JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Implementation of Smart Traffic System Optimization through IoT Data in MATLAB

[1]Sakshi Kathuria
Scholar Ph.D. Scholar
Department of Computer Science
Sunrise University, Alwar, Rajasthan

[2] Dr.Kailesh Aseri
Assistant Professor
Sunrise University, Alwar, Rajasthan

Abstract: The advancement of hardware components into the Internet of Things (IoT) has permitted Smart Traffic route optimization to become more convenient. Traffic stream processing involves linking everything the differing time accessible to traffic flow rate of available vehicles on a highway and intelligent traffic platform allocation of that uses traffic signals in real time. Another traffic route optimization system, called smart traffic control, was created to cope with issues of pollution and to further optimize traffic flow on roads. This study describes a method for the substantial growth of traffic flow as well as well as conventional device alternatives that are capable of meeting traffic needs that works well in major cities, but isn't flexible enough to cope with the new needs. Traffic route optimization techniques proposed using the state-of-the-art methodology are focused on keeping an eye on the overall road infrastructure stability rather than on only individual behavior. Traffic intensity is able to adjust the timing of the signal according to the specific location of the roadside, rendering traffic control feasible, and even by interacting with the local system more accurately than ever before. And in the event of a local computer or server outage, the device is able to function as a little more effectively with a decentralized method. This research has ultimate goal to illustrated the traffic pattern study and simulate it in the time domain to analysis the real time traffic situation. This paper explores the Nodes Selection Algorithm which has mathematically presented in this thesis and encapsulate the formulation in MATLAB to construct the GUI. The GUI is the basic interface which has the arrival, discharge, old discharge of traffic nodes. The even created in this simulation has further categorized in three plans having three different time patterns of one hours, thirty mins and last small observation as 15 mins. This also has two specials phase introduced as statical and dynamic situation. The statical situation basically a non-changeable real time scenario where as the dynamic situation has conferred with real involvement of change due to external traffic controller in real time.

Keywords: - Smart Traffic route optimization, MATLAB, Nodes Selection Algorithm, Traffic controller in real time

I. INTRODUCTION

An emerging development that draws global attention from transportation experts, the automobile sector, and government decision-makers is intelligent transportation networks. Intelligent Transport Systems (ITS) are linked to advanced networking, information and electronic infrastructure innovations (Yang, 2020) to resolve transportation problems such as traffic congestion, protection, transport quality and preservation of the environment and are defined.

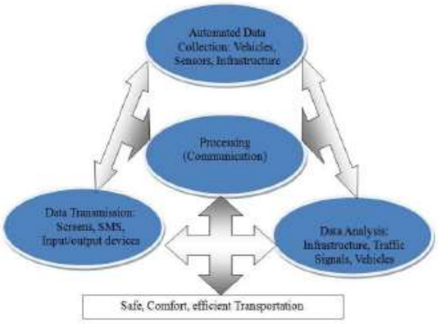

Fig. 1: Architecture / Overview Structure of ITS

The Fig. 1. ITS components can be described as above according to the figure it is automated processing of data - With professional hardware and software, this need detailed and precise strategic preparation. Automatic detection of cars, a car locator focused on GPS Chen & Xu (2020), cameras, sensors, etc. This is some of the data processing devices used. Analyses such as traffic count, tracking, transport speed, time, location, pause, etc. may be conducted for this vast volume of data.

Data Transfer: In integrating smart transportation networks, it is a crucial feature of providing quick and real-time details. The details can be conveyed to the passenger via an advertising connected to traffic through SMS, the Telephone, on-board cars, etc.

Data processing: Involves adaptive logic analysis, correction of errors, data cleaning, and synthesis of data. To forecast the traffic situation, the processed data was further analyzed. Details in real time, such as drive time, disruptions, traffic collisions, shifts in lanes, workplace, detours, etc. That is the advantage since the data is processed.

Smart transportation networks cover virtually all facets of transportation engineering and simplify them with the related points above. There are many intelligent auxiliary transportation networks, and the following are among the most relevant and most used around the world to solve the issue of traffic and transport:

Fig. 1: Subsidiaries of ITS

Internet, telephones, mobile phones, cable television, radio, and other forms of technology are all included in the Advanced Traveler Information System (ATIS), which is also known as the Advanced Traveler Information System (ATIS). In order to assist passengers and drivers in making informed decisions on flight departures, optimal routes, and availability, we have developed this tool.

Methods of Transport

Advanced Traffic route optimization System (ATROS): It is used as a mechanism for traffic route optimization and regulation by the Traffic Police Force and Traffic Regulatory Authority by tracking traffic movement and making necessary decisions at the right moment. By leveraging real-time information to interfere and change signals, such as road signs, to enhance traffic flow, traffic route optimization systems maximize vehicle travel de Souza (2017).

Advanced Public Transit System (APTS): seeks to increase the operating performance of all forms of public transport and to improve the state of the transport system by rendering it more efficient. The way public transportation systems act and the nature of transport facilities that public transportation systems can offer are evolving with the aid of APTS.

Emergency Response System (EMS): The Intelligent Transportation System is the newest field of study (Chen, , 2009). In order to build a transport infrastructure that can offer assistance in emergency circumstances, EMS is primarily concerned with the implementation of different intelligent transport system technology.

