IoT Based Smart Traffic Control System Using Sumo Traffic Simulator

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A thesis submitted to the Department of Electrical and Electronic Engineering in partial fulfillment of the requirements for the degree of
B.Sc in Electronic and Communication Engineering and B.Sc in Electrical and Electronic Engineering

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Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Abstract

Traffic congestion is the most alarming problem in the world now. Huge amount of different types of pollution and wastage of resources are seen due to traffic related issues. People waste a lot of time in traffic which is never said to be productive. Traffic problems cause damage to the people, their vehicles, environment they live on, and even the animals around them. Violating traffic rules is the most common reason of having a poor traffic condition for a certain area or country. This eventually give rises to other traffic problems throughout the world. Therefore design of smart traffic system using IoT is a reliable solution. Having a smart traffic system can minimize the traffic issues over time. Technology has improved a lot within last few decades. Using IoT wireless the traffic can be monitored, based on the monitored data automatically traffic signals can be controlled. Thus traffic can be developed. Using image processing, if anyone tries to violate traffic rules can be taken under law. People also can get traffic status of any road if smart traffic control system is implemented at that certain area. By this way, through developing every now and then, a very strong smart traffic control system can be implemented. Over time traffic issues can be eliminated from the world.

Keywords: IoT, Smart, Traffic, Control, Sumo, Sumo Gui, Simulator.

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List of Acronyms

IoT	Internet of Things
GUI	Graphical User Interface
PCE	Passenger Car Equivalent

Chapter 1

Introduction

1.1 Objective

The main objective of this thesis paper is to enhance the traffic system using sensors for making a congestion free road and to minimize the human intervention in controlling traffic signals using (IoT internet of things). Everyday millions of vehicles are moving on the road and to maintain road safety, an error free traffic system is essential. Our roads are using the traffic system which are mostly controlled manually. Human intervention cause error and this error might cause a fatal accident. To avoid such accidents we would like to introduce a system which will cause traffic system to work efficiently using IR sensors. The vehicles on the road of Dhaka city and its neighboring districts are increasing every day and with increasing numbers of vehicles on the road it is however difficult to control the rules and regulation of the roads manually for the traffic police and other officials. The proposed SMART traffic control system can reduce the pressure from the traffic police and will help to boost the efficiency in maintaining the rules and regulations for the road officials. The process of the STC is to detect the congestion of the vehicle.

1.2 Background

Lately, road congestion is growing rapidly. In cities and outskirts, the number of vehicles are increasing every day. Vehicle jams are resulting in increasing carbon emission, time moving from one place to another increasing which results in valuable time loss and more importantly the wastage of fuel is touching huge numbers. Poor traffic management and lack of organization are causing long waiting on roads. Momentary causes incorporate traffic signal flaws, wasteful law requirement, lack of street foundation, mishaps and so on. Long haul causes are credited to financial development of the general public, changes in way of life of individuals and so forth. As a result, traffic issues have turned out to be one of the vital territories to be investigated. It incorporates observing of traffic thickness, correspondence, rerouting of traffic to dodge further postponement. IoT of things can help in smooth usage of traffic framework. Traffic system are the most common system around the globe used every day in the transportation sector for preventing traffic congestion caused by vehicles, to provide ease in vehicle movements on the road and to provide road safety for the pedestrians. More than a billion vehicles are moving every day on roads and everyday using this traffic system for moving.

https://www.greencarreports.com/news/1093560_1-2-billion-vehicles-on-worlds-roads-now-2-billion-by-2035-report

The first-time traffic system was implemented using a three-light signal in USA and these three lights green, amber and red used at every intersection around the world to signal the vehicles whether to move or to stop. The system was essential in order to maintain road safety measurements. However, despite having this system many unwanted incidents happened which causes death and severe injuries. In Bangladesh 4,702 accidents were reported in 2019, in which caused a number of 5227 people died and 6953 people were injured.

(https://www.thedailystar.net/frontpage/bangladesh-road-accidents-in-2019-stats-by-nirapad-sarak-chai-1849588)

Apart from accident every Bangladeshi citizen waster their valuable time on traffic congestion and less movements results in excessive carbon emission. A study suggested that traffic in Dhaka city alone waste 5million working hours.

1.3 IoT: Internet of Things

IOT, (internet of things) is a system which enhances the connectivity of more than one object in our day to any life. With the help of IOT we can stay connected with our designed things via internet. We can track the security of our house, we can track the position of our children etc. All we need is Internet to connect our hardware. The data in the hardware is mainly sent by sensors. We can use the sensors and programmed them for our good purpose. In order to program the sensor a micro controller is used in order to provide a gateway the data to be exchanged. Sensor reads the according to the instructions which had been programmed in arduino or at mega 32. Internet connection is widespread now. Around the globe more than 4 billion people are using internet. So, with the help of internet we can read the data from the sensors, exchanged in the micro controller and can be sent anywhere or can be stored in hard drive or in online drive for future use. Today we can see the weather forecast on our smartphone which is literally done by IOT. The sensors and the tools of weather forecast station collects the data of temperature and that data is uploaded on the internet and providing information for the weather to a lot of people. This phenomena is very essential for travelling and transportation.

Chapter 2

Methodology

2.1 Software and Interface

For the Smart Traffic Control System, Sumo Traffic Simulation software was used. Sumo works with python integration and basically a user interface for traffic simulation. Sumo has been used here to prepare a custom map. The map has several intersections to operate a dynamic traffic system. Here in this traffic system traffic lights with custom algorithms have been incorporated. Objective here is to mitigate real life traffic issues implementing an automated smart traffic control system. Outcome contains better traffic status and less pollution along with roads safely using the interface of sumo gui.

To mitigate issues like Cross Blocking, Green Idling, Vehicle floating and excessive pollution effective traffic system is needed right now for the entire world. To avoid cross blocking and green idling issues, green light timing can be- (i) lengthened (ii) shortened or skipped as per situation demands.

Cross Blocking: When downstream is full and no vehicle can pass despite green light.

Green Idling: When no vehicle is there but green light is on for a lane.

For Smart Traffic Control System, Sumo traffic simulator has been used. Here 4 roads with 2 lanes each which are connected in an intersection have been chosen as a base model. Several intersections are connected together to make a network. Each intersection contains a traffic light. Each lane has two sensors namely lane Area detector sensor and Induction Loop Detector sensor. These two sensors actually help to configure traffic lights with certain algorithms. A grid of 10 intersections has been taken as a map.

