An Implementation of Nodes Selection Algorithm for Smart Traffic System Optimization in MATLAB GUI

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

[2] Dr. Sanjay Pachauri
Professor and Dean R & D
IIMT College of Engineering. Greater Noida

Abstract: Traffic management system is considered as one of the major dimensions of a smart city. With the rapid growth of population and urban mobility in metropolitan cities, traffic congestion is often seen on roads. To tackle various issues for managing traffic on roads and to help authorities in proper planning, a smart traffic management system using the Internet of Things (IoT) is proposed in this paper. 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 management 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 management 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- Traffic management system, Traffic stream processing, Nodes Selection Algorithm, MATLAB

I. INTRODUCTION

A city is a complex system which consists of many interdependent subsystems where traffic system is one of its important subsystems. A study says; it is the cornerstone of the world's economy. Moreover, it is also declared as one of the major dimensions of the smart city. With the rapid growth of the population of the world, the number of vehicles on roadways is increasing consequently, the rate of traffic jams is also increasing in the same manner. Traffic jams are not just wasting time but, in some cases, it is witnessed that criminal activities like mobile snatching at traffic signals also happen in metropolitan cities. On the other hand, it is not only affecting ecosystem badly but the efficiency of industries is also being affected. It is, therefore, identified that active traffic management is a necessity. In majority countries, traffic is managed through fixed time signals whereas, in large cities of some developed countries, traffic is managed through centrally controlled systems. The paradigm of the Internet of Thing (IoT) has been introduced in traffic management systems. To the best of our knowledge, it is identified that till date the current traffic management systems are centralized. In case of networking issues, such systems may crash. In addition, there is less focus on fluctuations in traffic flow. Therefore, the proposed system manages the traffic on local and centralized servers by exploiting the concepts of IoT and Artificial Intelligence together. The representation of traffic data in statistical form can also be helpful to authorities for real-time controlling and managing traffic. Moreover, it may also be helpful for future planning.

1.1 Advantages of ITS System Architecture

The preceding section describes how the frame design may assist to improve the integration of desirable characteristics into a complex and changing framework like ITS. The ITS framework may provide numerous more advantages. The following benefits are provided by ITS Architectures:

- Provide a foundation for the development of the vision for smart national and regional frameworks transport systems.
- Provide advice on the design of new components or the expansion of existing components and formal interface standards.
- Create a framework that satisfies compatible, expandable and interoperable system criteria that facilitate future growth and expansion.

1.2 The Existing architecture/Challenges

A typical design for the current transport device as shown in Fig. 1 shows the implementation on the server side. The client interacts with the server of REST Resources to transfer XML files. The word REST stands for "representational state transfers," a paradigm of web services that concentrate on resources with six limits to provide the GUI features. When designing a feature interface, which is a transparent, stateless interface, client-server architecture, multi-layer system, caching and on-demand code execution, we have six limitations to overcome. It is a conventional framework focused on a two-tier (user client) model in which the client has a server connection powered by request / answer, and the server implementation takes care of all the collection, sorting and delivery operations of the data received. From customers. The REST interface is used disseminate details to clients and computers, suggesting that data collection loading will interrupt the operation of data exports.