In their studies utilizing vehicle-to-infrastructure (V2I) or vehicle-to-vehicle (V2V) communications, researchers have considered the various architectures and models built over the years for four main ITS divisions in order to promote the quality of life in urban areas. And the community complex. With traffic control across the network, management techniques are important. As mentioned, the aim is to efficiently manage traffic using an acceptable traffic scheme through the algorithm and method of researching and developing the infrastructure.

When the population of urban cities grows, so does commuting by car, which creates road congestion. Over the past few years, the average number of vehicles in India has been rising at a rate of 10.16 percent annually. Spending hours in congested traffic has become an essential part of the metropolitan lifestyle, posing health and environmental threats. The expansion in the number of automobiles on the road has made traffic flow more efficient.

Significant motivation to minimize traffic congestion are also created by the high fuel cost and environmental issues. A Vehicle Traffic Information System (ATIS) can also be added to minimize these traffic circumstances. ATIS utilizes remote sensing technology that enables the pilot, often without looking at the traffic light pole, to display real-time traffic details within the car. Any specific facts, such as the period left to adjust a traffic light and the road the car is driving on, is also recommended by ATIS. The usage of ATIS will also revolutionize India's traffic information system, which could reduce the number of traffic collisions at intersections, reduce noise emissions, improve the fuel economy and add further to the assessment of the Indian economy (Lee 2009).

Traditional method for traffic control

Set metal poles on the left side of the road at intersections displaying a traffic signal are used in the conventional form of traffic route optimization. What is, in certain situations, whether we are behind a heavy car or if we may not pay attention to a traffic signal (Jayaraman, 2019), it is not possible to see it from multiple road perspectives, it can even contribute to numerous issues such as disruptions in traffic movement, unconscious hops out of traffic? Accidents and disruptions in traffic movements are often induced by adverse weather situations such as fog and heavy rain. Some typical problems that are backed by survey results from Indian transport are triggered by disrupted traffic light visibility:

Accidents caused by unconscious traffic light infringement: According to the police, vehicles turning on red lights are responsible for 10 percent of deaths on Delhi highways. As many as 6,420 vehicles have been prosecuted at an intersection in Delhi this year for operating red lights. Sometimes it is on purpose, but often it triggers certain kinds of accidents on the road due to the lack of traffic details that the driver gets or the lack of commitment to a traffic signal.

Delhi's annual fuel loss report reports that 0.37 million kilograms of compressed natural gas, 0.13 million liters of diesel and 0.41 million liters of gasoline are lost every day owing to car slowdowns. Delhi's annual fuel loss report notes that - Focused on the use of petrol. The layers shown in the table below offer a simple understanding of each vehicle's fuel consumption at traffic lights (Table 1.1):

Table 1: vehicle's fuel consumption at traffic lights

S. No.	Vehicle Type	Fuel Consumption (in ml/hr)
1.	**Petrol**	
	➢ **4-Wheeler**	**747**
	➢ **2Wheeler**	**170**
2.	**Diesel**	**833**
3.	**CNG**	**1827.5**

1.3 Traffic control using ATIS

The intention is to shift traffic control to switch the vehicles themselves from conventional fixed traffic signals to moving them. When ATIS is mounted in the car itself, this would remove the issue of interrupting the driver's traffic light visibility. This would make it easier for the driver to collect all the essential details regarding the existing traffic. In addition, as the traffic signal switches from amber to orange, the Warning Device helps draw the driver's attention to traffic updates to decrease the risk of traffic delays (Chang 2010; Xiao & Wang; 2011). So, the primary role played by ATIS is:

- Intimate real-time traffic statistics.
- Warning cab.

Installing an ATIS in the traffic control system of a nation will give precise basic details regarding existing traffic to the driver. In addition, this will contribute to decreased gasoline usage, congestion and disruptions in traffic lighting (Faisal, 2011; Srivastava; 2012).

ATIS

An Advanced Passenger Information System (ATIS) is any system that captures, analyses and offers information to help passengers on road transport travel from their original position (origin) to their preferred destination. ATIS may work solely inside the vehicle from the information supplied (autonomous system) or it may even use the details supplied by traffic control centers. Accident sites, road and weather conditions, optimum directions, suggested speeds, and lane constraints can be useful knowledge all part of an intelligent transportation system or intelligent transportation networks (Zhou, 2012).

Types of systems

There are many kinds of systems, which may be public, private, or a mix of the three. They can be offered for free, via user subscriptions, or through third-party sponsorship. In addition to television, radio, and computers, delivery of ATIS can be accomplished through cell phones, which can include mapping, text messaging using SMS information systems, automobiles, variable-message signs, and any other mode of communication, whether for personal or mass distribution prior to, during, and after travel. Kiosks may be found in airports, bus stops, metro stations, and tourist attractions, among other places.

Smart Traffic System implemented Countries

Advanced PNISs are used in several nations around the world under different titles, in one way or another.

Australia - Uses the Australian government's Smart traveler service, operated by the ADIA and Trade, and offers global travel details as well as travel advice.

The United States: This provided passenger intelligence goods and facilities covering all forms of transport. Transportation, previous to the introduction of the '511' telephone passenger information scheme, to check European activities.

Portugal: A Launch including an Integra Network Administrator has been initiated as part of the European Union Program Agency, the Transnational Atlantic Program.

Iran: In Tehran and Iran, traffic updates providing details of the general traffic situations of the key lanes, the location and clearing of traffic jams and the suggested alternate routes.