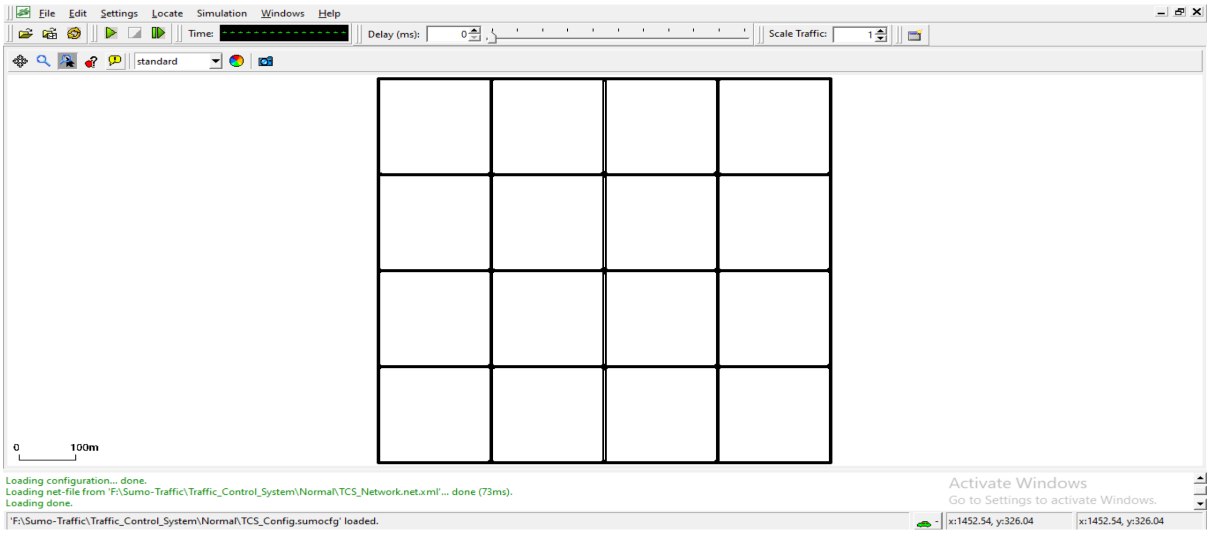


Fig: A custom map with 10 Intersections

For integrating TraCI with the system, additional tagged files containing Sensors' algorithms have been added to the main sumo configuration file. Here traffic lights and Sensors are enabled and modified in the sumo net-edit interface. Ordinarily, 90sec is used to be the dedicated green light time for a lane. After installing an induction loop detector and lane Area Detector Sensors time for getting a green light direct depends on the lane coverage. An intersection has been taken as a standard to implement various operations.

2.2 Algorithm

For emergency vehicle to pass, following code has been implemented as a python script based on runner.py module.

```
<tlLogic id="B1" type="static" programID="0" offset="0">
<phase duration="42" state="GrGr"/>
<phase duration="3"  state="yryr"/>
<phase duration="42" state="rGrG"/>
<phase duration="3"  state="ryry"/>
</tlLogic>
```

Here, if a vehicle is identified as an emergency vehicle then for that particular lane this code will run simultaneously until the vehicle can pass. Following has an intersection representation with one Induction loop sensor and Lane area sensor to read proper data from the road conditions.

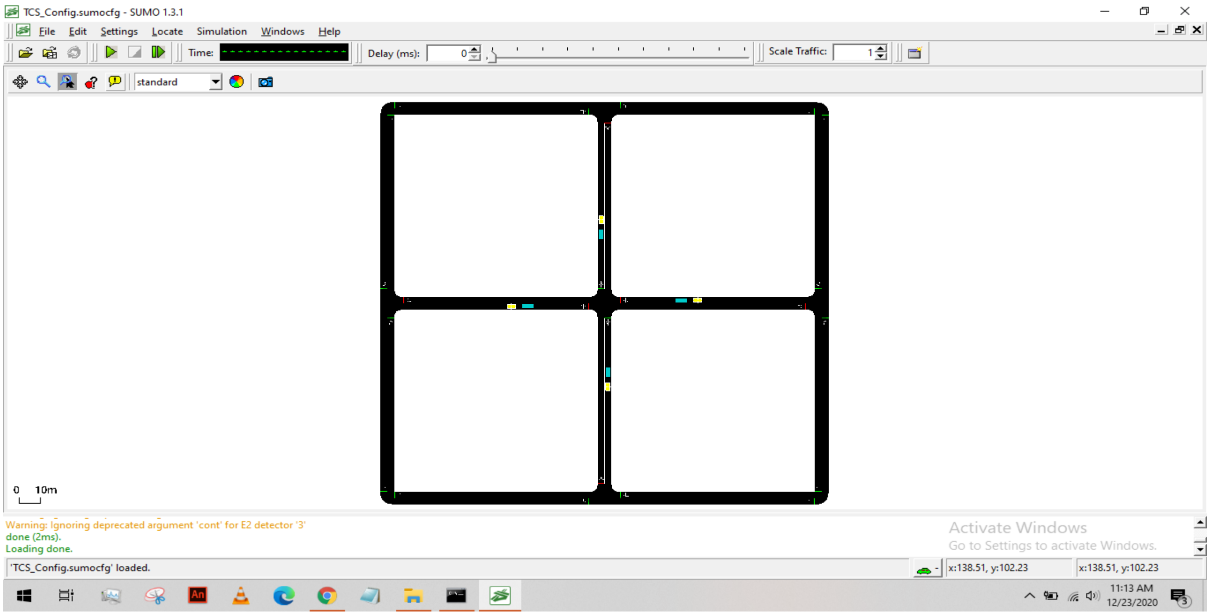


Fig: A single intersection taken to monitor traffic conditions

For induction loop and lane area detector sensor following codes has been integrated with the configuration file:

```
<inductionLoop id="0" lane="B2B1_0" pos="50"
freq="100" file="null"
friendlyPos="false" splitByType="true"/>
<laneAreaDetector id="3" lane="B0B1_0" pos="55"
length="5" freq="100"
file="null" cont="true" timeThreshold="7"
speedThreshold="50" jamThreshold="9" friendlyPos="false"/>
```

For traffic lights in any intersection following algorithm has been implemented as a part of the lane observation and decision taking on the fact that green idling and cross blocking is checked. If there are four lanes with induction loop and lane area detector sensor in any intersection, then we consider how many vehicles are present in the lane and area or portion of lane that was covered by the vehicles. Considering the vehicle density green light is allocated to the most required lane. Empty lanes are avoided during the green light cycling and less vehicle density lanes are given with less priority if there is no emergency vehicles are present. The algorithm looks something like:

```
getInductionLoopData ()
getLaneAreaDetectionData ()
x, y = traci.vehicle.getPosition(vehID)
traci.simulationStep()
while traci.simulation.getMinExpectedNumber() > 0:
<tlLogic id="A1" type="static" programID="0" offset="0">
<phase duration="42" state="GrGr"/>
<phase duration="3"  state="yryr"/>
<phase duration="42" state="rGrG"/>
<phase duration="3"  state="ryry"/>
</tlLogic>
def run():
   step = 0
    traci.trafficlight.setPhase("A1", 2)
    while traci.simulation.getMinExpectedNumber() > 7:
        traci.simulationStep()
        if traci.trafficlight.getPhase("B1") == 2:
            if traci.inductionloop.getLastStepVehicleNumber("0") > 9:
                traci.trafficlight.setPhase("B1", 3)
            else:
                traci.trafficlight.setPhase("B1", 2)
        step += 1
    traci.close()
```

Chapter 3

Implementation

In order to comply with Webster's formula, timely traffic volumes are used in the flow calculation. With regard to different vehicle types, PCE is used as a unit for traffic volume where a truck, a bus, or a coach is equivalent to 3.5 passenger cars, a bicycle equals to 0.2 passenger car and a motorcycle equals to 0.5 passenger car. Normally when traffic lights are configured, it follows an algorithm which is taking readings from the lanes and calculating a timing cycle for an intersection. There are certain issues with ordinary automated traffic lights, mentionable terms are, cross blocking and green idling.