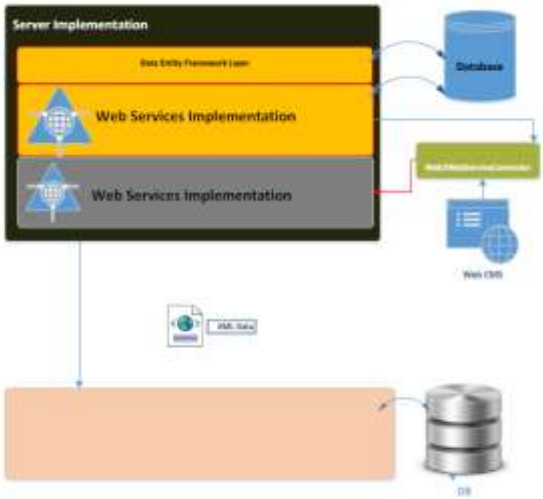

Fig. 1 Transport System

For a time-critical device like an intelligent transit system where the knowledge regarding the bus arrival at the stop is obsolete every minute, there are several issues with such engineering. Service quality attributes are the indicators that talk about the capacity of a software device to work under all situations. This needs to update details for all locations in real time and exchange the same information between various linked buses illustrates the necessary emphasis on the consistency of the service functionality of the system and the system architecture's capacity to monitor features such as efficiency and reaction. Space, precision and extensibility. This can apply to the various system design components so that in services offered by the system, each component leads to achieving high service quality. This is one of the key aspects that the existing device design fails since the architecture's multiple layers are not well interconnected and the coordination between them is inconsistent with mixed results. The degree of independence in integrating components will not be provided by simply doing different levels in a system and then putting different components on certain levels so it also has to be sure to monitor the usage of common tools such as database tables to prevent output stalemates.

II. REVIEW OF LITERATURE

George et al. (2018), This work uses IOT and Adaptive Neuro Fuzzy Inference System (ANFIS) to improve traffic conditions. An ANFIS traffic light controller with inputs as waiting time and vehicle density is developed using MATLAB SIMULINK environment. A camera is used to capture the traffic scenes and this image is transferred to the cloud using Arduino UNO and Thing Speak Platform. The image is then analyzed in the server using ANFIS controller and appropriate control signals are sent to the traffic signals.

Javaid et al. (2018), The purpose of this paper is to propose a smart traffic management system using the Internet of Things and a decentralized approach to optimize traffic on the roads and intelligent algorithms to manage all traffic situations more accurately. This proposed system is overcoming the flaws of previous traffic management systems. The system takes traffic density as input from cameras which is abstracted from Digital Image Processing technique and sensors data, resultantly giving output as signals management. An algorithm is used to predicts the traffic density for future to minimize the traffic congestion.

Sodhro et al. (2019), this article contributes in three distinct ways: to develop a QoS-aware, green, sustainable, reliable, and available (QGSRA) algorithm to support multimedia transmission in V2V over future IoT-driven edge computing networks; to implement a novel QoS optimization strategy in V2V during multimedia transmission over IoT-based edge computing platforms; to propose QoS metrics such as greenness (i.e., energy efficiency), sustainability (i.e., less battery charge consumption), reliability (i.e., less packet loss ratio), and availability (i.e., more coverage) to analyze the performance of V2V networks.

Keerti kumar (2015), This paper explains the gains achieved to date by 2015 in the loT patterns. Any common challenges that must be seen during the installation process are provided with a short description of the loT system architecture. In the paper, the evolution of the Internet of Things (loT) is discussed. Technical requirements are provided for developments in wireless networking and different media. Current trends are being addressed in IoT technologies to build an intelligent transportation infrastructure. In V2V communications, enhancements in service protocols are being made. It can be inferred that by refining the procedures, the fastest path to the destination can be achieved. Copyright and copyright concerns are relevant in the Internet of Things selling of goods.

Ren (2019), In this article, they describe the block chain as a decentralized infrastructure opposed to a cloud-based central framework to enable vehicles to work together without needing to go through a central computing node's authority. Transmission of data between vehicles uses a peer-to-peer network where each node communicates directly to all other nodes validated by the appropriate endpoints; the right to gain lanes is accepted by all relevant vehicle contracts, as well as by a smart contract unanimously decided upon.

Ahmed (2016) The new research efforts to allow smart IoT-based environments are addressed in this article. By developing a classification focused on connectivity enablers, categories of networks and technology, and WLAN principles, targets, and functions, they collect and classify the literature. In addition, the essay highlights the unparalleled possibilities provided by the Internet of Things-based smart worlds and their impact on human existence. Also featured are several case studies published by numerous businesses.

