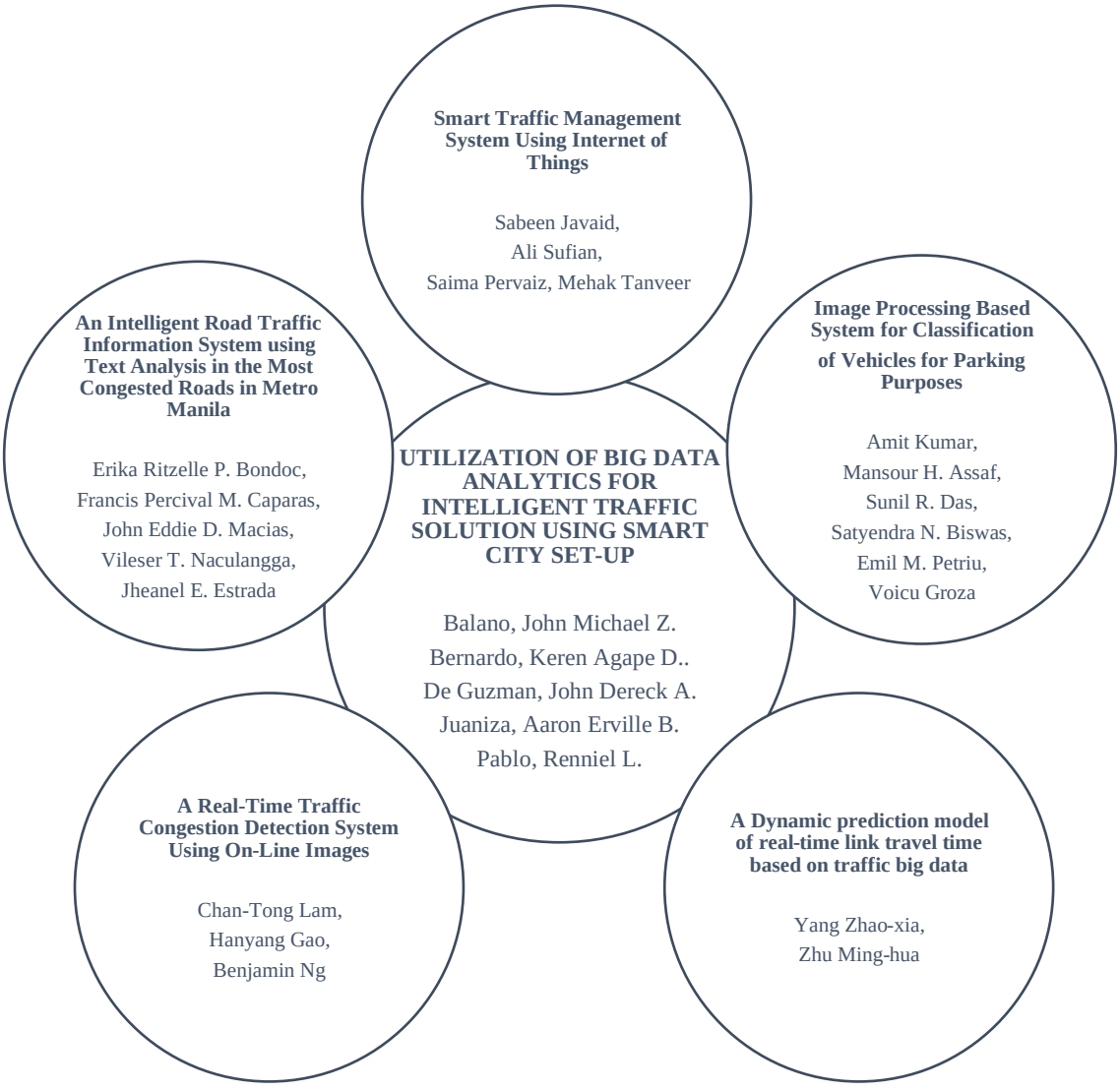

Figure 3.1 Theoretical Framework

The Figure 3.1 generalizes research findings, theories and principles which are closely connected with this study. The Latent Dirichlet Allocation (LDA) algorithm was used to identify each topic per tweet using the specific word bag. The extracted features will be used by the four machine learning algorithms as the final dataset to be observed.

The processing of images of cars designed for recognition of cars and parking systems can be carried out in various ways. The image processing and detection of moving vehicles in illegal parking have numerous applications in traffic control and law enforcement.

Sensor has various applications in many studies. Sensors are an integral part of traffic density in many applications of traffic management systems. It measures distance by sending a sound wave of a certain frequency and listens for that sound wave, to bounce backwards. this system uses ultrasonic to increase accuracy.

For road users it would be convenient to have a traffic congestion detection system in real time that provides low cost traffic status and data in real time.

3.2 Conceptual Framework

3.2.1 IPO Model

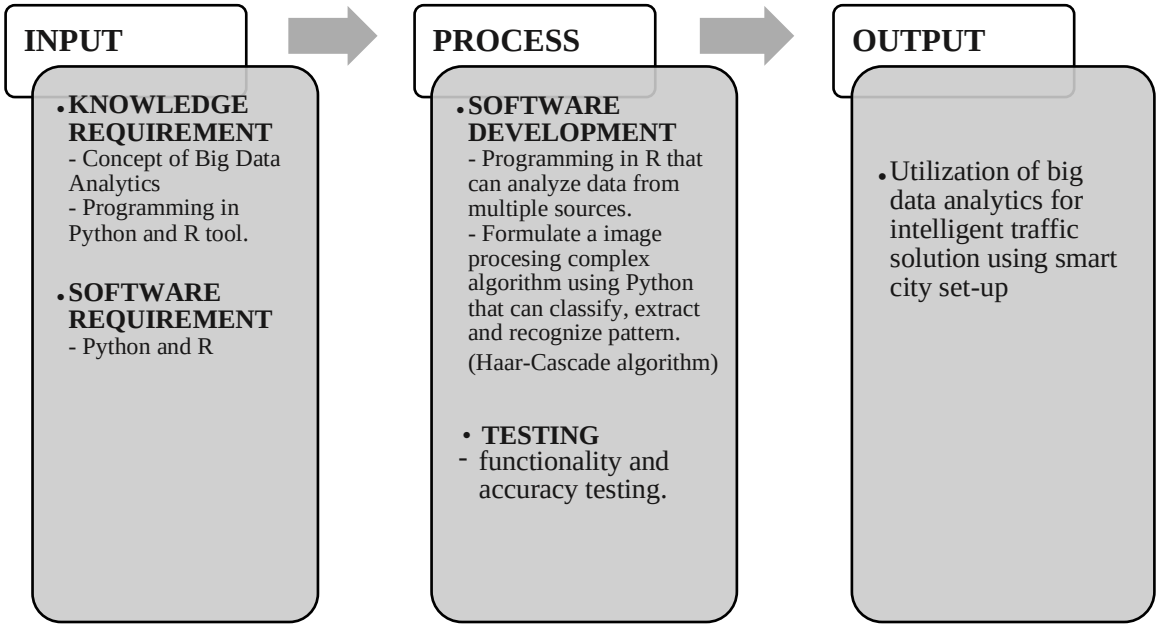

Figure 3.2 IPO model

Figure 3.2 shows the big data analytics input, processes and output diagram for smart traffic solution. The diagram's input part requires the programming language knowledge that will be used to use traffic solution. The part of the process includes data collection, image processing and image analysis for vehicle recognition, classification on vehicle types and categorization of traffic activities. The output part of the diagram will provide real-time qualitative traffic information.