The enhanced usage of the traffic grid accounts for much of the challenges that traffic networks encounter today. One of the key challenges needing consideration is road congestion. In order to address the traffic congestion crisis, traffic control and management specialists and decision makers have come up with several potential solutions. Some of these solutions have been targeted at raising the number of roads or lanes to satisfy demand, or at lowering demand for traffic by the introduction of fines and the raise of taxation on the use of the system. Moreover, neither alternative presented a promising compromise due to political considerations and viability constraints. Another approach is to use the new method in a more successful way. Both the short and long term, this choice offers valuable benefits and possibilities. In this thesis, with a particular emphasis on the long term, this technique is worked (Karakuzu & Demirci, 2010; Khekare & Sakhare; 2013).

Data Challenges in an Intelligent Transport System

The processing of data relies on how fast information is accessible from storage, but also on the technology or method utilized for data processing. Data from intelligent transport systems originate from many different sensors and before using a formal analytical technology (Javed, 2019), numerous problems must be overcome. Some of the following difficulties are listed:

- For inaccurate items in the dataset, the data must be cleansed in order for these inaccurate entries not to affect the outcome.
- Data from diverse sources should be merged so that the influence of various aspects may be analyzed in order to examine the link between various aspects within the same or between separate data sources.
- A number of value sets in a complicated system such as the ITS may be exponential, since there are millions of mishaps, such as bus arrival occurrences.
- The amount and frequency of data on hundreds of roads from thousands of cars, which results in hundreds of thousands of arrival, departure and location events, making it more difficult to cope with the first three criteria.
- Processing this data in real time as soon as it is ready for analysis.
- Real-time presentation of predictive analytical findings, so that predictive analysis may be employed efficiently.

II. METHODOLOGY

Traffic Detection

The overarching aim of this study is to establish a robust traffic control scheme in a metropolitan environment (Tizghadam & Leon-Garcia, 2008). By combining two separate components, namely the traffic detection and routing framework, this system was created. In Figure 3.1, a standard workflow is shown.

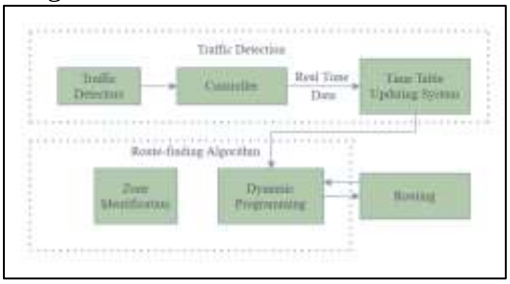

Fig. 3: Standard Workflow of Identification and Direction Scheme

Dynamic data showing the condition of traffic flow is used to guide traffic inside a city to be reached by detectors placed on all potential roads within the street network. Different types of traffic detectors operate, advocates for this idea say including will not increase traffic (Mimbela et al, 2000)

Device for inductive loop detection:

Inductive component is the loop wire. a little drip of ring inductance happens as a vehicle cross over the ring. The detector senses an inductance shift and triggers the electronic device to transmit a pulse, signaling the vehicle's existence or passage, to the control unit.

Video image recognition system:

The linearity feature enables the customer to choose a limited range of linearity road detecting areas within the video camera's field of view. As a car enters one of these zones, it is calculated by observing, in the absence of an object, shifts depending on the status of the pixels the speed of the vehicle is then derived from the calculation. Calculates the time taken for a given vehicle to cross the known duration detection field.

Microwave radar traffic monitoring system:

transmits energy to the road field and, as the vehicle crosses the road, some of the energy that is transferred is reflected back to the receiver. Measuring the volume, distance, duration and occupancy of the vehicle is covered in this system.

GPS dependent vehicle monitoring system:

To regularly obtain positioning data from the vehicle, a GPS data logger may be used. There are typically three sections of a GPS data logger, Such things as GPS receivers, data storage medium, and power supply systems.

Acoustic Traffic Detection System:

Tests the traffic, presence and velocity of automobiles by detecting acoustic energy or acoustic noises originating from vehicle traffic from a range of sources inside each vehicle and from vehicle tire contact with the lane.

Infrared and Magnetic Traffic Monitoring System:

Sense's calibration due to vehicles reformation. This monitoring system is formulated on the behalf of infrared traffic monitoring. The inactive sensors, as they have no active elements existence of a metallic material, detect changes in the magnetic field. To measure the time each vehicle requires to cover a given path, both of the above detection systems will include the size of vehicles and the speed of each vehicle are also factors in how many cars. Ring reagents are now the prevalent reagents in usage at present, since they come at a base price, whereas alternate reagents are not owing to the poor history of these reagents (Lees, 2008). The inductance loop detectors are therefore believed to be located in each street segment in this research analysis. The following parts comprise the loop detector seen in Fig.4:

- One or two independent loop wire rotations wrapped in the dock through a shallow threaded hole.
- An input cable to the control cabinet from the curbside throwing box.
- Electronic device of detection (DEU) in the control unit.