Benevolo (2016), The goal of this article is to examine smart mobility initiatives as part of a wider spectrum of smart city initiatives and to discuss the role of ICTs in fostering smart mobility interventions and their effect on efficiency. The lives of the public and people. The value that the city as a whole has developed. The study of smart mobility initiatives, embedded in recent research on the smart cities as well as its more cohesive elements, i.e., the interactive city and the green city, yields several fascinating outcomes. Proposing a classification of behavior around an interconnected solution to smart mobility is the key contribution of this work; it varies significantly from the literature-based research that typically focused on particular issues of smart mobility. From the study, smart mobility, dynamic Mobility, smart development, and smart city initiatives all interact with mobility. Smart mobility, with its unique and coherent priorities, leads to the aims of the global city, impacting the most important objectives of the developed community, such as minimizing the area's environmental effect or improving people's quality of life. According to the team, six key smart mobility priorities are fully integrated with the overall goals of the smart city.

Bonomi (2014) Other than an explosive spread of endpoints, the Internet of Things (IoT) offers more. In certain cases, it is annoying. They discuss these interrupts in this chapter and propose a hierarchical distribution architecture, called Fog Computing that extends from the edge of the network to the kernel. In particular, they are paying attention to the latest dimension introduced to big data and analytics by the Internet of Things: a variety of globally dispersed outlets on the edge. Fog computing, which is a hierarchically dispersed content distribution platform consisting of computing, storage and network infrastructure, was addressed in this segment. They investigated core aspects of fog computing and how cloud computing is complemented and extended by fog. They explored the usage cases that inspired the need for fog, thus stressing the relevance of haze inside the Internet of Things and the big data room for different industries. They also offered a high-level summary of the technological architecture of Fog, outlining the different technological components needed to achieve the vision of Fog.

III. METHODOLOGY

3.1 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. The 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).

3.2 Zone Identification and Nodes Selection 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. 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 2, 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. 3). For high-speed algorithms, the usage of the search radius has no particular benefit.

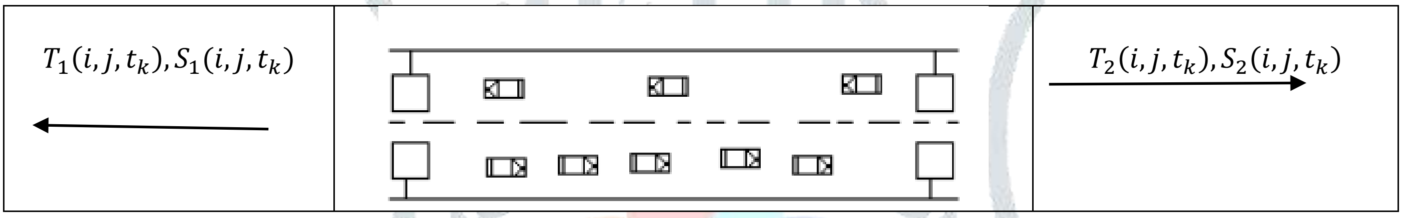

Fig. 2 Traffic means speed and the average travel time related to each lane

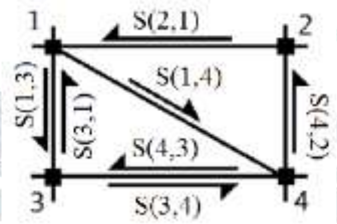

Fig. 3. the rates and hours table for the planned network

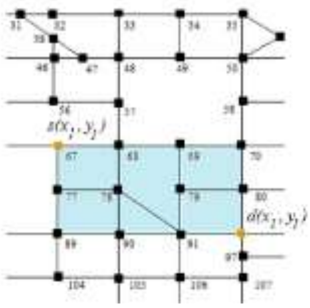

Fig. 4 A street network illustration

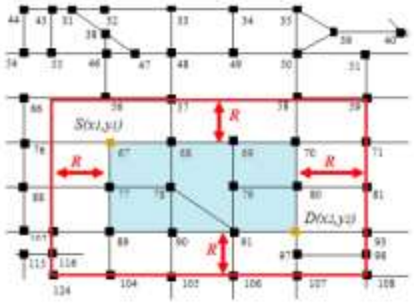

Fig. 5 Extended zone

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 4)

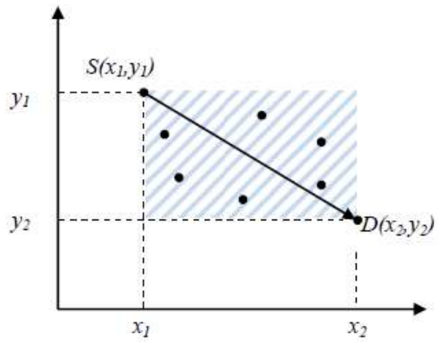

Fig. 6 Travel pattern I

- 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 5)