3.2.2 Gathering of the Related Facts or Information

- Research about Image Processing Techniques

  Image processing is the methodology for traffic detection. It is the key source of data on how the road traffic situation conditions will be handled and evaluated by the system.

- Research about software to be used

  As the study focuses on smart technology, the research plays an important role in programming. OpenCV library is a computer vision plug-in and python are the program's IDE. The entire system algorithm providing the traffic detection decision support system by image processing.

- Research about Related Literature

  This project analysis will be conceptualized through studies and research on local and foreign studies and ventures. Proponents can get ideas and concepts on how the entire system should be constructed.

- Research about Traffic Behaviors and Control Systems

The congestion of traffic has a dynamic and wide range of reasons for its existence. People's social habits, the size of the vehicle and the quality of roads are the main concerns for traffic control. Proponents therefore need to understand how and why traffic congestion exists.

- Interview with related agency

Gaining information directly from a relevant entity through an interview should be considered. Necessary queries can all be answered reliably. The Manila Traffic and Parking Bureau (MTPB) was the related agency unit for this report.

- Site Searching

  To complete the project study the proponents searched an intersection lane which is between Ayala Blvd. and San Marcelino to implement, test and evaluate the success system on the road.

3.2.3 Flow of Research Process

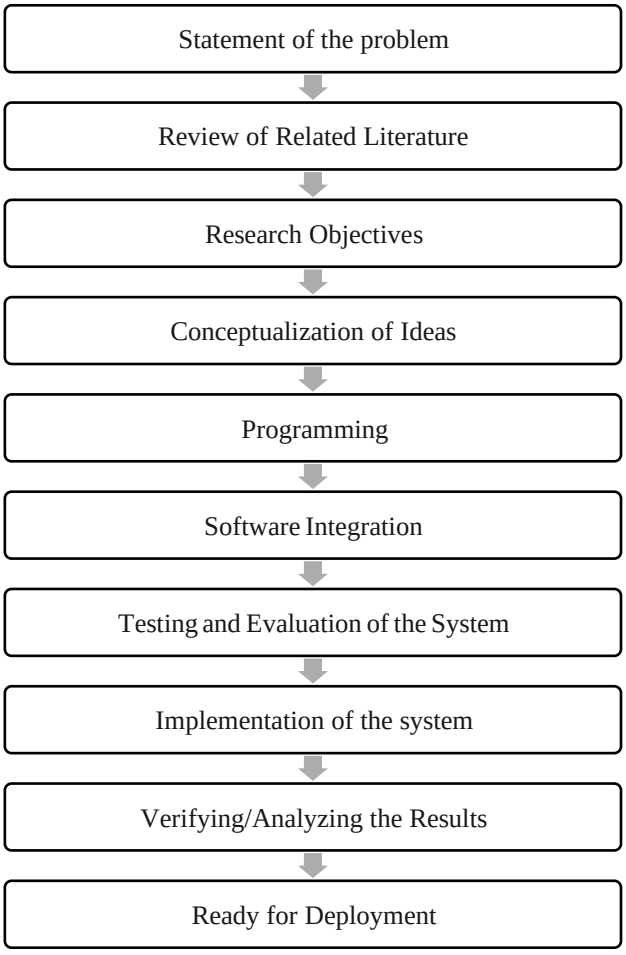

Figure 3.3 Flow Process of the Project

Figure 3.3 represents the entire process from the statement of the problem to the implementation of the output of the project. After the conceptualization of ideas, the proponents conducted research from different studies relating their topic to acquire more knowledge about the utilization of the project.

3.3 Block Diagram

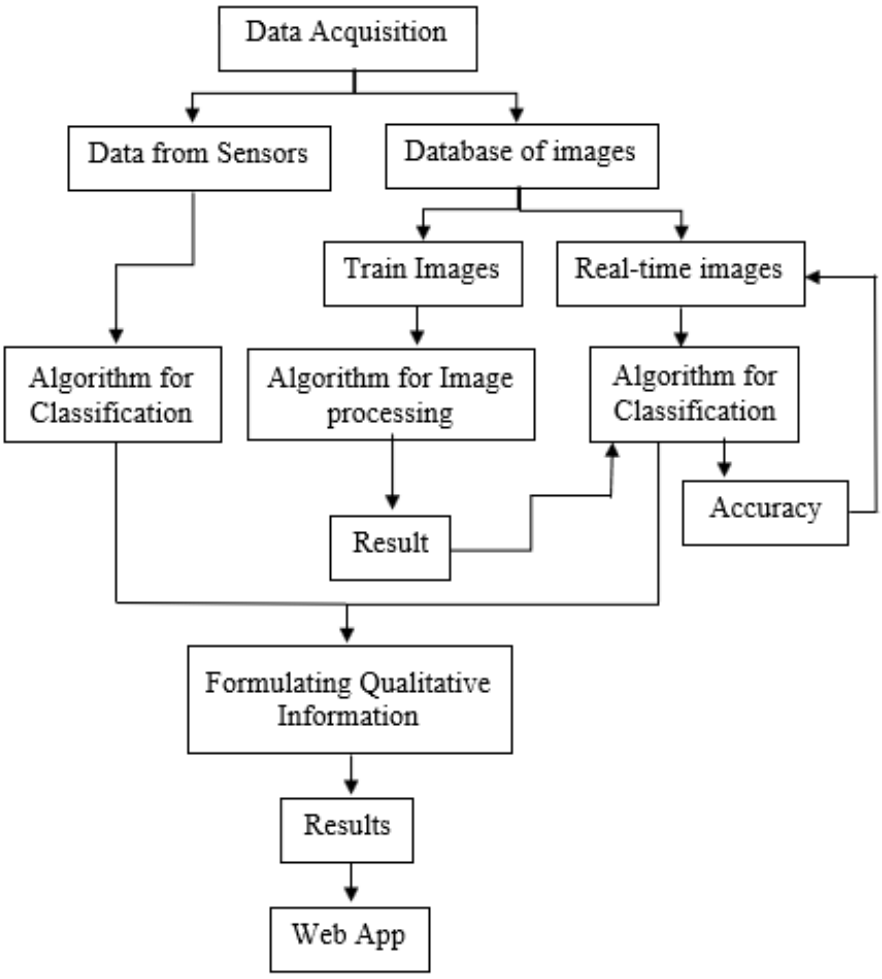

Figure 3.4 Block Diagram

Figure 3.4 explains the system block diagram. The various data collected from the device consisting of a Surveillance camera, float switch, temperature and humidity sensors. In the surveillance camera, proponents get the unchanged captured image. This guarantees successful training for a controlled road. The algorithm for image processing used is Cascade trainer GUI for training image data. After collecting all traffic-related elements, to differentiate between camera data and sensors separately.