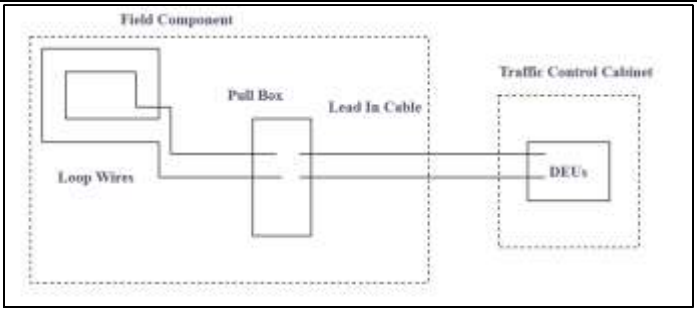

Fig. 4: The Apparatuses of a Sensor based Detection system

For each 20-second time period, the inductance loop detector can calculate two significant parameters, namely:

- Occupation; Vehicle time ratio for beginning the cycle (sec.)
- Number of vehicles (vehicles / 20 seconds / ln) approaching (I) or exiting (E) portion of the street

Every 20 seconds, a model calculates the average traffic speed on every street portion, L (i, j). Assuming that the number of vehicles per day was measured by traffic detectors over a continuous 24-hour cycle.
Suppose the street segment density (i.e., number of cars) is D I j, tk), as well as the observed volumes E I j, tk). If we assume there are no cars in the road segments at t = t0, then for the required time period of tk = 20 s, the number of vehicles is provided as follows:

$$\Delta t1 = (t1 - t0) = 20 \text{ sec.};$$

$$D(i, j, t1) = I(i, j, t1) - E(i, j, t1),\ I(i, j, t1) \geq E(i, j, t1)$$

$$\Delta t2 = (t2 - t1) = 20 \text{ sec.};$$

$$D(i, j, t2) = D(i, j, t1) + I(i, j, t2) - E(i, j, t2),\ D(i, j, t2) + I(i, j, t2) \geq E2(i, j, t2).$$

$$\Delta tk = (tk - tk\text{-}1) = 20 \text{ sec.};$$

$$D(i, j, tk) = D(i, j, tk\text{-}1) + I(i, j, tk) - E(i, j, tk),\ D(i, j, tk\text{-}1) + I(i, j, tk) \geq E(i, j, tk)$$

Therefore, the average velocity of motion S I j, tk) can be represented at the period tk in each street segment as seen in Equation 3.1:

$$S(i,j,t_k) = S_f(i,j) * \left(1 - \frac{D(i,j,t_k)}{J(i,j)}\right)$$

J (i, j) = Jam compactness on Road section i, j, Veh/L(i,j)
Sf (i, j) = Speed boundary on Road section i, j, mi/h
Thus, Equation 3.2: will decide the time needed to cover the street segment L I j)

$$T(i,j,) = \begin{Bmatrix} \frac{L(i,j)}{S(i,j,t_k)}, & D(i,j,t_k) \neq 0 \\ \frac{L(i,j)}{S_f(i,j)}, & D(i,j,t_k) = 0 \end{Bmatrix}$$

Where:
Tk = The period of formation of the last timeline
T I j, tk) = street section average travel period I j in the time interval = tk
S I j, tk) = average speed of traffic in the street section of I j in the tk interval, mph
L (i,j) = measurement of the section of I j lane, slope

It should be remembered that, as seen in Fig.5, the average traffic rates or average travel times correlated with various directions for the road field in question are not equivalent.

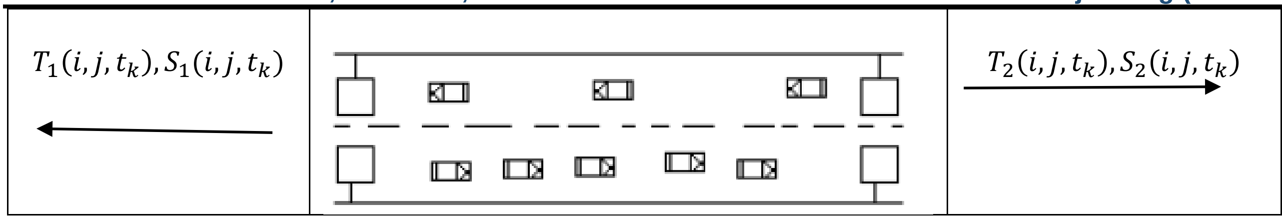

Fig. 5: presentation of vehicles on road and time correlation

Design of a Network

A street network comprised of nodes and links is known as a weighted directed graph, which includes the following elements:

Node's category (N): A node in the graph is a terminal or intersection point. A st-intersection is abstracted in this analysis.

A set of connections (l): The connection between the I and j nodes and the street segment removal is how we can join these two nodes.

Sub-chart: A subset of a particular chart is a sub-chart. Each street network consists of several subnets in this analysis. A subnet of the metropolitan highway network is the street network itself.

Buckle - A buckle is the link that lets a knot adhere to itself. The expense (travel time) of the buckles is nil in this research. In addition, the street network requires traffic to pass. Therefore, motions must be represented as links that can be seen from several perspectives.

Path: A set of ties moving in the same direction. An unbroken series of connections must be possible to navigate in order for a path to occur between two nodes.

Link length: This is the distance that is connected with a link, link, or route. The State Coordinate System should be used for calculating the location of nodes or intersections. a system of coordinates developed for a geographic area in the United States is a statewide coordinate system. Each state can have one or two coordination structures at the state level (for example, the southern Ohio level coordinate system and the northern Ohio state level). In addition, it is a method utilizing rectangular, rectangular or Cartesian coordinates rather than spherical coordinates to calculate the locations of the geodesic station (the geographical coordinate system of longitude and latitude).