3.1 Smart Traffic Light Control

To mitigate traffic issues, Green Light timing can have three cases briefly mentioned above. Those cases are:

Lengthened- Here if too much traffic hits on a lane and allocated timing is not sufficient to increase efficiency of the traffic system then the timing is being extended for that lane. So it gets more time to pass the traffic and violate the algorithm to increase efficiency.

Shorted- When certain lane contains less traffic but allocate green time is more than necessary which is time consuming for other lanes having vehicles to pass. Therefore, Green light timing will be shortened for these lanes.

Skipped- If a lane does not contain any vehicle green light needs to be ignored for that lane so that others can get some benefit out of it. Sumo has an integrated vehicle tracking system in it which is generating the vtk file. Here from this we can encounter any vehicle in the network.

Their speed, emission and co-ordinates for a certain instance can be monitored. Damaged vehicles on the roads can also be detected faster.

Induction Loop Detector and lane Area Detector can count vehicles and they can detect incoming vehicles as well. Here the algorithm is, when a lane encounters vehicles on a sensor having on the mark of threshold, Traffic light interrupts and shows a green light for that lane. After the cycle ends normal traffic algorithm works, if another lane shows the same threshold situation then traffic algorithm shows green light to that lane after completing the previous situation. Thus, green idling and cross blocking are being tackled.

Lane Area Detector Sensor is more of like a vehicle tracking camera in any traffic area. Therefore, in contrast to an induction loop, a lane area detector has a certain length which is specified through length attribute declaration. Output here is measuring either standing or jammed vehicles and keep tracking vehicles currently present on its range.

3.2 Emergency Vehicle

To deal with the emergency vehicles, activating induction loop in a way that whenever the loop detects an emergency vehicle, it switches to Green phase and all other lanes are given with Red phase as an interrupt of the whole system. Following screenshots shows how an emergency vehicle is being dealt with. Here as soon as the vehicle is detected by induction loop the lane switches to Green Phase. If more than one induction loop sensors detect emergency vehicles then the prior lane will show Green phase then other lanes will have their Green phase.