All the data collected undergoes to algorithm for classification. The system provides qualitative information base on the traffic conditions in the area. Processing data from various sources will provide a big data product and traffic conditions. Vehicle classification can also be used to determine what type of vehicles can pass the road under bad weather and give statistical information on what type of vehicle passes a certain road over a certain period. After analyzed all the data collected, it will go through to the web app that could assist drivers and commuters.

3.4 Research Method

The proponents shall carry out the following processes in order to fulfill the specific objectives of this study.

To establish a big data product capable of recognizing, classifying and categorizing traffic activities for urban development purposes;

The proponents will identify the programming language most suitable for developing an image processing. There are different types of programming language, each with its own functional specialty. The proponents must determine the specific function the system will perform. Choosing the most appropriate programming language that is will improve system performance and accuracy. Creating the Haar-Cascade Classifier to Detect Vehicle will be the algorithm. The system must conclude on the current traffic activities in the area from the processed data. Processing data from various sources will provide with a big data product and provide volume of the vehicles.

Vehicle classification can also be used to determine what type of vehicles can pass the road under bad weather and give statistical information on what type of vehicle passes a certain road over a certain period of time.

To design a big data product capable of detecting environmental conditions that can provide route passability information to the commuters;

Create a large data product that can detect environmental conditions such as floods. The proponents will receive a string output from the float switch that contain the flood height and classify what types of vehicles can pass through. And in order to provide route passability information to the commuters, the proponents process and analyze the image data by the data collected from the sensors and send it to the web for all the commuters to be informed.

To formulate a predictive model that can analyze data from multiple sources and provide qualitative traffic information;

After determining the programming language, the system algorithm must be well programmed to create a predictive model that will simultaneously analyze the data from the database of various lamppost and provide qualitative information to the commuters. After the program is completed, the proponents will conduct the performance test. This will ensure a good and accurate functioning program.

To deploy the predictive models in a small-scale set-up.

The predictive model that is designed for providing a qualitative traffic information will be deployed in a small-scale set-up along the Ayala Blvd, Ermita, Manila.

3.5 Operation

This study was designed to establish a data-based approach that could send a specific type of information to a web that could assist drivers in their daily lives. This project is designed to inform all drivers in the event of a traffic jam, it gives real-time image of the road and in the event of flooding, this project warns all drivers that flooding is taking place and provides information about what kind of vehicles can pass through the flood and vehicles that cannot pass.

3.5.1 Creating the Haar-Cascade Classifier to Detect Vehicles

The classification of cascades consists of a collection of stages. Each classifier stage labels the region defined as either positive or negative by the current sliding window location. A positive image is one containing an object that must be detected; a negative image is one not containing a need-to-find object. The proponents will place a negative image of a road without the vehicles then the positive image will indicate vehicle being discovered. If the image is determined negative, the region classification is complete and the window will proceed to the next place by the detector. If the image is positive, the classifier proceeds to the next level.

The final phase classifies and the detector reports a vehicle discovered at the present window place for evaluation and subsequently builds a second classifier featuring higher detection rates.

3.5.2 Testing Procedure

1.) The gathered data images from the sensor will go through digital acquisition.

2.) The data gathered from the digital acquisition will process using image processing.

3.) The image that process will analyze to know if there is a light, moderate or heavy traffic on the road.

4.) The image that analyzed has a qualitative information will go through the web app that could assist drivers.

3.6 Financial Plan

Table 2. Bill of Materials

Materials	Quantity	Amount
System Unit	1	13,500

CHAPTER 4

This chapter presents the project's specific description, attributes, and organizational structure. The project's limitation and capabilities are also presented.

4.1 Technical Description of the Project

Utilization of Big Data Analytics for Intelligent Traffic Solution Using Smart City Set-up is a project that is successful in enhancing traffic efficiency using big data analysis technology to an Intelligent transportation system at the intersection between Ayala and San Marcelino, Ermita manila.

This project is consisting only of software part. It includes python program with OpenCV program package interface. Data gathered from multiple sensors should be properly tagged and supported by wireless protocols that can improve safety in data traffic. Data collected can be stored first or instantaneously forwarded to the system. Then in the camera, the application programmed using OpenCV must be run to perform the Haar cascade algorithm that will identify the volume of the vehicles on the road. The sensors of flood level and humidity will not need the use of package, just if else conditions and other common program code. While in time estimation, we put 1 second delay for each vehicle passing on the road for the calculation of estimated time traffic. Python program maintains the synchronization and dynamic control of time as a qualitative output of the road condition for vehicles to efficiently pass the road.