NS Algorithm and path planning for traffic route optimization

The NS is short form of node-based algorithm which is very similar to A * algorithm. An exploration heuristic method that has as its goal to cover a limited range of nodes between the place it starts from origin and destination to decide which nodes produce the route with the shortest travel time is the shortest path search algorithm (Chao & Hongxia, 2010). It is beneficial to develop an area delineation node constriction to increase algorithm performance mentioned, because of the broad scale of street intersections in the network. Referring to Figure 6, if the driver demands a path between the source node and the destination node d with a travel period of less than 5 minutes, then the area determination algorithm concerns the nodes in the smaller (blue) rectangular region spanning from the source s (x1, y1) and destination d (x2, y2), the dynamic programming technique scans the defined nodes to detect t the shortest identified route requires motorist to spend at least 5 minutes on it quest range (R) and search for the shortest route in another sub-region can be eventually expanded by dynamic programming technology. Large-Sized (see Fig 7). For high-speed algorithms, the usage of the search radius has no particular benefit.

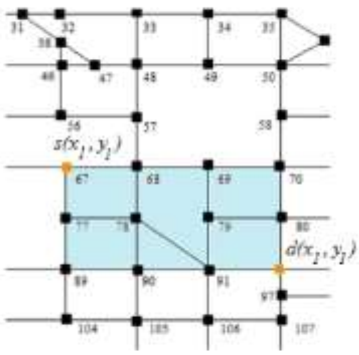

Fig. 6: A street network illustration

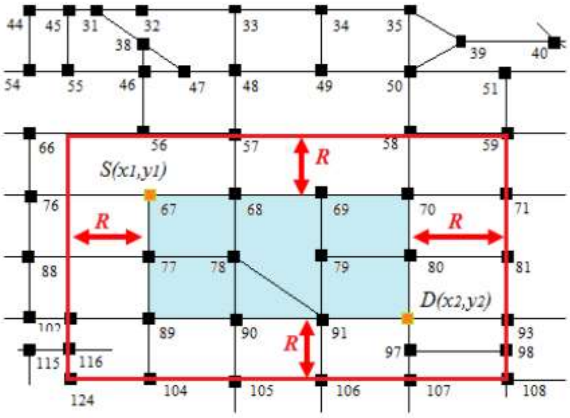

Fig.7: Extended zone

The following four potential trigger patterns are taken into consideration to identify a technique for deciding the region in which the desired nodes are located:

- If $x1 \leq x2$ and $y1 \geq y2$ then the location of the selected node *Ni(xi,yi)* , can be defined by:

$x1\text{-}R \leq xi \leq x2+R$ and $y2\text{-}R \leq yi \leq y1+R$ (See Figure 8)

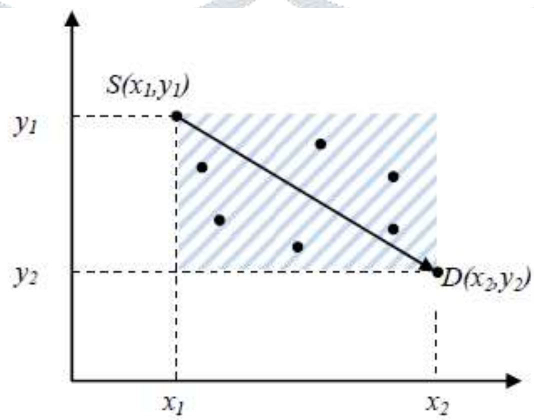

Fig. 8: Travel pattern I

- If x2 ≤ x1 and y1 ≤ y2 then:

$x2\text{-}R \leq xi \leq x1+R$ and $y1\text{-}R \leq yi \leq y2+R$ (See Figure 9)

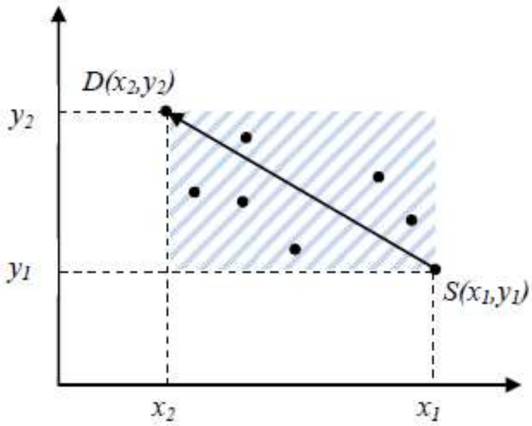

Fig. 9: Travel pattern II

- If x1 ≤ x2 and y1 ≤ y2 then:

x1-R≤ xi≤ x2+R and *y1-R≤yi≤ y2+R* (See Figure 10)

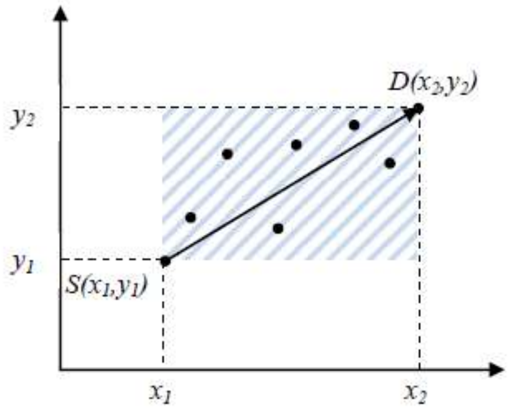

Fig. 10: Travel pattern III

- And finally, If *x1≥ x2* and *y1≥ y2* then:

x2-R≤ xi≤ x1+R and *y2-R ≤yi≤ y1+R* (See Figure 11)