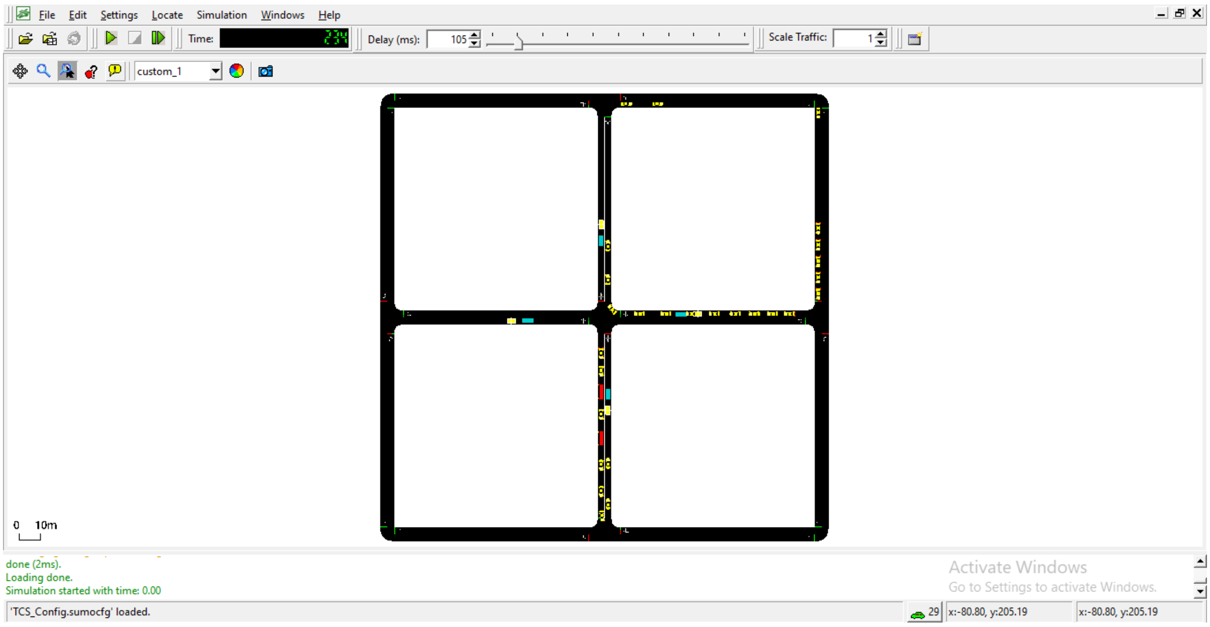


Fig: Lane without any emergency vehicle detection

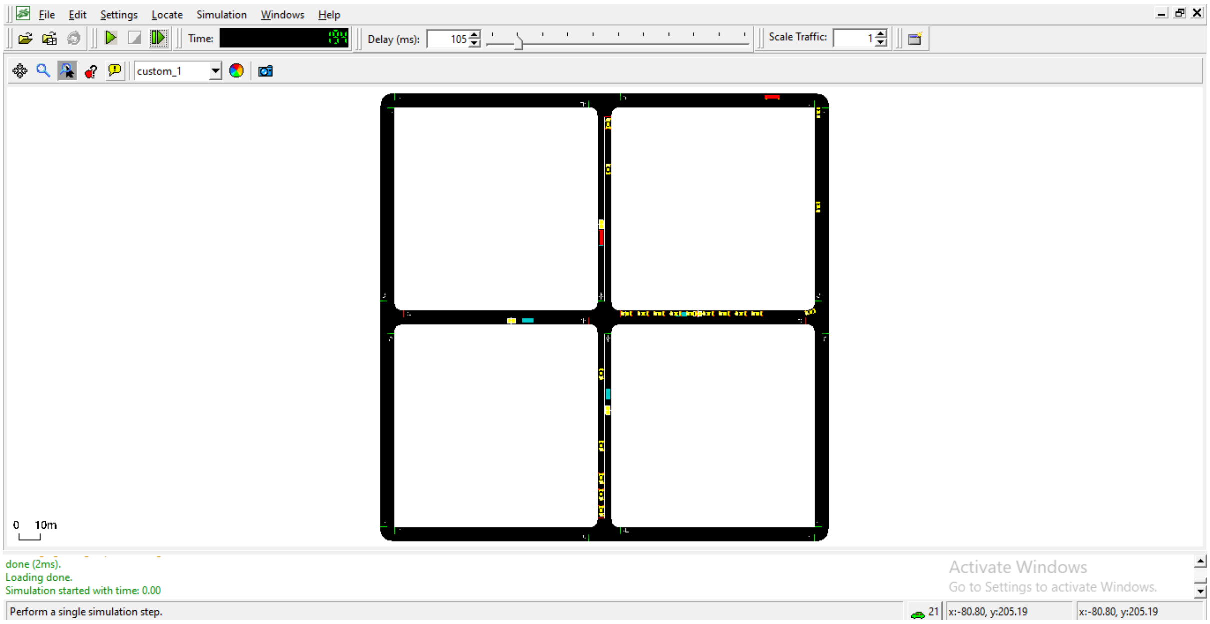


Fig: Situation of Emergency vehicle detected

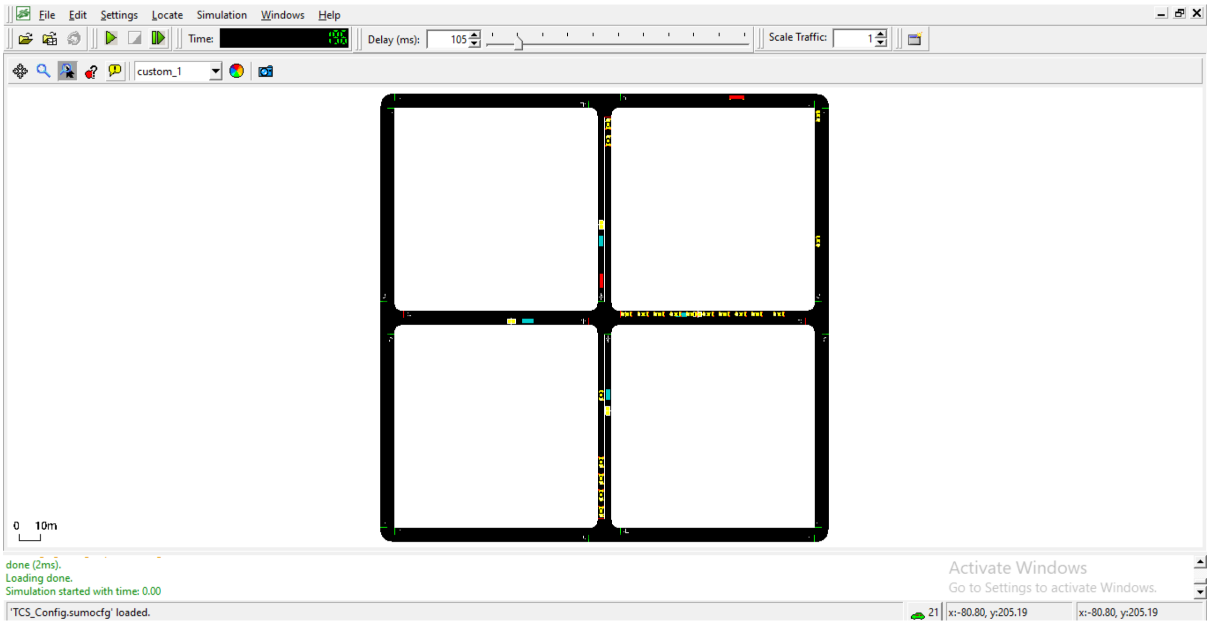


Fig: Green phase for the emergency vehicle to pass

3.3 Green Idling and Cross Blocking Checked

Previously, it has been mentioned that green idling and cross blocking are two major incidents that costs a huge valuable time to the people by getting stuck in the traffic. The smart traffic system has been designed in such a way that before taking any detector readings, system checks for green idling or cross blocking issues are there or not. If the system, finds any empty lane. It simply discards the lane during traffic light system calculation. Thus green light and cross blocking has been mitigated.

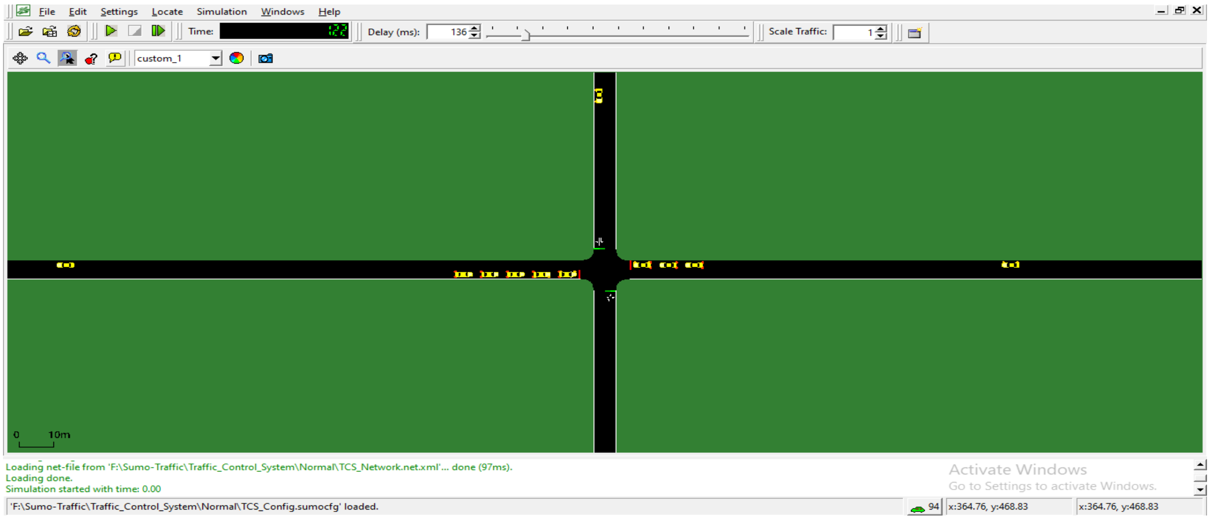


Fig: Ordinary Traffic System where green idling is seen as empty lane has green light when other lanes are in red light creating traffic jams

