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AN INTELLIGENT TRANSPORT SYSTEM FOR TRACKING OFFENDERS USING QUEUE DETECTION ALGORITHM.

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Abstract

Intelligent Transport Systems and Services is the integration of information and communications technology with transport infrastructure, vehicles and users. The increase in urbanisation and traffic congestion create an urgent need to operate our transportation systems with maximum efficiency In this work, the fuzzy logic and queue algorithms for traffic management in intelligent transportation system was used in metropolitan areas. The proposed algorithms allow to reduce travel time, fuel consumption and emissions. Object oriented design and methodology was used and PHP programming language also was used to implement the model. The results show that the proposed system can significantly reduce average travel time, detection traffic offenders and control of overloads, and viable punishment is given to the offenders and the proposed system is suggested to be distributed throughout the city to provide full coverage of the region

1.0 Introduction

Intelligent Transportation System could be traced back to the 1960's with the development of the Electronic Route

Guidance System or ERGS in the U.S to provide drivers with route guidance information based on real-time analysis. The system used special hardware located at various intersections across the road network, on-board 2-way devices in vehicles that would form the hub of communication between the drivers and the ERGS system, a central computer system that processed the information received from the remote systems.

Intelligent Transport Systems and Services could be defined as the integration of information and communications technology with transport infrastructure, vehicles and users. The increase in urbanisation and traffic congestion create an urgent need to operate our transportation systems with maximum efficiency (Ibeh, 2016). Real-time traffic signal control is an integral part of modern Urban Traffic Control Systems aimed at achieving optimal utilisation of the road network. Providing effective real time traffic signal control for a complex traffic network could be challenging. Signal system operation is further complicated by the recent trend that views traffic signal system as a small component of an integrated multimodal transportation System. Optimisation of traffic signals and other control devices for the efficient movement of traffic on streets and highways constitutes a challenging part of the advanced traffic management system of intelligent transportation system (Rameshwar et al. 2011). For a large-scale traffic management system, it may be difficult to assess the state of traffic network and to tell whether it is flowing smoothly. Over the past few years, multi-agent systems have become a crucial technology for effectively exploiting the increasing availability of diverse, heterogeneous and distributed information sources. Researchers over the years have adopted numerous techniques and used various tools to implement multi-agent

systems for their problem domains. As researchers gain a better understanding of these autonomous multi-agent systems, more features are incorporated into them to enhance their performance and the enhanced systems can then be used for more complex application domains (Osigwe et al., 2011). Intelligent software agent is an autonomous computer program, which interacts with and assists an end user in certain computer related tasks (Macro et al., 2007). In any agent, there is always a certain level of intelligence. The level of the Intelligence could vary from pre-determined roles and responsibilities to a learning entity. Multi-Agent System is the aggregate of agents, whose object is to decompose the large system to several small systems which communicate and coordinate with each other and can he extended easily. Agent-based simulations are models where multiple entities sense and stochastically respond to conditions in their local environments, mimicking complex large scale system behavior. The urban traffic system is a much complex system, which involved many entities and the relationship among them are complicated. Therefore, the most important issues for a learner agent is the assessment of the behavior and the intelligence level of the other agents (Ugwu, 2009). By sharing vital information, Intelligent Traffic System allows people to get more from transport networks, with greater safety and with less impact on the environment. Intelligent Traffic System helps the whole transport system to work most effectively and efficiently. Intelligent Traffic System integrates users, transport systems, and vehicles through state-of-the-art information and communications technology. The intelligent transport system will actually help in improving travelers safety, efficiency and comfort. Intelligent Traffic System helps shippers and carriers move freight to its destination reliably and efficiently.