4.2 Project Structure

4.2.1 Project Set-up

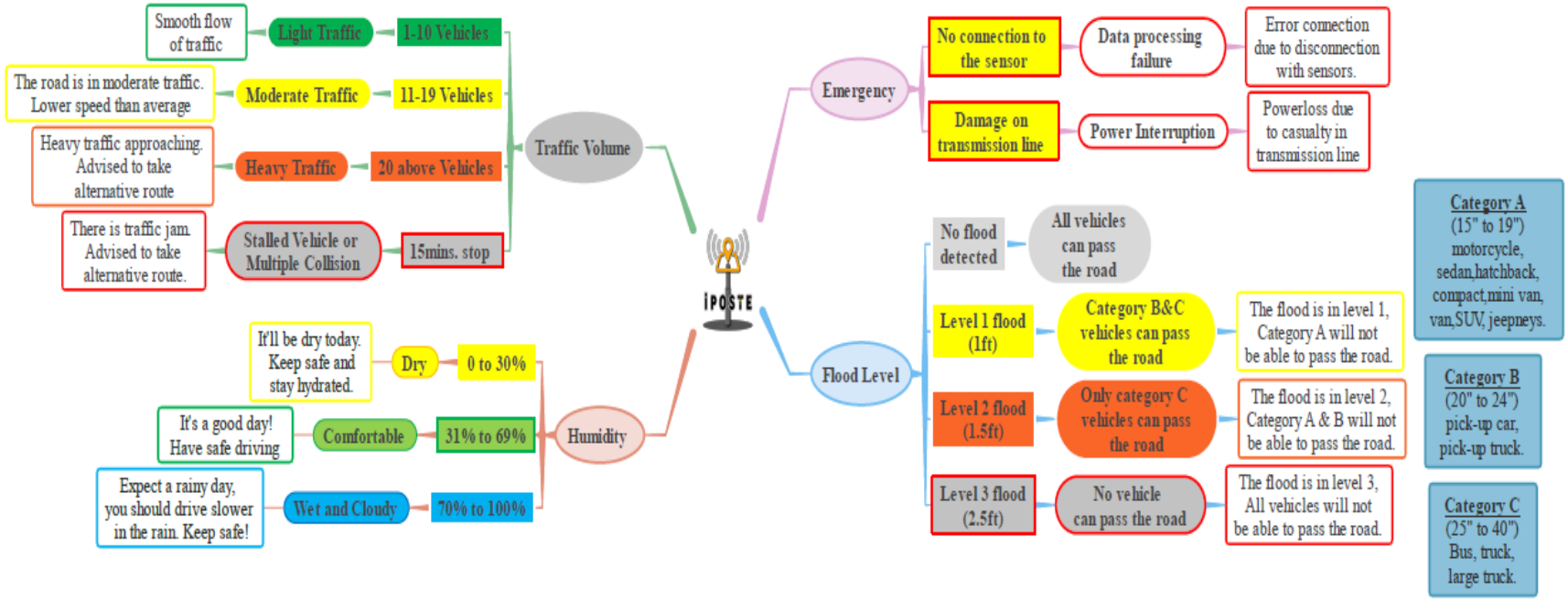

Figure 4.1 Mind Map

Figure 4.1 is representation of the multiple sources analyzed big data in the system which will assist to drivers and commuters that provide qualitative traffic information of the road condition.

4.3 Project Capabilities and Limitations

The project has a capability to provide a big data product to recognize the traffic activities base on multiple sources. These sources are camera, float switch and humidity sensor that simultaneously process data to the system. From the gathered data of the camera the system can recognize the volume of the vehicle and inform the commuters if heavy traffic, moderate traffic and light traffic. From the data of float switch the system can categorize level 1 (1ft), level 2 (1.5ft), level 3(2.5ft) of the flood in which the system can advise the commuters if the vehicle can pass the road. From the output of humidity sensors, the system can advise the commuters if rainy or sunny. Also, when the flow of vehicle is stuck within a period of time, the system will assume that the road has a collision.

One limitation of the project is when the road has a collision the system cannot directly say what kind of accident cause the collision. Also, when at night the system can hardly detect vehicles, because of the camera has no night vision. Another is the system cannot detect stray animals, the activities of people, violations along the road

The qualitative information given from the system may be used for the traffic analysis, traffic management and road safety application, with the availability of economical sensors and wireless sensors network can helps commuters in determining the condition of the road.

CHAPTER 5

This chapter presents the summary of findings, conclusion, and the recommendations for further improvement and development of the project.

5.1 Summary

Utilization of Big Data Analytics for Intelligent Traffic Solution using Smart City Set-Up is built to provide qualitative traffic information such as temperature, humidity, route passability, accident, projected traffic time and real-time traffic status monitoring in that region.

5.2 Conclusion

The following conclusions were made regarding the overall function of the system through the testing/operation of the project:

1. The Python program designed for the system reliably provided an effective package in real time traffic monitoring for the output of the road condition.
2. The OpenCV package in python enhances processing of receive data of the system.
3. The Haar cascade is the easiest and reliable algorithm in detecting an object through image processing.

5.3 Recommendation

In improving the project's overall results, the researchers recommend:

1. To improve the specifications required in running program.
2. To adjust the detection of the real-time length for more precise device measurement.
3. To increase the time, estimate for passing the route.
4. To enhance accident detection.
5. To improve the classification of vehicles
6. To implement alternative routes

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APPENDIX A

Program Codes

PYTHON MAIN SCRIPT

```
import cv2
import clouds
import logfile


#IMAGE FROM CAMERA 1
car_cascade11 = cv2.CascadeClassifier("Cascades\\1\\cascade A1.xml")
car_cascade12 = cv2.CascadeClassifier("Cascades\\1\\cascade B1.xml")
car_cascade13 = cv2.CascadeClassifier("Cascades\\1\\cascade C1.xml")
img1 = cv2.imread("east\\east.png")
gray_img = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
cars11 = car_cascade11.detectMultiScale(gray_img, scaleFactor= 1.11,
minNeighbors= 4)
cars12 = car_cascade12.detectMultiScale(gray_img, scaleFactor= 1.5,
minNeighbors= 5)
cars13 = car_cascade13.detectMultiScale(gray_img, scaleFactor= 1.275,
minNeighbors= 4)

if (len(cars11) and len(cars13))  == 0:
   print()
else:
   sum1 = int(len(cars11)) + int(len(cars12)) + int(len(cars13))
   print ("\n From Camera 1: \nNumber of Cars: " + str(sum1))

   for x, y, w, h in cars11:
      img1 = cv2.rectangle(img1, (x, y), (x + w, y + h), (0, 0, 255), 2)
            cv2.putText(img1, 'Category 1', (x, y - 10),
         cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 255), 2)
   for x1, y1, w1, h1 in cars12:
      img1 = cv2.rectangle(img1, (x1, y1), (x1 + w1, y1 + h1), (0, 255, 255), 2)
            cv2.putText(img1, 'Category 2', (x1, y1 - 10),
         cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 255), 2)
   for x2, y2, w2, h2 in cars13:
      img1 = cv2.rectangle(img1, (x2, y2), (x2 + w2, y2 + h2), (0, 255, 255), 2)
            cv2.putText(img1, 'Category 3', (x2, y2 - 10),
         cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 255), 2)

   cv2.rectangle(img1, ((0, img1.shape[0] -1)), (520, img1.shape[0] -45), (255,
   255, 255), -1),
   cv2.putText(img1, "Number of cars detected: " + str(sum1), (0, img1.shape[0]
   -10),
            cv2.FONT_HERSHEY_TRIPLEX, 1, (0, 0, 0), 1)
```