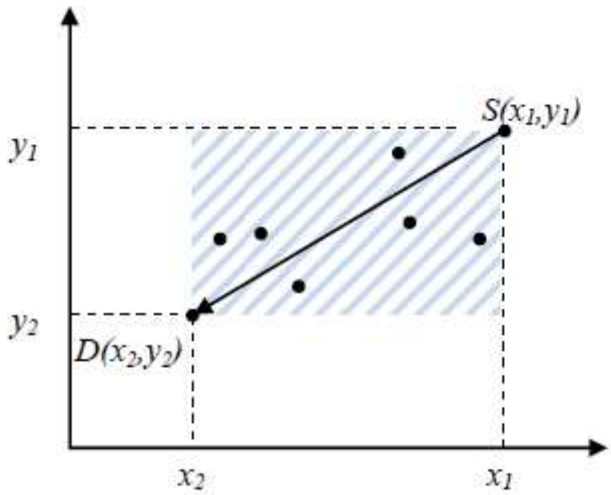

Fig. 11: Travel pattern IV

The following key sets regarding

N = {*S, N2, N3…, D*}, *N1 = S* and *Nn+1 = D*
Fig. displays a standard false code used to define and pick a contract to solve the problems described above mentioned.

III. SIMULATION AND OUTCOMES

The setup has been implanted in MATLAB. The front GUI has been created with MATLAB GUIDE. The Smart Traffic System Optimization through IoT gathered data has been constructed (Lecue, 2011). It will be used to locate cars that may be carrying contraband or in a wreck as a result of high-speed driving. The genetic algorithm was developed to collect data from all locations around the intersection and is currently used to analyses one position and therefore designs in several directions.
This research aims to provide insight into the traffic flow pattern and examine it within the temporal domain to learn about traffic conditions in real time. This thesis focuses on developing an algorithm known as the Nodes Selection Algorithm. This method is outlined in this thesis, and it is represented mathematically in MATLAB to generate the GUI presented below. The user interface is the most basic kind of interface which is in use at the moment and contains the arrival, discharge, and prior discharge of traffic nodes. In this simulation, three distinct strategies have been further divided into three-time patterns of one hour, thirty minutes, and the final fifteen minutes. Additionally, they also have two aspects incorporated, which are defined as "static" and "dynamic" situations. With regard to static situations, in which no changes have occurred, this instance qualifies as a non-changeable real-time scenario. In this instance, the dynamic situation describes true participation of alter as a result of external traffic controller activity in real time.
This new technology would be able to manage traffic as well as count cars. administrator of the device is authorized to conduct maintenance on the local server. Below the figure which has been take through screen sort of running simulation of traffic light having three plan 1, plan 2 and plan 3. This simulation also provides the spending time for specific traffic test with two situations as statics and dynamics.

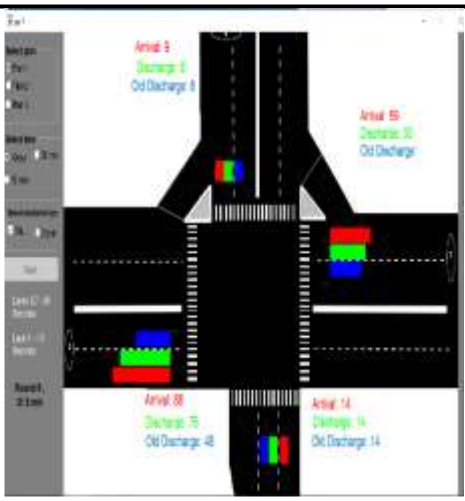

Fig. 12: Plan 1 -1 Hour - Simulation Static

As the above figure come out after the simulation execution as arrival, discharge and old discharge has been planned 1 in selected time 1 hours. As the above figure has static option on in GUI. There are four sections as one (top left) has 9-arrival, 8-discharge and 8-old discharge, second (top right) has 59-arrival, 50-discharge and 0-old discharge, third has 88-arrival, 76-discharge and 48-old discharge and the last one has 14-arrival, 14-discharge and 14-old discharge.

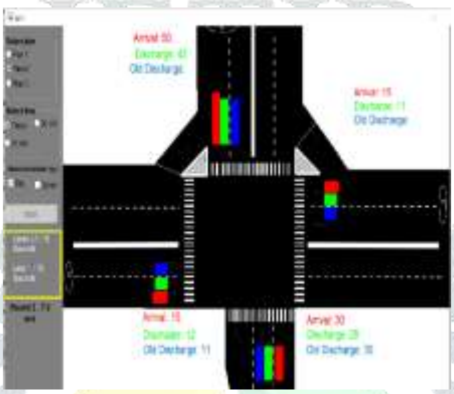

Fig. 13: Plan 2- 1 Hour- Simulation Static

As the above figure come out after the simulation execution as arrival, discharge and old discharge has been planned 2 in selected time 1 hours. As the above figure has static option on in GUI. There are four sections as one (top left) has 50-arrival, 43-discharge and 0-old discharge, second (top right) has 15-arrival, 11-discharge and 0-old discharge, third has 15-arrival, 12-discharge and 11-old discharge and the last one has 30-arrival, 29-discharge and 30-old discharge.