People spend more of their precious time commuting to work, school, shopping, and social event as well as dealing with traffic light. Ambulance and emergency response vehicles (police, fire service, etc) are trapped in the midst of horrific logjams. On major roads, traffic is always heavy in all directions whether before, during or after working hours. Worse still, there are constraints in using alternative transportation system like using the airways (which may be expensive for the average person), waterways (which could be dangerous in third world countries due to the conditions of ferries and canoes) or railways (which are still of mundane and archaic designs in a third world country like ours). Even when these other alternatives are available and usable, vehicular transportation will always be necessary somewhere along the line. As demand for road transport increases, it gets to a point of saturation where vehicles will have to compete for road usage. This leads to traffic congestion. Most traffic light systems operate on a timing mechanism which changes its lights after a given interval. This could be inefficient in certain circumstances. Since timer control mechanism is a form of open loop control system, there is no feedback from the controlled variable (volume of traffic) to the controller (traffic control system using lighting). For instance, the duration of the green light will always be same whether the road is congested or not

To solve these congestion problems it is better to build new control system; a smart and intelligent control system that will track offenders since the intelligent traffic light system senses the presence or absence of vehicles and reacts accordingly. The idea behind intelligent traffic systems is that drivers will not spend unnecessary time waiting for the traffic lights to change. An intelligent traffic system detects traffic in many different ways. With all the

technological implementations, traffic congestion has not been fully nipped in the bud and this is evident in the long ubiquitous queues and traffic jams that greet us daily on our ways to (and from) work. Though several traffic control systems have been invented over the years, the need to make these controls smart cannot be over-emphasized.

2.0 Literature Review

Jayashree et. al., (2011): proposes a mobile location tracking application in a cellular mobile network based on Location Based Service. The proposed system is implemented as a client server system that helps the users to locate their friends and receive alerts whenever they are nearby.

Fahmy (2007), proposed a fuzzy logic control system for a roundabout with four approach intersection to extend or terminate the signal phase and to select the sequence of next phases based on the traffic flow that detected at the input of the fuzzy controllers and converted into fuzzy values. Performance analysis showed that the total waiting time in the developed control system is low compared with the actual system. Also, the proposed traffic system provided reliability and independence in decision making.

Madhavan and Cai (2007) proposed a fuzzy traffic control system to control traffic flows under ordinary and unexpected traffic situations for the isolated intersection. The developed system is receiving information from sensors that placed at incoming and outgoing lanes to make optimal decisions and to minimize the traffic delay. A simulator has been developed to evaluate the performance of the fuzzy system under different conditions. The fuzzy system showed better performance in up normal conditions and a similar performance in normal condition withexisting control system. Whereas,

Vonglao (2007) proposed a fuzzy logic system to calculate the best green time of each intersection phase at each cycle based on the traffic density for T, simple and roundabout intersections. The results showed that the developed control system is more efficient than a predictable controller.

Abbas et al. (2009) developed a fuzzy logic control algorithm to control traffic signals for flexible traffic on oversaturated isolated intersections with the integration of left and right turns. The developed control system was used to decide whether to extend the current green time or terminate it based on a set of fuzzy rules and real-time traffic information. It was also used to control the continuous and safe flow of emergency vehicles.

Zarandi and Rezapour (2009), proposed a fuzzy signal control system for the T-isolated intersection with two-way streets and left-turn lanes. The control system helped in the decision to extend or terminate the current green time and to change the sequence level based on the real-time traffic information. The performance of the proposed system was evaluated by using simulation methods. The results of the developed control system showed significant improvement over pre-timed control strategy.

3.0 Material and Methods

3.1 Analysis of Existing system

Rizwan et al. (2016) proposed a decentralised control model which was a combination of multi-destination routing and real time traffic light control based on a concept of cost-to-go to different destinations. Their work presented a basic electronic traffic signaling protocol framework and two of its derivatives, a reliable protocol for intersection traffic signals and one for stop sign signals. These protocols enabled recipient vehicles to robustly differentiate the signal's designated directions despite the potential