##

```
#FIRST TRAFFIC INFO
vehicle_count = sum1
if vehicle_count <= 3:

#PRINT INFORMATION
   import time
   print("Traffic Condition: No traffic build up\n" \
   "Estimated time travel: " + time.strftime('%M minute and %S seconds',
time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))

#EXCEL FILE

   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')

   worksheet.write('A2', 'No traffic build up')
   worksheet.write('B2', time.strftime('%M minute and %S seconds',
time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))

   workbook.close()

elif vehicle_count <= 6:
#PRINT INFORMATION
   import time
   print("Traffic Condition: Light traffic\n" \
   "Estimated time travel: " + time.strftime('%M minute and %S seconds',
time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))
#EXCEL FILE
   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')
```

```
    worksheet.write('A2', 'Light traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))

    workbook.close()

elif vehicle_count <= 9:
#PRINT INFORMATION
    import time
    print("Traffic Condition: Moderate traffic\n" \
        "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))
#EXCEL FILE
    import xlsxwriter
    workbook = xlsxwriter.Workbook('output\\result.xlsx')
    worksheet = workbook.add_worksheet()

    worksheet.write('A1', 'Traffic Condition')
    worksheet.write('B1', 'Estimated Time Travel')
    worksheet.write('C1', 'Flood Level')
    worksheet.write('D1', 'Humidity')
    worksheet.write('E1', 'Temperature')

    worksheet.write('A2', 'Moderate traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))

    workbook.close()

else:
#PRINT INFORMATION
    import time
    print("Traffic Condition: Congested Traffic\n" \
    "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))
#EXCEL FILE
    import xlsxwriter
    workbook = xlsxwriter.Workbook('output\\result.xlsx')
    worksheet = workbook.add_worksheet()

    worksheet.write('A1', 'Traffic Condition')
    worksheet.write('B1', 'Estimated Time Travel')
    worksheet.write('C1', 'Flood Level')
    worksheet.write('D1', 'Humidity')
    worksheet.write('E1', 'Temperature')
```

```
    worksheet.write('A2', 'Congested traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars11))*4 + int(len(cars12))*5 + int(len(cars13)*8 + 70))))

    workbook.close()

#########################################################################


    #IMAGE FROM CAMERA 2
    car_cascade21 = cv2.CascadeClassifier("Cascades\\2\\cascade A2.xml")
    car_cascade22 = cv2.CascadeClassifier("Cascades\\2\\cascade B2.xml")
    car_cascade23 = cv2.CascadeClassifier("Cascades\\2\\cascade C2.xml")
    img2 = cv2.imread("east1\\east1.png")
    gray_img = cv2.cvtColor(img2, cv2.COLOR_BGR2GRAY)
    cars21 = car_cascade21.detectMultiScale(gray_img, scaleFactor= 1.275, minNeighbors= 4)
    cars22 = car_cascade22.detectMultiScale(gray_img, scaleFactor= 1.02, minNeighbors= 4)
    cars23 = car_cascade23.detectMultiScale(gray_img, scaleFactor= 1.045, minNeighbors= 4)


    if (len(cars21) and len(cars22))  == 0:
        print()
    else:
        sum2 = int(len(cars21)) + int(len(cars22)) + int(len(cars23))
        print ("\n From Camera 2: \nNumber of Cars: " + str(sum2))

        for x, y, w, h in cars21:
            img2 = cv2.rectangle(img2, (x, y), (x + w, y + h), (0, 0, 255), 2)
                    cv2.putText(img2, 'Category 1', (x, y - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 255), 2)
        for x1, y1, w1, h1 in cars22:
            img2 = cv2.rectangle(img2, (x1, y1), (x1 + w1, y1 + h1), (0, 255, 0), 2)
                    cv2.putText(img2, 'Category 2', (x1, y1 - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 0), 2)
        for x2, y2, w2, h2 in cars23:
            img2 = cv2.rectangle(img2, (x2, y2), (x2 + w2, y2 + h2), (0, 255, 255), 2)
                    cv2.putText(img2, 'Category 3', (x2, y2 - 10), cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 255, 255), 2)

        cv2.rectangle(img2, ((0, img2.shape[0] -1)), (520, img2.shape[0] -45), (255, 255, 255), -1),
```

```
    cv2.putText(img2, "Number of cars detected: " + str(sum2), (0, img2.shape[0]
    -10),
                cv2.FONT_HERSHEY_TRIPLEX, 1, (0, 0, 0), 1)

#########################################################################


    #SECOND TRAFFIC INFO
    vehicle_count1 = sum2
    if vehicle_count1 <= 3:

    #PRINT INFORMATION
       import time
       print("Traffic Condition: No traffic build up\n" \
        "Estimated time travel: " + time.strftime('%M minute and %S seconds',
    time.gmtime(int(len(cars21)) * 4 + int(len(cars22)) * 5 + int(len(cars23) * 8 +
    70))))

    #EXCEL FILE
       import xlsxwriter
       workbook = xlsxwriter.Workbook('output\\result1.xlsx')
       worksheet = workbook.add_worksheet()

       worksheet.write('A1', 'Traffic Condition')
       worksheet.write('B1', 'Estimated Time Travel')
       worksheet.write('C1', 'Flood Level')
       worksheet.write('D1', 'Humidity')
       worksheet.write('E1', 'Temperature')

       worksheet.write('A2', 'No traffic build up')
       worksheet.write('B2', time.strftime('%M minute and %S seconds',
    time.gmtime(int(len(cars21))*4 + int(len(cars22))*5 + int(len(cars23)*8 + 70))))

       workbook.close()

    elif vehicle_count1 <= 6:
    #PRINT INFORMATION
       import time
       print("Traffic Condition: Light traffic\n" \
       "Estimated time travel: " + time.strftime('%M minute and %S seconds',
    time.gmtime(int(len(cars21)) * 4 + int(len(cars22)) * 5 + int(len(cars23) * 8 +
    70))))
    #EXCEL FILE
       import xlsxwriter
       workbook = xlsxwriter.Workbook('output\\result1.xlsx')
       worksheet = workbook.add_worksheet()
```

```
    worksheet.write('A1', 'Traffic Condition')
    worksheet.write('B1', 'Estimated Time Travel')
    worksheet.write('C1', 'Flood Level')
    worksheet.write('D1', 'Humidity')
    worksheet.write('E1', 'Temperature')

    worksheet.write('A2', 'Light traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars21))*4 + int(len(cars22))*5 + int(len(cars23)*8 + 70))))

    workbook.close()

elif vehicle_count1 <= 9:
#PRINT INFORMATION
    import time
    print("Traffic Condition: Moderate traffic\n" \
    "Estimated time travel:" + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars21)) * 4 + int(len(cars22)) * 5 + int(len(cars23) * 8 + 70))))
#EXCEL FILE
    import xlsxwriter
    workbook = xlsxwriter.Workbook('output\\result1.xlsx')
    worksheet = workbook.add_worksheet()

    worksheet.write('A1', 'Traffic Condition')
    worksheet.write('B1', 'Estimated Time Travel')
    worksheet.write('C1', 'Flood Level')
    worksheet.write('D1', 'Humidity')
    worksheet.write('E1', 'Temperature')

    worksheet.write('A2', 'Moderate traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars21))*4 + int(len(cars22))*5 + int(len(cars23)*8 + 70))))

    workbook.close()

else:
#PRINT INFORMATION
    import time
    print("Traffic Condition: Congested Traffic\n" \
    "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars21)) * 4 + int(len(cars22)) * 5 + int(len(cars23) * 8 + 70))))
#EXCEL FILE
    import xlsxwriter
```

```
    workbook = xlsxwriter.Workbook('output\\result1.xlsx')
    worksheet = workbook.add_worksheet()

    worksheet.write('A1', 'Traffic Condition')
    worksheet.write('B1', 'Estimated Time Travel')
    worksheet.write('C1', 'Flood Level')
    worksheet.write('D1', 'Humidity')
    worksheet.write('E1', 'Temperature')

    worksheet.write('A2', 'Congested traffic')
    worksheet.write('B2', time.strftime('%M minute and %S seconds',
time.gmtime(int(len(cars21))*4 + int(len(cars22))*5 + int(len(cars23)*8 + 70))))

    workbook.close()

#########################################################################


#IMAGE FROM CAMERA 3
car_cascade31 = cv2.CascadeClassifier("Cascades\\3\\cascade A3.xml")
img3 = cv2.imread("east2\\east2.png")
gray_img = cv2.cvtColor(img3, cv2.COLOR_BGR2GRAY)
cars31 = car_cascade31.detectMultiScale(gray_img, scaleFactor= 1.275,
minNeighbors= 5)

if len(cars31)  == 0:
    print()
else:
    sum3 = int(len(cars31))
    print ("\n From Camera 3 \nNumber of Cars: " + str(sum3))

    for x, y, w, h in cars31:
        img3 = cv2.rectangle(img3, (x, y), (x + w, y + h), (0, 0, 255), 2)
                cv2.putText(img3, 'Category 1', (x, y - 10),
            cv2.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 255), 2)

    cv2.rectangle(img3, ((0, img3.shape[0] -1)), (520, img3.shape[0] -45), (255,
    255, 255), -1),
    cv2.putText(img3, "Number of cars detected: " + str(sum3), (0, img3.shape[0]
    -10),
            cv2.FONT_HERSHEY_TRIPLEX, 1, (0, 0, 0), 1)

#########################################################################
```

```
#THIRD TRAFFIC INFO
vehicle_count2 = sum3
if vehicle_count2 <= 3:

#PRINT INFORMATION
   import time
   print("Traffic Condition: No traffic build up\n" \
    "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31)) * 4  + 70)))

#EXCEL FILE
   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result2.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')

   worksheet.write('A2', 'No traffic build up')
   worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31))*4 + 70)))

   workbook.close()

elif vehicle_count2 <= 6:
#PRINT INFORMATION
   import time
   print("Traffic Condition: Light traffic\n" \
   "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31)) * 4 + 70)))
#EXCEL FILE
   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result2.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')

   worksheet.write('A2', 'Light traffic')
```