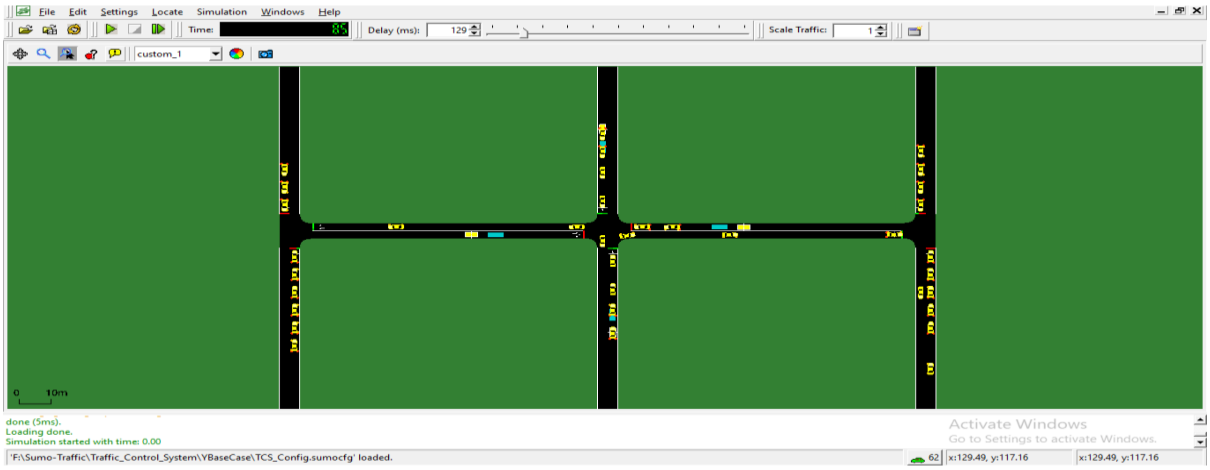


Fig: Green Idling and Cross blocking has been eliminated in Smart Traffic Control System

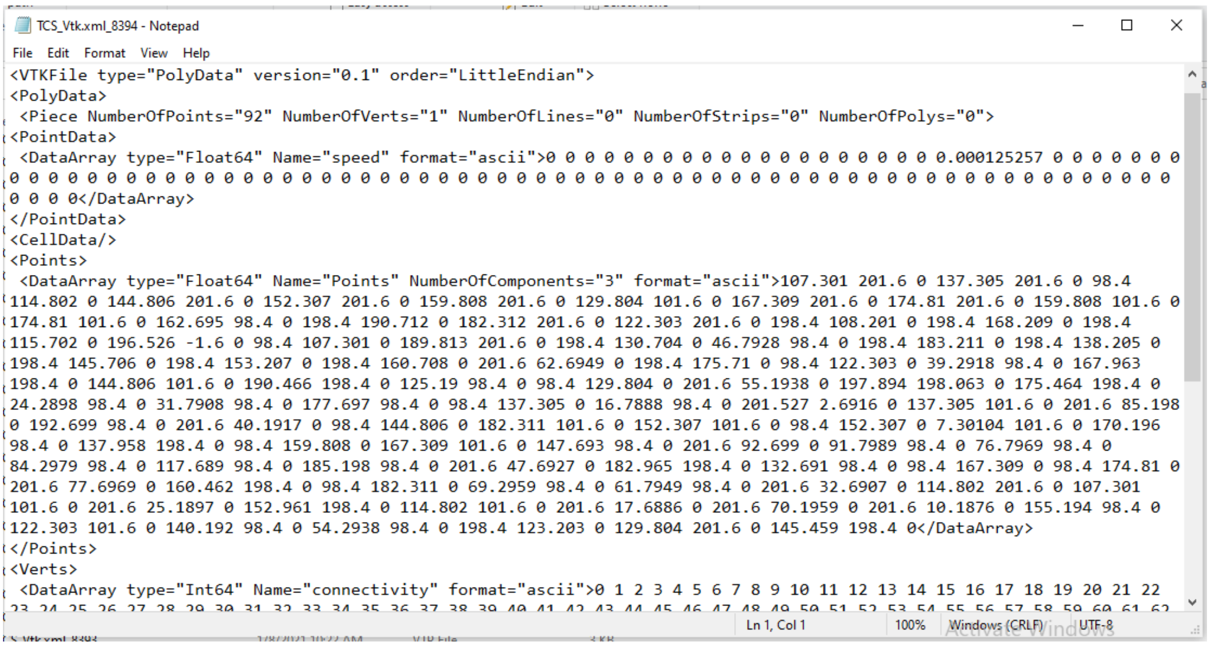
Chapter 4

Result and Improvements

Every system is being develop to make life easier and efficient. Traffic issues cost the most for every single people, from corporates to students, businesses to medical emergencies, and so on.

4.1 Tracking Vehicle Location

Vehicle tracking can be done using vtk file type. Here, vtk file gives an output for each and every vehicle containing coordinates of the location of certain vehicle in every time step. The location is a three dimension coordinate system thus very precise and accurate location can be observed along with elevation of the certain place where the vehicle is present or passing. In the same way Induction Loop and Lane Area Detector sensor have altogether a feature named MIMO (multiple input and multiple output), calculates vehicle entering in any lane and thus consecutive readings can give a clear route map for any vehicle present in the system.