confusions caused by reflections. They also demonstrated how to use one of the protocols to construct a sample application: a red-light alert system and also raised the issue of potential inconsistency threats caused by the uncertainty of location system being used and discuss means to handle them. In some parts of Nigeria, previous analysis of the current traffic control system has shown that some of the junctions are controlled by traffic wardens while some are not manned at all. Some of these junctions also have traffic lights strategically located but are not intelligent. Traffic wardens could easily get tired as they are humans, and they can also vacate their duty post for shelter when the weather becomes unfriendly. Cars can experience long travel times due to inefficient fixed time traffic light controller being used at the some junctions in the cities. Moreover, there is no effective intelligent traffic system that works twenty four hours (day and night) to effectively control signal at these busy junctions. To make the system intelligent, proximity sensors or cameras will be used to monitor the traffic and activate a change in the cycle time of the lights. Less traveled routes may not really need a regular cycle of green light except when cars are present. However, this will depend largely on having prior knowledge of flow patterns at the intersection so that signal cycle times and placement of cameras or sensors may be customised for the intersection. They used Neural network algorithm which instigate the intelligent system in their work by combining fuzzy logic and genetic algorithm to makes the traffic system smart and effective for car passages.

3.1.1 Algorithm for the Existing System

N = 0
While N < 13
{
Random selection of initial population of 20 chromosomes from the pool population of 256 chromosomes
fuzzy rules are considered for the first Fuzzy Logic Controller (FLC1) :(1)*If (input1 is Few) and (input2 is Few) then (output1 is G1).* (2)*If (input1 is Few) and (input2 is*

Medium) then (output1 is G1).(3)*If (input1 is Few) and (input2 is Many) then (output1 is G1).*(4)*If (input1 is Medium) and (input2 is Few) then (output1 is G2).*(5)*If (input1 is Medium) and (input2 is Medium) then (output1 is G2).*(6)*If (input1 is Medium) and (input2 is Many) then (output1 is G1).*(7)*If (input1 is Many) and (input2 is Few) then (output1 is G3).*(8)*If (input1 is Many) and (input2 is Medium) then (output1 is G3).*(9)*If (input1 is Many) and (input2 is Many) then (output1 is G1).*

Evaluate the fitness of each chromosome in the population

Select chromosomes from the current population, being the probability of selection an increasing function of fitness.

Crossover to the pair at a randomly chosen point to form two offspring with probability of crossover equal to 0.1.

Mutate the two offspring at each locus with probability of mutation equal to 0.01, and place the resulting chromosomes

in the new population.

Replace the current population with the new population.