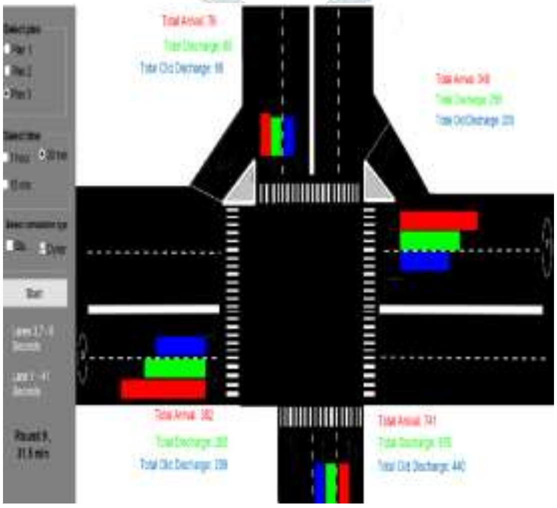

Fig. 14: Plan 3, Time 30 Min, Simulation Type Dynamic

As the above figure come out after the simulation execution as arrival, discharge and old discharge has been planned 3 in selected time 30 mins. As the above figure has static option on in GUI. There are four sections as one (top left) has 76-arrival, 65-discharge and 66-old discharge, second (top right) has 348-arrival, 258-discharge and 205-old discharge, third has 382-arrival, 265-discharge and 209-old discharge and the last one has 741-arrival, 576-discharge and 440-old discharge.

IV. CONCLUSION AND FUTURE SCOPE

In order to use multi functionality of components in IoT, the intelligent traffic route optimization system was created. Traffic optimization is accomplished by IoT framework to efficiently use all traffic signal times according to the number of vehicles present on the path. Smart Traffic route optimization System is designed to address congestion issues effectively and redirect at crossings on a route. This study provides an effective remedy for the exponential growth in traffic flow of big cities in particular, which increases day by day, whereas conventional systems are not efficiently managed. Considering the cutting-edge solution. The best solution for traffic control systems would be a smart traffic route optimization framework. Efficient and more reliable tracking of road traffic circumstances. This intelligently adjusts the signal timing on the individual roadside due to the traffic level and controls traffic movement by coordinating more efficiently than ever with local servers. The centralized solution improves and operates when the framework functions even though a local node or central server fails.

This research is working toward one goal: Showing how traffic patterns may be modelled and simulated, which might then be used to get better insight into the current traffic conditions. This thesis looks at the Nodes Selection Algorithm, which has been mathematically laid out in this thesis and the formulation has been encapsulated in MATLAB to create the GUI. The graphical user interface (GUI) is the fundamental interface which has the arrival, discharge, and old discharge of traffic nodes. The simulated object also has been built and broken down into three categories, and further into three separate time patterns with three distinct end time options of one hour, thirty minutes, and the final fifteen minutes. Additionally, this game also includes two phases which are marked as "statical" and "dynamic" situations. The static situation, as one may generally expect, is exactly the same day after day, week after week, and year after year. However, the dynamic situation, with its fresh participation of change, features varying patterns each day, week, and year.

REFERENCE

1. “A novel and Secure Smart Parking Management System (SPMS) based on integration of WSN, RFID, and IoT”, IEEE, pp. 102-106, 2018
2. A., Loia, V., Tommasetti, A., Troisi, O., khah, M.S. & Siano, P. (2016). Iot-based Smart Cities: A Survey.
3. Abhirup Khanna, Rishi Anand, “IoT based Smart Parking System”, 2016 International Conference on Internet of Things and Applications (IOTA)Maharashtra Institute of Technology, Pune, India 22 Jan - 24 Jan, 2016.
4. Abida Sharif1, Jianping Li, Mudassir Khalil, Rajesh Kumar, Muhammad Irfan Sharif, Atiqa Sharif, “Internet of Things – Smart Traffic route optimization System For smart Cities Using Big Data Analytics”, IEEE, 2017.
5. Ahmed, E., Yaqoob, I., Gani, A., Imran, M. & Guizani, M. (2016). Internet-of-Things-Based Smart Environments: State of the Art, Taxonomy, and Open Research Challenges. 10-16.
6. Ala Al-Fuqaha, Mohsen Guizani, Fellow, Mehdi Mohammadi, Mohammed Aledhari, “Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications”, IEEE Communication Surveys & Tutorials, Vol. 17, No. 4, Fourth Quarter, 2015
7. Albert Rego, Laura Garcia, Sandra Sendra, Jaime Lloret, “Software Defined Network-based control system for an efficient traffic route optimization for emergency situations in smart cities”, Accepted Manuscript, 24 May 2018.
8. Amit Roy, Priyam Poddar, Smart Traffic & Parking Management using IoT”, IEEE, 2016.
9. Apthorpe, N., Huang, D.Y., Reisman, D., Narayanan, A. & Feamster, N. (2019). Keeping the Smart Home Private with Smart(er) IoT Traffic Shaping. *Proceedings on Privacy Enhancing Technologies.*129-148.
10. Arunan Sivanathan, Daniel Sherratt, Hassan Habibi Gharakheili, Adam Radfordy, Chamith Wijenayake, Arun Vishwanathz and Vijay Sivaraman, “Characterizing and Classifying IoT Traffic in Smart Cities and Campuses”, IEEE, Conference on Computer Communications Workshops, 2017.
11. Avoiding in Wireless Sensor Networks”, IEEE Communications Letters, 2013
12. Baldassarre, M.A., Caivano, D., Serrano, & Stroulia, E. (2018). “Smart Traffic”: An IoT Traffic Monitoring System Based on Open-Source Technologies on the Cloud. 13-18.
13. Balid, W., Tafish, H., Refai, H. (2016). Versatile Real-Time Traffic Monitoring System Using Wireless Smart Sensors Networks. *IEEE Wireless Communications and Networking Conference (WCNC 2016).*
14. Benevolo, C., Dameri, R.P. & Auria, B. (2016). Smart Mobility in Smart City. Action taxonomy, ICT intensity and public benefits.
15. Benevolo, C., Dameri, R.P. & Auria, B. (2016). Smart Mobility in Smart City Action Taxonomy, ICT Intensity and Public Benefits. *Springer International Publishing Switzerland.*13-28.
16. Bonomi, F., Milito, R., Zhu, J. & Addepalli, S. (2014). Fog Computing and Its Role in the Internet of Things. 13-15.
17. Bonomi,F., Milito, R., Natarajan, P. & Zhu, J. (2014). Fog Computing: A Platform for Internet of Things and Analytics. *Springer International Publishing Switzerland.*169-186.