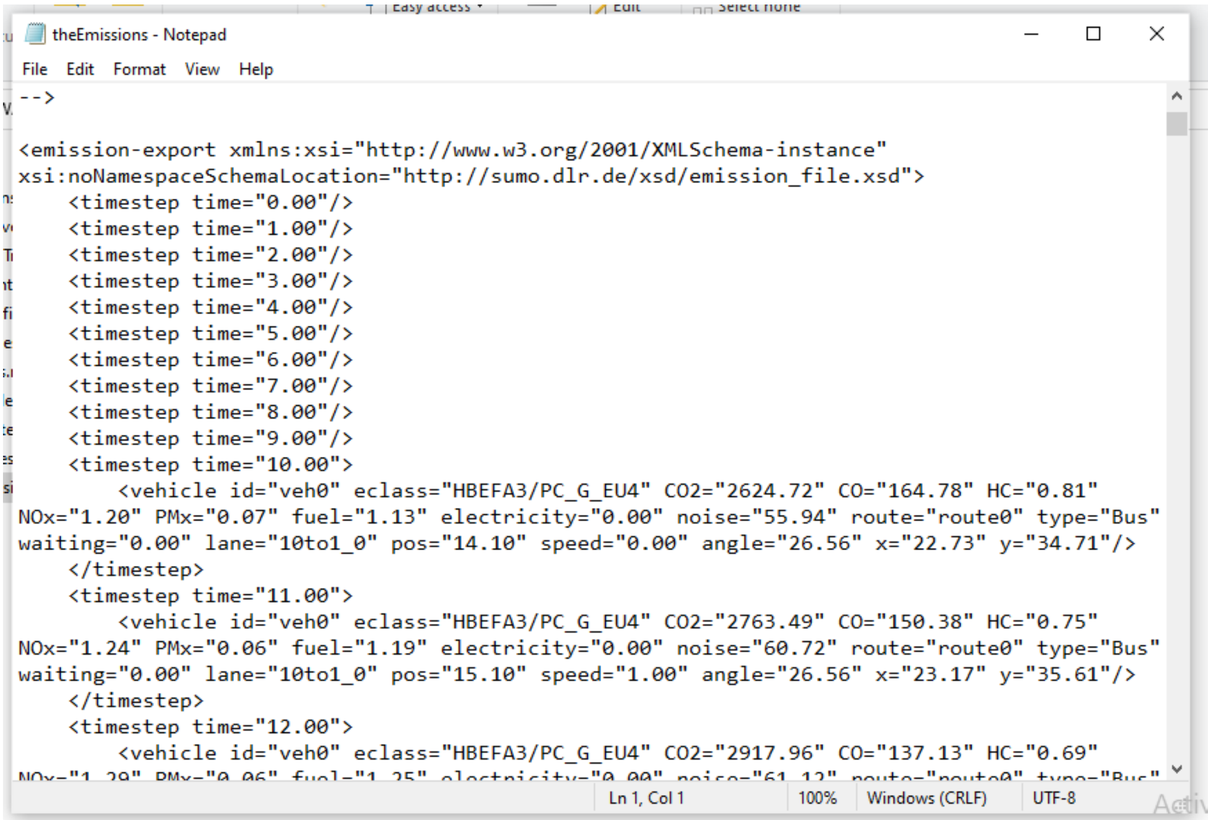


```
TCS_Vtk.xml_8394 - Notepad
File Edit Format View Help
<VTKFile type="PolyData" version="0.1" order="LittleEndian">
<PolyData>
 <Piece NumberOfPoints="92" NumberOfVerts="1" NumberOfLines="0" NumberOfStrips="0" NumberOfPolys="0">
<PointData>
 <DataArray type="Float64" Name="speed" format="ascii">0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.000125257 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0</DataArray>
</PointData>
<CellData/>
<Points>
 <DataArray type="Float64" Name="Points" NumberOfComponents="3" format="ascii">107.301 201.6 0 137.305 201.6 0 98.4
114.802 0 144.806 201.6 0 152.307 201.6 0 159.808 201.6 0 129.804 101.6 0 167.309 201.6 0 174.81 201.6 0 159.808 101.6 0
174.81 101.6 0 162.695 98.4 0 198.4 190.712 0 182.312 201.6 0 122.303 201.6 0 198.4 108.201 0 198.4 168.209 0 198.4
115.702 0 196.526 -1.6 0 98.4 107.301 0 189.813 201.6 0 198.4 130.704 0 46.7928 98.4 0 198.4 183.211 0 198.4 138.205 0
198.4 145.706 0 198.4 153.207 0 198.4 160.708 0 201.6 62.6949 0 198.4 175.71 0 98.4 122.303 0 39.2918 98.4 0 167.963
198.4 0 144.806 101.6 0 190.466 198.4 0 125.19 98.4 0 98.4 129.804 0 201.6 55.1938 0 197.894 198.063 0 175.464 198.4 0
24.2898 98.4 0 31.7908 98.4 0 177.697 98.4 0 98.4 137.305 0 16.7888 98.4 0 201.527 2.6916 0 137.305 101.6 0 201.6 85.198
0 192.699 98.4 0 201.6 40.1917 0 98.4 144.806 0 182.311 101.6 0 152.307 101.6 0 98.4 152.307 0 7.30104 101.6 0 170.196
98.4 0 137.958 198.4 0 98.4 159.808 0 167.309 101.6 0 147.693 98.4 0 201.6 92.699 0 91.7989 98.4 0 76.7969 98.4 0
84.2979 98.4 0 117.689 98.4 0 185.198 98.4 0 201.6 47.6927 0 182.965 198.4 0 132.691 98.4 0 98.4 167.309 0 98.4 174.81 0
201.6 77.6969 0 160.462 198.4 0 98.4 182.311 0 69.2959 98.4 0 61.7949 98.4 0 201.6 32.6907 0 114.802 201.6 0 107.301
101.6 0 201.6 25.1897 0 152.961 198.4 0 114.802 101.6 0 201.6 17.6886 0 201.6 70.1959 0 201.6 10.1876 0 155.194 98.4 0
122.303 101.6 0 140.192 98.4 0 54.2938 98.4 0 198.4 123.203 0 129.804 201.6 0 145.459 198.4 0</DataArray>
</Points>
<Verts>
 <DataArray type="Int64" Name="connectivity" format="ascii">0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Ln 1, Col 1    100%    Windows (CRLF)    UTF-8
```


Fig: vtk file of 8394th vehicle of the system taken random as an example

4.2 Monitoring Vehicle Condition

Smart traffic control system has been developed to be an incredible traffic solution for all issues. Vehicle condition plays a great role in the traffic. Vehicles with good conditions are less pollutants to the environment. Smart traffic control system can detect faulty and malfunctioning vehicles. Using the emission outputs for each vehicle in every time step, Carbon di Oxide CO2, Carbon Mono oxide CO, Hemocyanin HC, Nitrogen Oxide NOx, and many other pollutants can be observed. Here, Electronic vehicles are also included. Fuel consumption and noise pollutions can be monitored as well, with that, fuel consumption has been reduced a lot using smart traffic control system.



```
-->

<emission-export xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="http://sumo.dlr.de/xsd/emission_file.xsd">
    <timestep time="0.00"/>
    <timestep time="1.00"/>
    <timestep time="2.00"/>
    <timestep time="3.00"/>
    <timestep time="4.00"/>
    <timestep time="5.00"/>
    <timestep time="6.00"/>
    <timestep time="7.00"/>
    <timestep time="8.00"/>
    <timestep time="9.00"/>
    <timestep time="10.00">
        <vehicle id="veh0" eclass="HBEFA3/PC_G_EU4" CO2="2624.72" CO="164.78" HC="0.81"
NOx="1.20" PMx="0.07" fuel="1.13" electricity="0.00" noise="55.94" route="route0" type="Bus"
waiting="0.00" lane="10to1_0" pos="14.10" speed="0.00" angle="26.56" x="22.73" y="34.71"/>
    </timestep>
    <timestep time="11.00">
        <vehicle id="veh0" eclass="HBEFA3/PC_G_EU4" CO2="2763.49" CO="150.38" HC="0.75"
NOx="1.24" PMx="0.06" fuel="1.19" electricity="0.00" noise="60.72" route="route0" type="Bus"
waiting="0.00" lane="10to1_0" pos="15.10" speed="1.00" angle="26.56" x="23.17" y="35.61"/>
    </timestep>
    <timestep time="12.00">
        <vehicle id="veh0" eclass="HBEFA3/PC_G_EU4" CO2="2917.96" CO="137.13" HC="0.69"
```