N = N+1

}

Select best chromosome as solution

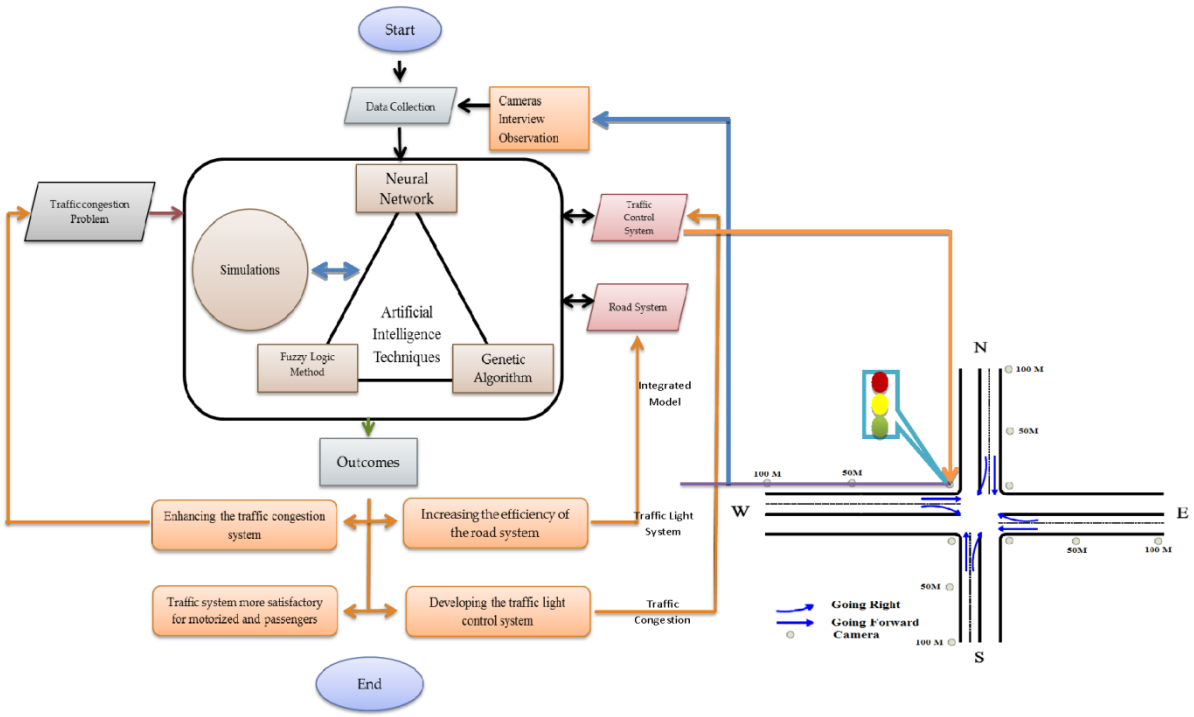

Figure 3.1: Architecture of the Existing system (Rizwan et al. 2016)

3.2 Analysis of the Proposed System

The proposed system tend to improve on the existing system of Rizwan et al. (2016) by initiating the smart and intelligence monitoring system that is specifically keep track of traffic offenders. This will be accomplished with the help of queue algorithm. The algorithm is a machine learning algorithm that is intended in solving the offenders by monitoring who break the rules of conventional traffic control system at the laboratory modelling stage. The conventional traffic control system indicates each light at a particular time interval to pass a vehicle at one lane and stop vehicle on the other lane. The light is broken into three (3) categories (Red, Amber and Green). This informs each lane what to do at a particular time, where the red signifies STOP, amber signifies READY, and green signifies GO. Each light is designed to turn itself on whenever it is necessary and turn off the time elapse. The improvement on this design is to have it make decisions (judgments) on

how to control traffic instead of using timer circuits alone. However, the number of private automobiles used mainly by people with middle and high income, has increased faster than any form of transportation in Lagos (Nigeria) and this has increased the demand of expansion of roads, parking space and improved computerised traffic control system. This project will however be limited to laboratory stage modelling of single-lane roads at every junction. “idea lot of time will be required to investigate traffic routines at different junctions, coupled with the challenges of electric power outages and funding, quite a couple of assumptions will be used in the design. In carrying out this project, a lot of time will be required to investigate traffic routines at different junctions. Current data from major roads are required. CCTV and some high focusing cameras are required at each junction where the traffic lights will be sited. With the knowledge of the present state of infrastructure in most Nigerian highways, these are tall orders. Electric power outages will be installed through the use of solar system in other to beat down the funding challenges. Figure 3.2 illustrated the proposed system.