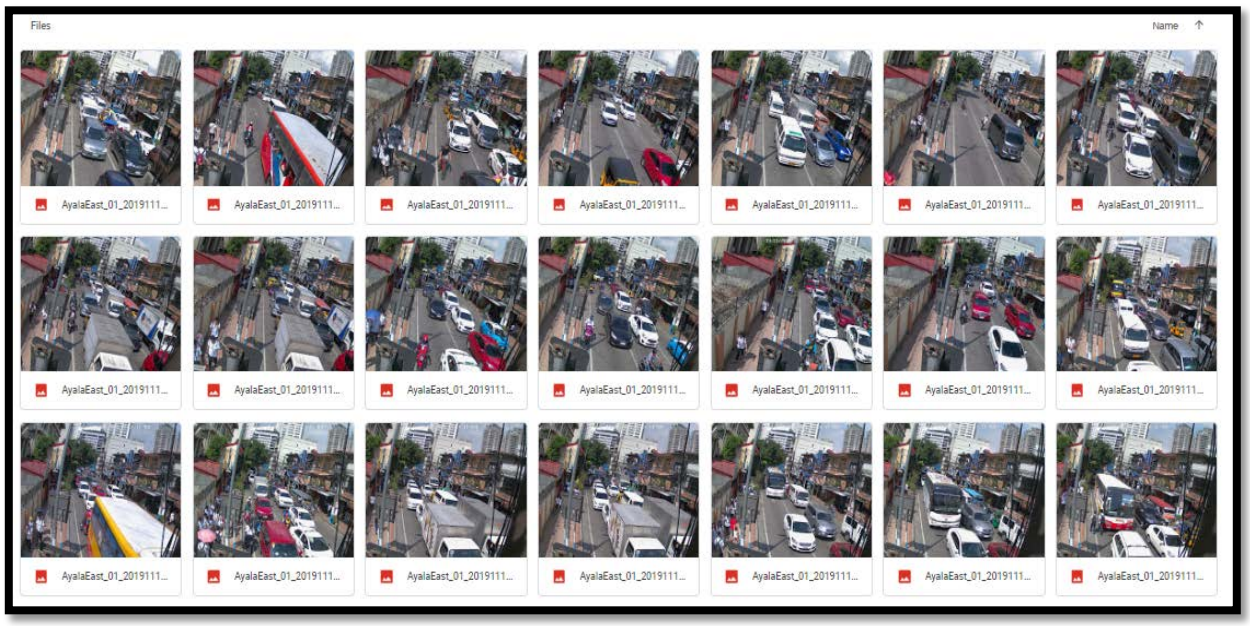
```
   worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31))*4 + 70)))

   workbook.close()

elif vehicle_count2 <= 9:
#PRINT INFORMATION
   import time
   print("Traffic Condition: Moderate traffic\n" \
   "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31)) * 4 + 70)))
#EXCEL FILE
   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result2.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')

   worksheet.write('A2', 'Moderate traffic')
   worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31))*4 + 70)))

   workbook.close()

else:
#PRINT INFORMATION
   import time
   print("Traffic Condition: Congested Traffic\n" \
   "Estimated time travel: " + time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31)) * 4 + 70)))
#EXCEL FILE
   import xlsxwriter
   workbook = xlsxwriter.Workbook('output\\result2.xlsx')
   worksheet = workbook.add_worksheet()

   worksheet.write('A1', 'Traffic Condition')
   worksheet.write('B1', 'Estimated Time Travel')
   worksheet.write('C1', 'Flood Level')
   worksheet.write('D1', 'Humidity')
   worksheet.write('E1', 'Temperature')

   worksheet.write('A2', 'Congested traffic')
```