Fig: Emission output for Monitoring Vehicle Condition

4.3 Tracking over Speeding

Over speeding is one of the major reasons for accidents to occur. Smart traffic system has ways to determine such cases. System has Lane Area Detector sensors which works like a camera mounted on any road. This sensor can record speed of any vehicle like the speedometer does. Therefore speed of any vehicle can be monitored in real time that passes over the sensor. Another way of tracking such case is generating emission type file. Here the file contains every details of a vehicle on the system. The file works like vehicle monitoring output. Therefore the file gives clear idea about speed of any certain vehicle.


```
    <timestep time="24.00">
        <vehicle id="veh0" eclass="HBEFA3/PC_G_EU4" CO2="5996.16" CO="68.62" HC="0.45"
NOx="2.43" PMx="0.11" fuel="2.58" electricity="0.00" noise="67.47" route="route0" type="Bus"
waiting="0.00" lane="10to1_0" pos="119.10" speed="14.00" angle="26.56" x="69.68"
y="128.63"/>
        <vehicle id="veh1" eclass="HBEFA3/PC_G_EU4" CO2="5326.12" CO="68.45" HC="0.44"
NOx="2.16" PMx="0.09" fuel="2.29" electricity="0.00" noise="66.31" route="route1" type="Car"
waiting="0.00" lane="2to1_0" pos="81.10" speed="12.00" angle="264.29" x="307.81"
y="415.60"/>
        <vehicle id="veh2" eclass="HBEFA3/PC_G_EU4" CO2="4438.82" CO="76.89" HC="0.45"
NOx="1.82" PMx="0.08" fuel="1.91" electricity="0.00" noise="64.58" route="route2"
type="Truck" waiting="0.00" lane="10to11_0" pos="57.10" speed="9.00" angle="0.00" x="4.80"
y="84.21"/>
        <vehicle id="veh4" eclass="HBEFA3/PC_G_EU4" CO2="3178.91" CO="119.45" HC="0.62"
NOx="1.37" PMx="0.06" fuel="1.37" electricity="0.00" noise="61.76" route="route2"
type="Truck" waiting="0.00" lane="10to11_0" pos="20.10" speed="3.50" angle="0.00" x="4.80"
y="47.21"/>
    </timestep>
```


Fig: A certain time step for a Vehicle with ID to monitor speed and location

4.4 Traffic Control on Intersections

Traffic jam due to traffic signal is annoying for all. Traffic lights have certain time cycle that allows a certain for every lane to pass green light in turns. Green Idling and Cross Blocking was two issues which Smart traffic control system mitigated with advanced custom traffic algorithms. Among few thousands vehicle simulation in Sumo, random data has been collected from 15 vehicles. Normal traffic system has way higher waiting time on signals. More waiting on signals means more waste of time and drivers being impatient. Highest impatience has been noted as 18%, highest waiting time found is 44 seconds. This may lead to stress and panic attacks for People having emergency issues that may result accidents on the road.

Normal Traffic Condition					Smart Traffic Condition			
Desired Depart	Impatience	Time Loss	Waiting Time	Vehicle	Waiting Time	Time Loss	Impatience	Desired Depart
38	0.15	55.58	44	Vehicle 01	25	29.9	0.08	1
113	0.08	70.62	23	Vehicle 02	18	25.9	0.06	1.25
29	0.13	44.12	38	Vehicle 03	9	14.6	0.03	7
17	0.11	40.41	33	Vehicle 04	11	15.2	0.06	6.3
48	0.16	65.54	29	Vehicle 05	23	23.4	0.06	5.1
58	0.12	49.63	37	Vehicle 06	13	14.6	0.04	4.7
102	0.09	57.12	41	Vehicle 07	15	23.9	0.07	2
78	0.13	60.32	34	Vehicle 08	31	37.8	0.05	3.8
95	0.17	47.67	33	Vehicle 09	22	12.3	0.06	7
36	0.08	70.76	41	Vehicle 10	24	11.8	0.03	3.6
68	0.11	61.82	39	Vehicle 11	13	25.7	0.06	5.5
61	0.15	46.71	44	Vehicle 12	16	27.4	0.08	2
49	0.18	56.18	31	Vehicle 13	29	29.5	0.03	6
57	0.13	37.55	38	Vehicle 14	19	33.1	0.06	8.3
88	0.07	68.33	41	Vehicle 15	27	13.5	0.04	1.7

Table: Comparison between ordinary traffic control systems with Smart Traffic Control System on a traffic signals

Smart traffic control system has improved algorithms to deal with all these issues. Highest waiting time has been reduced to a highest value of 31 seconds and impatience to a highest value of 8%. Thus around 50% chances of accidents has been overcome. The comparison table of following also shows desire departure time which is when a driver thinks he may pass the road was way high 113 seconds for normal traffic system which has been reduced to a maximum of 8.3 seconds. Therefore travelling and commuting from one place to another becomes more efficient than before. Efficiency with safety has been taken care of altogether. Smart traffic system can be a game changer for the world as it not only controls traffic it monitors and controls every single vehicle present in the system.

Chapter 5

Future Development

Traffic congestion is the most alarming problem in the world now. Huge amount of different types of pollution and wastage of resources are seen due to traffic related issues. People waste a lot of time in traffic which is never said to be productive. Traffic problems cause damage to the people, their vehicles, environment they live on, and even the animals around them. Violating traffic rules is the most common reason of having a poor traffic condition for a certain area or country. This eventually give rises to other traffic problems throughout the world. Mental damages, Anxiety are the things to be faced by the people who all are commuting one city to another in their everyday life for various purposes. A number of accidents are also recorded every now and then which is due to inefficient traffic system as well. Therefore design of smart traffic system using IoT is a reliable solution. Having a smart traffic system can minimize the traffic issues over time. Technology has improved a lot within last few decades. Using IoT wirelessly the traffic can be monitored, based on the monitored data automatically traffic signals can be controlled. Thus traffic can be developed. Using image processing, if anyone tries to violate traffic rules can be taken under law. People also can get traffic status of any road if smart traffic control system is implemented at that certain area. By this way, through developing every now and then, a very strong smart traffic control system can be implemented. Over time every single traffic issues of any kind can be eliminated from the world.

5.1 Smart Traffic Parking System

The data is collected from completely different distributed sensors in indoor parking and on-street parking. Second, the collected information from the sensors are going to be analyzed and processed domestically with the assistance of IoT devices. It's planned that a true time process for the good parking information is extracted from the sensors. The info are going to be evaluated by exploitation machine learning algorithms that successively processes in line with predefined conditions. Additionally, the system includes portable application that lets users simply check the closest automobile parking with avoiding doable traffic jam via Google API that provides a true time reading of the traffic standing. The cloud internet service can collect the information from fog microcontroller distributed devices that are close to user’s location to start out analyzing and process data. Then the info are going to be transmitted to users to point the closest on the market parking that offers the bottom traffic jam. Therefore, the user can receive a right away response from the cloud showing the amount of accessible parking places delineated within the map with the less packed roads from users existing location.