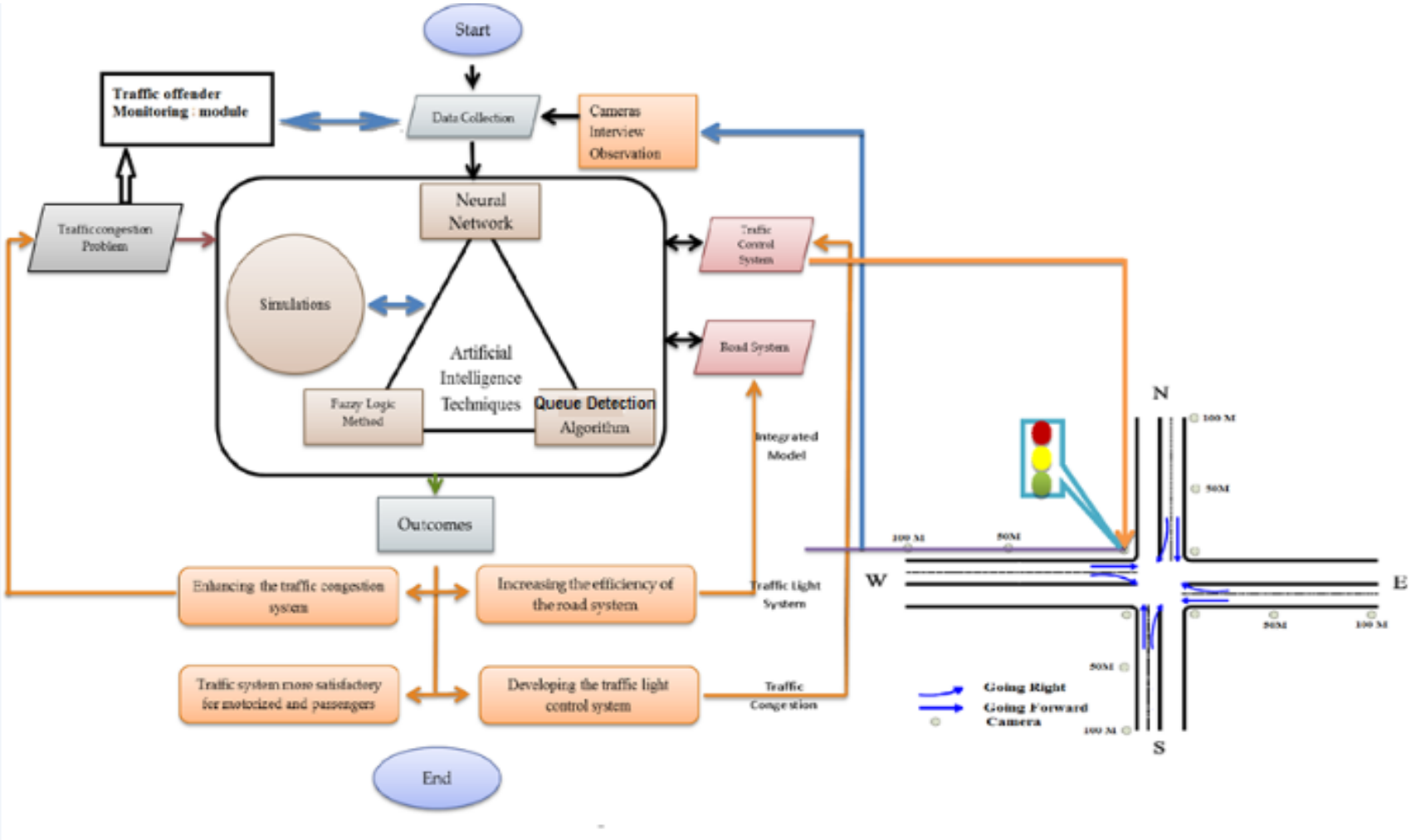

Figure 3.2: Architecture of the Proposed System

The traffic offender module is the new additional module to existing system whose functionality is to keep track and records of traffic offenders in a stationary position where traffic system is stationed. The traffic offender module used queue algorithm together with the existing system algorithm through the used of sensor to keep track of vehicle plate number and drivers face after he/she has committed the crime. The module uses in the system is composed of a Master Node (MN), which has superior computational and energy resources and is connected to a remote database via TCP/IP over UMTS. The MN is wirelessly connected to a number of regularly spaced Sensor Nodes (SNs) operating on a low duty-cycle and woken-up on demand. A basic module infrastructure deployed along the motorway is shown in Figure 3.2.1. This module can be spatially replicated on both sides of the motorway to cover a wide area.

The sound signal is detected and processed by the embedded resource of the MN using an original algorithm that allow to automatically extract traffic parameters on site. The information is transmitted to a central server and made available to a remote user.

When a queue or traffic jam is detected at the MN location the SNs are activated by the MN in order to locate the position of the queue or traffic jam, thus providing a real-time picture of the traffic flow sampled at the same space interval as the SN deployed on the motorway. The communication between the devices is performed by a crosslayer MAC Routing protocol. While it simultaneously supports communication with both the associated SNs by the RF Unit and with the central serve by the UMTS modem.