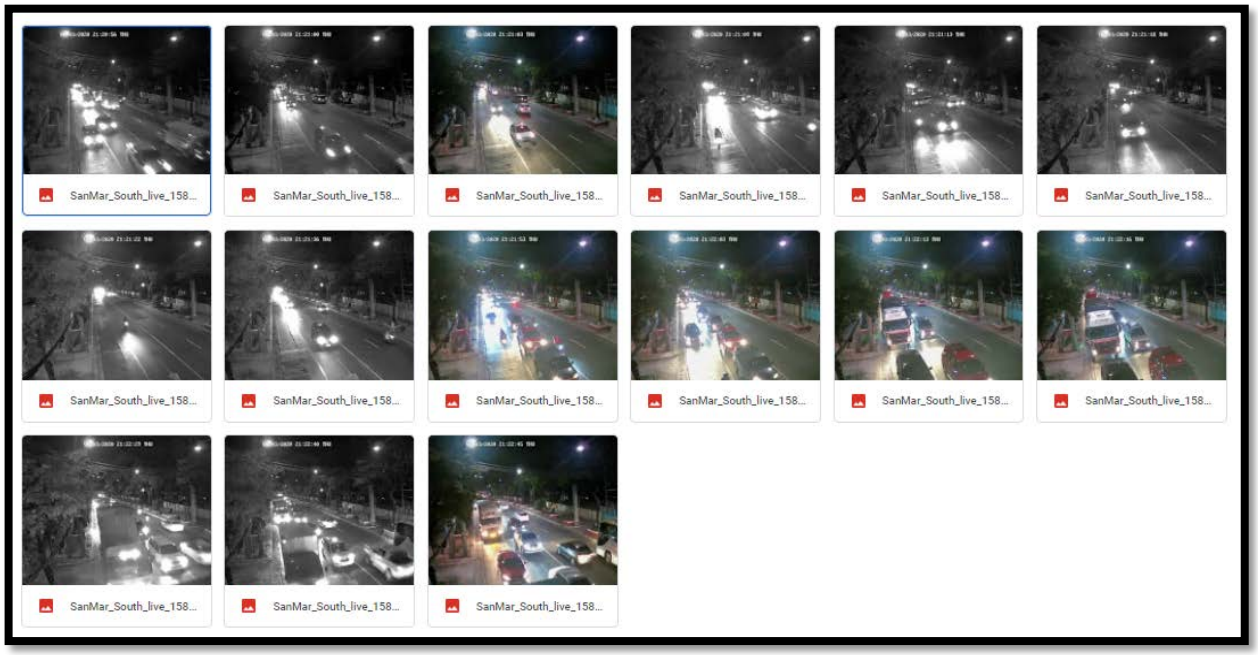
```
    worksheet.write('B2', time.strftime('%M minute and %S seconds', time.gmtime(int(len(cars31))*4 + 70)))

    workbook.close()

#########################################################################


resized2 = cv2.resize(img3, (800,500))
cv2.imshow("Camera 3", resized2)
resized1 = cv2.resize(img2, (800,500))
cv2.imshow("Camera 2", resized1)
resized = cv2.resize(img1, (800,500))
cv2.imshow("Camera 1", resized)
cv2.waitKey(0)
cv2.destroyAllWindows()

import humidity

print ('Output Files created!')
time.sleep(1)
print ('Closing in 5...')
time.sleep(1)
print ('Closing in 4...')
time.sleep(1)
print ('Closing in 3...')
time.sleep(1)
print ('Closing in 2...')
time.sleep(1)
print ('Closing in 1...')
```

APPENDIX B

Documentation

Sample of Images





Sample of Images

Data Gathering

Deployment of Camera System

Topic Defense

Title Defense

Project Presentation

APPENDIX C

Gantt Chart

Activity	2019								2020							
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Lecture & Research																
Research Related Literature																
Composing chapter 1																
Topic Defense																
Consultation with Project Adviser																
Composing of Chapter 2 and 3																
Initial Canvassing of Materials																
Title Defense																
Final Canvasing of Materials																
Purchasing of Materials and Equipments																
Designing of Server Control Room																
Programming of system																
Progress Defense																
Adjustments for the prototype																
Adjustments for the camera view																

Pre-final Defense																
Training of Images																
Data Gathering																
Trouble-shooting and revising of the program of the system																
Deployment																
Drafting Chapters 1 to 5																
Final Defense																
Finalization of Paper																
Book submission																

APPENDIX D

Curriculum Vitae

OBJECTIVES

To enhance and improve myself in any kind of job. To give quality performance at all times for attainment of the goal of the organization I am to be part of.

PERSONAL INFORMATION

Age: 23
Gender: Male
Civil Status: Single
Religion: Roman Catholic
Nationality: Filipino

SKILLS

Proficient in Soldering Techniques

Can easily adapt new Concepts

Initiator and passionate about working

CHARACTER REFERENCES

Engr. Timothy M. Amado
College of Engineering—TUP Manila
Faculty
09328672868

Niño D. Garcia
Schneider Electric
Test Engineer Developer
09273778645

John Michael Z. Balano, ECT

228 Longos Zapote V Bacoor City Cavite
+639382161182
balanojohnmichael@yahoo.com

EDUCATION

2016 – 2020 Technological University of the Philippines– Manila
Bachelor of Science in Electronics and Communications Engineering
Ayala Boulevard, Ermita, Manila

Credential *Passing Electronics Technician Licensure Examination October 2018*

2013- 2016 *Technological University of the Philippines*
Electronic Communications Engineering Technology (ECET)
(April 2, 2016)

2009-2013 *Amaya School of Home Industries*
Sahud-Ulan Tanza Cavite

2003-2009 *Longos Elementary School*
Zapote V Bacoor City Cavite

EXPERIENCE

*Seven hundred twenty training hours at the **Schneider Electric***
Test Engineering Department
Lot 1 Block 5 Phase 2 PEZA, Rosario, Cavite
(November-April 2016)

SEMINAR ATTENDED

February 2019
APPRECIATE: Annual Presentation of Project Research in Electromechanical, Civil, Information and Telecommunications Engineering 2019

I hereby certify that the aforementioned facts are true and correct to the best of my knowledge and belief.

John Michael Z. Balano

OBJECTIVES

Pursuing opportunity which will support me in my personal development with the use of the knowledge acquired from the school in an actual environment.

PERSONAL INFORMATION

Age: 23
Gender: Female
Civil Status: Single
Religion: Born-again Christian
Nationality: Filipino

SKILLS

Proficient in Microsoft Office Application

Basic knowledge in Digital Electronics, Troubleshooting, MATLAB, Python and R studio.

Can work independently in a fast-paced environment.

CHARACTER REFERENCES

Engr. Timothy M. Amado
College of Engineering—TUP Manila
Faculty
09328672868

Engr. Nilo M. Arago
College of Engineering—TUP Manila
College Secretary
09154688227

Keren Agape D. Bernardo

30 Tilapia St. Kaunlaran Village Caloocan City
+63917 8336783
Kerenbernardo31@gmail.com

EDUCATION

2016 – 2020 Technological University of the Philippines– Manila
Bachelor of Science in Electronics and Communications Engineering
Ayala Boulevard, Ermita, Manila

2013- 2016 *Technological University of the Philippines*
Electronic Communications Engineering Technology (ECET)
(April 2, 2016)

2008-2012 *Divine Grace School*
Quezon City

2003-2009 *Divine Grace School*
Quezon City

2002-2003 *Amparo Elementary School*
Caloocan City

ACHIEVEMENT AND AFFILIATION

Seven hundred twenty training hours at the
Philippines Broadcasting Company (PBS)
Visayas Avenue, Quezon City

Consumer Electronics Servicing NCII
Certificate no.: 15130602032247

OECES - TUP Manila (Member)
Organization of Electronics Engineering Students

IECEP - Manila Student Chapter (Member)
Institute of Electronics Engineers of the Philippines

APPRECIATE: Annual Presentation of Project Research
in
Electrome-chanical, Civil, Information and Telecommunications Engineering 2017

Tracks Orientation
Preparing the Headway for Achievement and Success of ECE students 2017

TRENDS
Topics in Research, Electronics, Networking and Data Science 2018

I hereby certify that the aforementioned facts are true and correct to the best of my knowledge and belief.