18. Chang, S.J., Hsu, G.Y., Yang, J.A., Chen, K.N., Chiu, Y.F. & Chang, F.T. (2010). Vessel Traffic Analysis for Maritime Intelligent Transportation System.
19. Chao, Y., & Hongxia, W. (2010, June). Developed Dijkstra shortest path search algorithm and simulation. In *2010 International Conference on Computer Design and Applications* (Vol. 1, pp. V1-116). IEEE.
20. Chen, C.W., Chen, X.C., Peng, I.H. & Chen, Y.W. (2009). Study of Safety and Efficient Routing for Intelligent Transportation System.
21. Chen, Y., & Xu, J. (2020). Research on Driving Behavior of Mountain City Passenger Car Drivers Based on GPS Data. In *Green, Smart and Connected Transportation Systems* (pp. 1497-1510). Springer, Singapore.
22. Chen, Y.K. (2012). Challenges and Opportunities of Internet of Things. 383-388.
23. Chopra, K., Moun, P. & Kapil, D. (2017). Smart Transport Recommender System. *2nd International Conference on Telecommunication and Networks.*
24. Chowdhury. & A. (2016). Priority Based and Secured Traffic route optimization System for Emergency Vehicle using IoT.
25. Dasararaju, H. K., & Taori, P. (2019). Data Management—Relational Database Systems (RDBMS). In *Essentials of Business Analytics* (pp. 41-69). Springer, Cham.
26. Dasari Vishal, H Saliq Afaque, Harsh Bhardawaj, T K Ramesh, "IoT-Driven Road Safety System", International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT), 2017
27. Dash, A., Dash, P. & Mishra, B.K. (2018). An Innovation Model for Smart Traffic route optimization System Using Internet of Things (IoT). *Cognitive Computing for Big Data Systems Over IoT, Lecture Notes on Data Engineering and Communications Technologies.* 355-370.
28. de Souza, A. M., da Fonseca, N. L., & Villas, L. (2017, May). A fully-distributed advanced traffic route optimization system based on opportunistic content sharing. In *2017 IEEE International Conference on Communications (ICC)* (pp. 1-6). IEEE.
29. Faisal, A., Nasser, A. & Rowaihy, H. (2011). Simulation of Dynamic Traffic Control System Based on Wireless Sensor Network. *IEEE Symposium on Computers & Informatics.*1-6.
30. Fozia Mehboob, Muhammad Abbas, Muhammad Atif Tahir, Richard Jiang, Somaya Al Maadeed, Ahmed Bouridane, "Automated Vehicle Density Estimation from Raw Surveillance Videos", SAI Computing Conference 2016, July 13-15, 2016.
31. Frank, A., Khamis, Y.S., Aamri, A. & Zayegh, A. (2019). IoT based Smart Traffic density Control using Image Processing.
32. Ganesh Venkat Sundar, Balaji Ganesh Rajagopal, "IoT based Passenger Information System Optimized for Indian Metros", International Conference on Electronics, Communication and Aerospace Technology, ICECA, 2017
33. Gayathri G, M Swathi, Monisha D, Monisha Jayaker, K Ezhilarasan, "ON ROAD CARD Using IoT" IEEE, pp. 587-591, 2017.
34. Ghazal, B., EIKhatib, K., Chahine, K. & Kherfan, M. (2016). Smart Traffic Light Control System.140-145.
35. Ghazal, B., ElKhatib , K., Chahine, K. & Kherfan, M. (2016). Smart Traffic Light Control System. 161-166.
36. Gubbi, J., Buyya, R., Marusic, S. & Palaniswami, M. (2013). Internet of Things (IoT): A Vision, Architectural Elements, and Future Directions.
37. Guicheng Shen, Bingwu Liu, "The visions, technologies, applications and security issues of Internet of Things", IEEE, 2011.
38. Guohang Huang, Dongming Chen, Xuxun Liu, "A Node Deployment Strategy for Blindness
39. Harsha, N., Nair, N., Jacob, S.M. & Paul, J. (2018). Density Based Smart Traffic System with Real Time Data Analysis Using IoT. *International Conference on Current Trends toward Converging Technologies, Coimbatore, India.*1-6.
40. Hasan Omar Al-Sakran, "Intelligent Traffic Information System Based on Integration of Internet of Things and Agent Technology" (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 6, No. 2, 2015
41. Hasan, M.M., Saha, G., Hoque, A. & Majumder, B. (2014). Smart Traffic Control System with Application of Image Processing Techniques. *International Conference On Informatics, Electronics & Vision.*