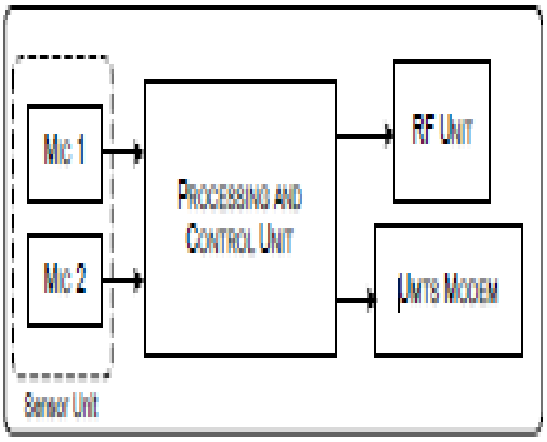

Figure 3.2.1: Proposed traffic offenders monitoring modules

A TCP-IP over UMTS Modem provides a bidirectional connectivity to the central server thus enabling a remote control of the MN operative parameters and creating an upgrade of the systems. The RF unit is based on Texas Instrument CC1000 low power transceiver operating in the UHF ISM band, implementing an FSK Manchester coding.

The setup of the MN is packaged into a compact lightweight panel which can be easy installed on the motorway's guardrail, While the MN Operation and Parameters Extraction Procedure is done when all vehicles emit characteristic sounds when moving on the road. The sound signal is connected to the source's position therefore, in reference to traffic sensing and vehicle detection can be achieved by processing the signal detected by the acoustic sensor.

The sensor unit consists in a pair of microphones (MIC1 and MIC2) arranged in a characteristic setup and deployed along the roadside, with the baseline parallel to the moving direction of the source.

4.0 Results and Discussions

The output or the results of this research will be discussed here. From the program screenshots to the matlab data analysis carried out . **IKC**values for the necessary field. The fields are Username and password and upon proper validation, the user will be redirected to the Evaluate page. If upon entering the field for the application\system and the user is not a registered user, he or she will be required to click on the sign up link in order to register so as to get proper

verification or validation. Also in the event that the user has forgotten his\her password, the user can then click on forgot password link in order to retrieve the login credential for the password. This is shown in figure 4.1