Keren Agape D. Bernardo

OBJECTIVES

To utilize my skills and abilities in the field of Electronics Engineering that offers professional growth while being resourceful, innovative and flexible as well as to practice my leadership skills and decision

PERSONAL INFORMATION

Age: 22
Gender: Male
Civil Status: Single
Religion: Roman Catholic
Nationality: Filipino

SKILLS

SOFTWARE

- Proficiency in Data Science Tools (Python, R and SQL)
- Proficiency in Electronic Work Benches (Multisim)
- Proficiency in Microsoft Office Applications
- Data Wrangling and Data Visualization

CHARACTER REFERENCES

Engr. Timothy M. Amado
College of Engineering—TUP Manila
Faculty
09328672868

Engr. Lean Karlo S. Tolentino
Director – Research & Extension
Technological University of the Philippines – Manila
+63 915 468 8227

John Dereck A. De Guzman

La Verti Residences, Donada St. Pasay City
0956 771 4615
im.jdeguzman30@gmail.com

EDUCATION

2016 – 2020
Technological University of the Philippines– Manila
Bachelor of Science in Electronics and Communications Engineering
Ayala Boulevard, Ermita, Manila

2013- 2016
Technological University of the Philippines
Electronic Communications Engineering Technology (ECET)

2009-2013
EBENEZER CHRISTIAN ACADEMY INC
Barangay Sto Cristo, San Jose Del Monte Bulacan
7th HONORABLE MENTION

WORK EXPERIENCE

SONY AUTHORIZED SERVICE CENTER: SOLID SERVICE
ELECTRONICS TECHNICIAN – TRAINEE
199 Congressional Ave., near corner of Mindanao Ave., Brgy. Bahay Toro
Quezon City Metro Manila 1106
May 2015 - October 2015

ACKNOWLEDGEMENT

GETTING GROUNDED ON ANALYTICS
DEVELOPMENT ACADEMY OF THE PHILIPPINES
May 14, 2020

I hereby certify that the aforementioned facts are true and correct to the best of my knowledge and belief.

John Dereck A. De Guzman

OBJECTIVES

To gain useful knowledge and skills in order to supplement what I have learned from school in a real work environment. In return, I give my support and commitment to be an asset to your company during my training period.

PERSONAL INFORMATION

Age: 24
Gender: Male
Civil Status: Single
Religion: Methodist
Nationality: Filipino

SKILLS

Computer literate in various windows based softwares

Computer assembly and Electronic circuit troubleshooting

Can easily learn and adapt new Concepts

CHARACTER REFERENCES

Engr. Timothy M. Amado
College of Engineering—TUP Manila
Faculty
09328672868

Engr. Lean Karlo S. Tolentino
Director—Reaserch and Extension
Technological University of the Philippines—Manila
+63 995 892 5845

Aaron Erville B. Juaniza

Block 3 lot 33 boston st. Barcelona 3 Buhay na tubig Imus City, Cavite
+63 908 150 7851
aejuaniza@gmail.com

EDUCATION

2016 – 2020 Technological University of the Philippines– Manila
Bachelor of Science in Electronics and Communications Engineering
Ayala Boulevard, Ermita, Manila

2013- 2016 *Technological University of the Philippines*
Electronic Communications Engineering Technology (ECET)
(April 2, 2016)

2009-2013 *Imus Institute Science Highscool*
Nueno Avenue, Imus City Cavite

2003-2009 *St. John Bosco School*
Villa De Primarosa Subd. Buhay na tubig Imus City Cavite

EXPERIENCE

*Seven hundred twenty training hours at the **Smart Communications***
Regional Service Assurance Group
Santolan Road, San Juan City, Metro Manila
(November-April 2016)

SEMINAR ATTENDED

February 2019
APPRECIATE: Annual Presentation of Project Research in Electromechanical, Civil, Information and Telecommunications Engineering 2019

I hereby certify that the aforementioned facts are true and correct to the best of my knowledge and belief.

Aaron Erville B. Juaniza

OBJECTIVES

A highly organized and hard-working individual looking for a responsible position to gain practical experience.

PERSONAL INFORMATION

Age:	24
Gender:	Male
Civil Status:	Single
Religion:	Catholic
Nationality:	Filipino

TECHNICAL SKILLS

Programming Languages: (Basic Knowledge in Python, MatLab, R Studio and GNUOctave)

Basic of Intel 8086/8088 microprocessor programming

Drafting and Drawing in AutoCad

Proficient in Soldering Techniques

Strong Interest in Technology

CHARACTER REFERENCES

Engr. Dave Angelo S. Dolaota
Intellismart Technology Inc.
PRDD-ES Engineer
0905 357 9212

Engr. Timothy M. Amado
Faculty -TUP Manila
0932 867 2868

Renniel L. Pablo

19B Road 25 Bahay Toro Quezon City
+63998 492 4601
rnnlpbl@gmail.com

EDUCATION

2016 – 2020 Technological University of the Philippines– Manila
Bachelor of Science in Electronics Engineering
Ayala Boulevard, Ermita, Manila

2013- 2016 *Technological University of the Philippines*
Electronic Communications Engineering Technology (ECET)
(April 2, 2016)

2008-2012 *Judge Juan Luna High School*
Judge Juan Luna St. SFDM Quezon City

2002-2008 *Toro Hills Elementary School*
Road 18 Project 8 Quezon City

EXPERIENCE

*Supervised Industrial training at the **Solid Electronics Corporation***
(Sony Authorized Service Center),
Quezon Avenue - Branch (May—
August 2015)
*Supervised Industrial Training at **Intellismart Technology Inc.***
Catanduanes St. Quezon City
(February—March 2020)

ORGANIZATIONS and SEMINARS

***OECES - TUP Manila** (Member)*
Organization of Electronics Engineering Students
***IECEP - Manila Student Chapter** (Member)*
Institute of Electronics Engineers of the Philippines

***APPRECIATE**: Annual Presentation of Project Research in Electromechanical, Civil, Information and Telecommunications Engineering 2017*
***Tracks Orientation**: Preparing the Headway for Achievement and Success of ECE students 2017*
***TRENDS**: Topics in Research, Electronics, Networking and Data Science 2018*

I hereby certify that the aforementioned facts are true and correct to the best of my knowledge and belief.

Renniel L. Pablo