5.2 Real Time Traffic Update

The transportation project for the Peking Olympic Games may be a nice example of providing traffic updates through public message units. The project used changeable message boards, radios, television, internet, and in-vehicle displays to observe and dispatch traffic updates. However, system development was quite overpriced because of advanced programs and devices. After that, many analysis efforts are created during this space to supply period traffic updates. A system is projected to show traffic intensity through 3 totally different lightweight colors on put in electronic boards at call points. During this system, the period traffic density is calculated from the typical vehicle speed determined by vehicle detection systems. The authors apply image process algorithms to method period traffic videos, and also the holdup estimation relies on optical flow. Similarly, electronic signboards square measure accustomed to avoid congestions by fixing totally different speed limits

This section presents the review of sensors that are used for vehicle detection and classification. The sensors utilized in intelligent traffic watching systems will be on-road sensors or in-vehicle sensors. The on-road traffic sensors will be once more classified into 2 types: intrusive and non-intrusive. The intrusive sensors are sealed on the road and are expensive compared to non-intrusive sensors. The intrusive sensors give correct information; but, they're questioned for the expenses in terms of installation. Maintenance, repair prices. The upkeep of such sensors needs road lane closures and traffic disruptions. The non-intrusive sensors will be mounted on totally different elements of roads/roadsides. This includes magnetic sensors, inaudible sensors, infrared sensors, acoustic sensors, video cameras; every sensing element has its benefits and downsides. The inaudible sensors are vulnerable to environmental factors. The video watching systems are relatively expensive than different sensors once considering the acquisition, installation, and maintenance prices. However, the sensors are comparatively less costly in purchase prices. A comparison of various intrusive and non-intrusive sensors are already rumored in a very few forms of analysis. The infrared sensors are sensitive to dangerous weather acoustic sensors don't provide correct results throughout cold temperatures. The magnetic sensors are unable to notice the vehicles that don't seem to be moving; but, there's no environmental condition influence. The magnetic sensors are wide used for vehicle detection and classification as a result of its straightforward installation, movability, and low value. The vehicle speed and length will be calculable by one or additional magnetic sensors, which can facilitate to approximate the road area occupancy live. The road occupancy live is correct for each highways and collector roads. Collector roads principally have little vehicles, that has comparatively low length thus a length primarily based road occupancy live is taken into account during this analysis. The road area occupancy live may be an abstraction live calculated by considering the length of the vehicle, the safe distance between vehicles, and a buffer length. The safe distance between the two vehicles is 2 m. Once a vehicle enters a road section, the road occupancy live is augmented by the length of the vehicle and diminished once the vehicle exits from that individual road section.

5.3 Pollution Mitigation

One of the foremost burdens traffic poses to society is its impact on the atmosphere in suggests that of air and sound pollution furthermore because the consumption of non-renewable materials. A lot of work is place into the event of solutions that scale back these harms. A traffic simulation ought to support such development by permitting to live quantity of generated pollution and therefore the amount of consumed fuel. Includes models and interfaces that fulfill these wants. A SUMO-vehicle owns the attribute "emissionClass" (see Vehicle Emission Classes). This attribute defines that emission model and that of its parameter sets shall be accustomed calculate the emissions. The models' resolutions and coverage of the vehicle population dissent among the emission models. Currently, the noise model solely distinguishes 2 vehicle types: traveler and significant duty vehicles. The discrimination is finished supported the vehicle's emissionClass; if the vehicle belongs to a traveler emission category, the noise parameter for a traveler vehicle area unit used, otherwise those of a significant duty vehicle. [3]

Automated Car System : With the growing accessibility of electrical vehicles, there will be a requirement for charging stations to facilitate the operator of Associate in Nursing electric vehicle to fill-up electrical the electrical} charge of his vehicle. The operator might need to manually perform bound actions, including charging the vehicle, getting into payment information, choosing choices (e.g., quick or slow charging), or initiating and/or approving the charging operation. Although a charging station reception is also programmed to automatically charge a vehicle in the dead of night to create use of lower power rates throughout off-peak hours, the operator of a vehicle might need to manually charge the vehicle throughout different times. For example, if a vehicle has been used for a part of daily, the operator might need to manually initiate charging throughout the day so the vehicle is totally charged to be used later that very same day. As a result, the operator of the vehicle might need to handle a high-voltage cable or connation, which can be dangerous, especially throughout inclement weather. A system for charging an electrical Vehicle includes a radio-frequency identification (RFID) reader, associate degree electronic database, a processor, and a robotic arm. The RFID reader is configured to spot vehicle info cherish the electric vehicle exploitation associate degree RFID tag mounted on the electrical vehicle. The processor is designed to retrieve from the electronic info a location of a charging port on the electrical vehicle supported the vehicle info. The robotic arm is configured to maneuver the charging connection consistent with the retrieved location to have interaction the charging port of the electrical vehicle to charge a battery. According to associate degree exemplary embodiment of the current disclosure, a way for charging an electrical Vehicle includes acquiring a plurality of pictures of a field of read whereas in a very vacant state, sleuthing whether or not the electrical vehicle has entered the sector of read supported associate degree analysis of the plurality of pictures whereas within the vacant state, initiating a following state upon sleuthing that the electrical vehicle has entered the sector of view, following a foothold and create of the electrical Vehicle whereas the electric vehicle is in motion supported a plurality of features of the electrical vehicle extracted from every image whereas in the following state, initiating associate degree establish state upon sleuthing that the electrical Vehicle isn't any longer in motion, characteristic a matching vehicle model candidate in a very info exploitation the position and create of the electrical vehicle in every image whereas in the establish state, initiating a connect state upon characteristic a matching vehicle model candidate, corroboratory whether or not a charging port on the electrical Vehicle is in associate degree expected location based on a last no inheritable image whereas within the connect State, and fascinating a charging connection into the charging port upon corroboratory that the charging port is within the expected location whereas within the connect state.

Chapter 6

Conclusion

Our current generation is now depending on technology for most of the cases. Automation has made our life easier than ever before. IoT has taken over and ruling the world with better efficiency. Traffic system is one of the most important aspects for each and every one right now. Commuting from place to place is a great deal and time is precious enough which should be wasted in a traffic jam or in collapsed road. Development of a smart traffic system can literally safe us a lot of time and even our lives from accidents. The project was focused mainly on traffic efficiency, emergency vehicle pass, better traffic signaling for less time waste, real-time vehicle monitoring and so on. Project gives us a huge improvement on waiting time on signal and other features. There are some other problems that raise during the completion of the project which has been kept for future development. A simulation interface Sumo gui has been used for the whole project which is more likely a real world simulation of traffic. The project has been developed for a world wide solution to most traffic issues to make this world a better place.

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