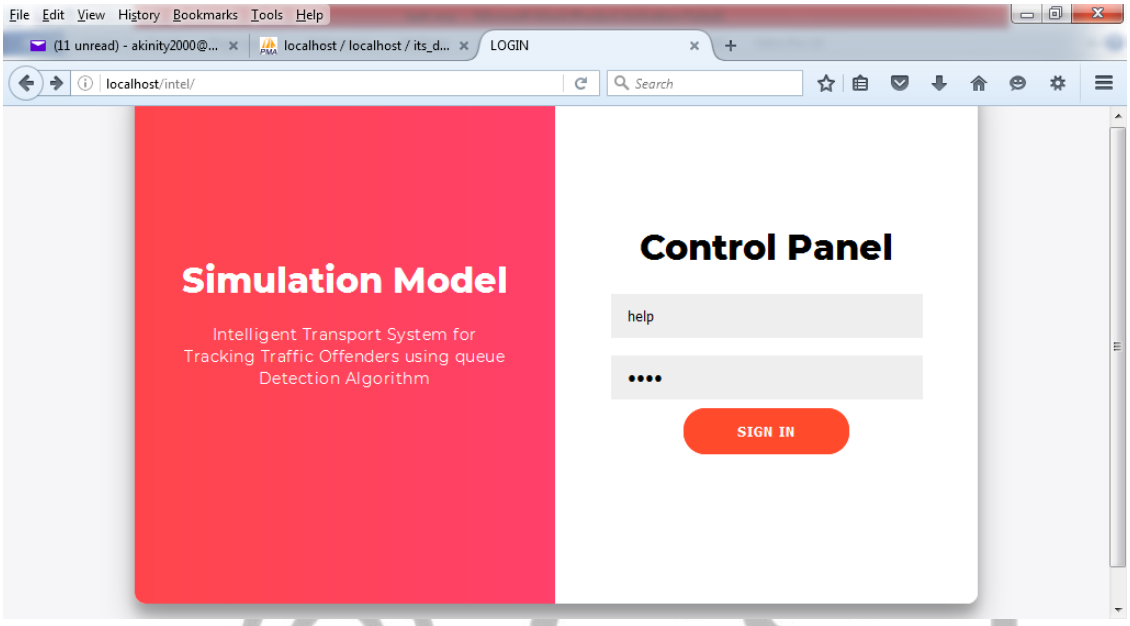

Figure 4.1: Login Page

Login Page: This is the first page the user gets to interact with. The user will be required to enter values for the necessary field. The fields are Username and password and upon proper validation, the user will be redirected to the Evaluate page. If upon entering the field for the application\system and the user is not a registered user, he or she will be required to click on the sign up link in order to register so as to get proper verification or validation. Also in the event that the user has forgotten his\her password, the user can then click on forgot password link in order to retrieve the login credential for the password. This is shown in figure 4.1

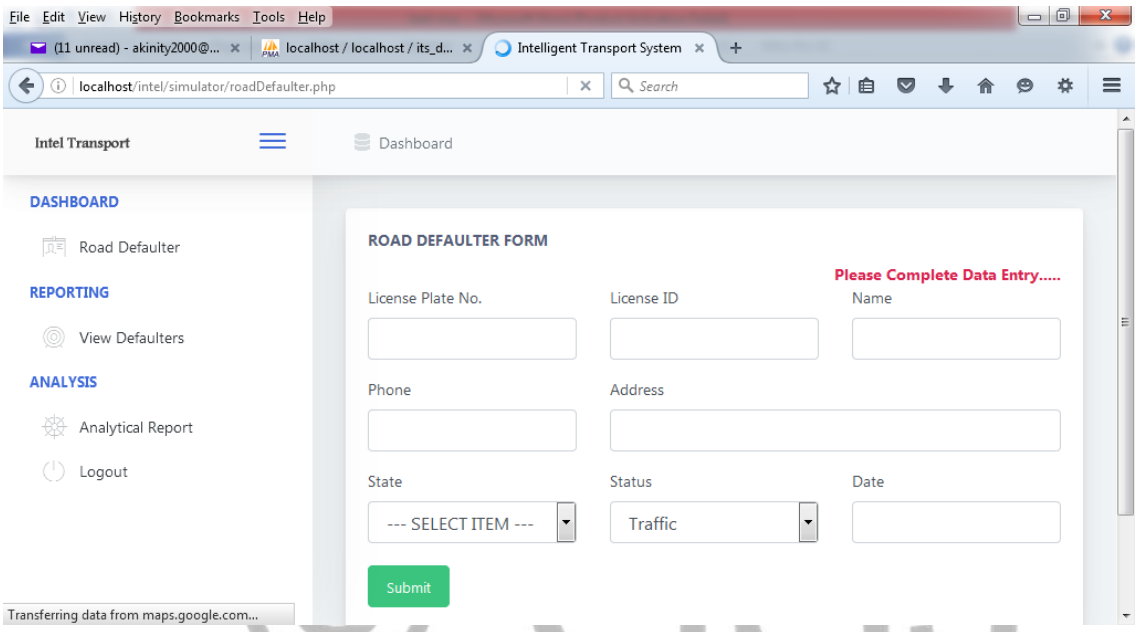

Figure 4.2: Registartion page

Register Page

The register page is presented to users who have not created an account with the system. The page requires users to enter their name, email address and password and then the register button is clicked. This will then inform the user that an account has been successfully created and from there, he is redirected to the login page where he must login with the registered credentials before proceeding to the evaluate page for checking his or her academic research finding. This is illustrated in figure 4.2

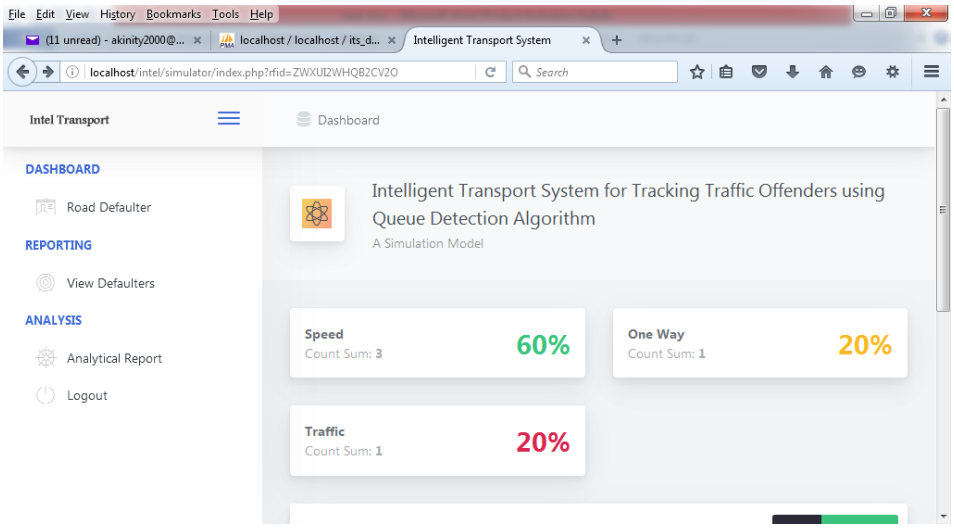

Fig 4.3: Evaluation Page

Figure 4.4 indicate the modules where punishments for the offenders while figure defaulters are kept and stored for in the 4.5 shows the analytical report of the mode database for proper screening and viable

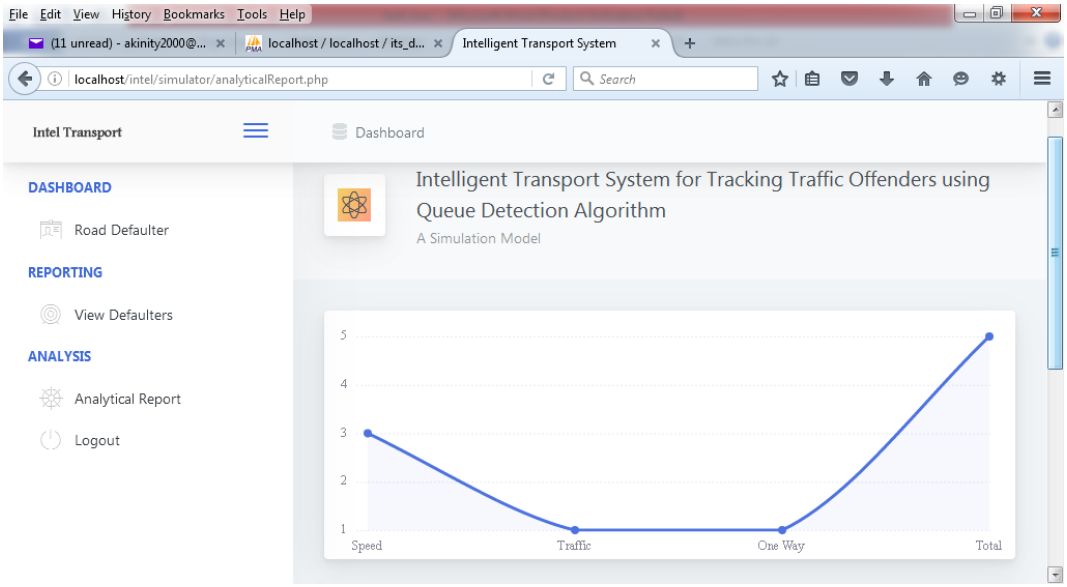

Fig 4.5: Analytical Report

5.0 Conclusion

In this work, the fuzzy logic and queue algorithms for traffic management in intelligent transportation system was used in metropolitan areas. The proposed algorithms allow to reduce travel time, fuel consumption and emissions. The results show that the proposed system can significantly reduce average travel time, fuel consumption and emissions.

This work is aimed at implementing a distributed intelligent transport system for detection traffic offenders and control of overloads, and viable punishment is given to the offenders. For this purpose, the proposed system is suggested to be distributed throughout the city to provide full coverage of the region.

In addition, each Road side controller units is responsible for managing congestion only in the area covered by its range. Thus, the vehicle can interact with a number of shares of the way to reducing the harmful impact of an overload, such as increased travel time, fuel consumption and O2 emissions.

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