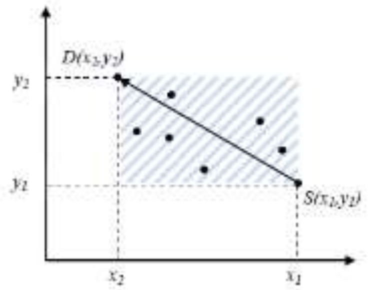

Fig. 7 Travel pattern II

- If x1 ≤ x2 and y1 ≤ y2 then:

$x1\text{-}R \leq xi \leq x2+R$ and $y1\text{-}R \leq yi \leq y2+R$ (See Figure 6)

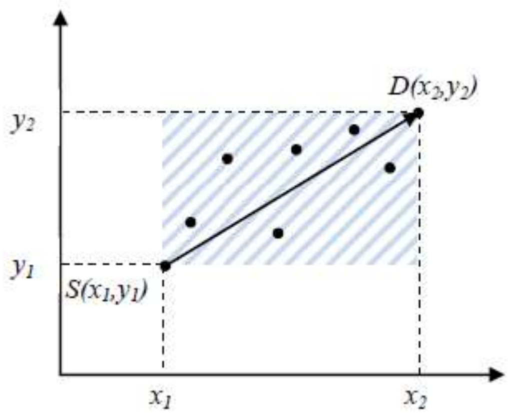

Fig. 8 Travel pattern III

- And finally, If $x1 \geq x2$ and $y1 \geq y2$ then:

$x2\text{-}R \leq xi \leq x1+R$ and $y2\text{-}R \leq yi \leq y1+R$ (See Figure 7)

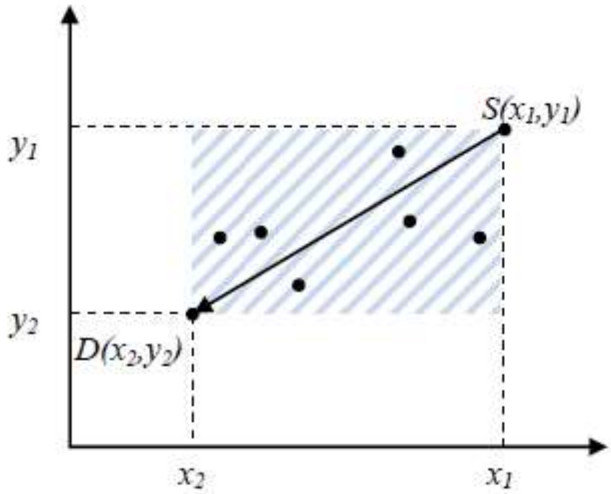

Fig. 9 Travel pattern IV

Since the unique address of each Ni node is I = 1,2, ... N, the node set identified in the designated region comprising the starting point 'S' and the destination point 'D' is:

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

IV. 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.

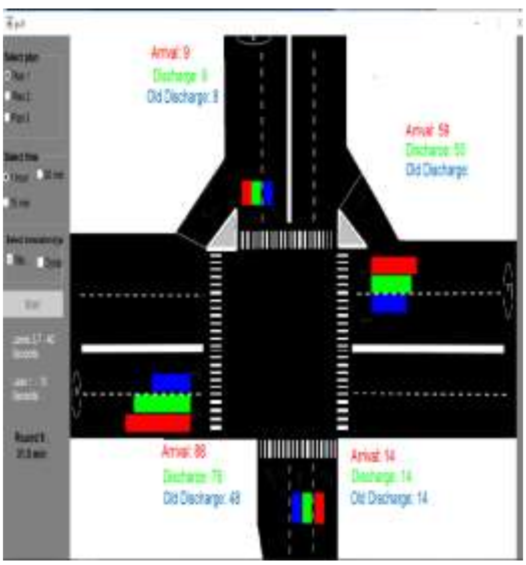

Fig. 6 Plan 1 -1 Hour - Simulation Static

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.

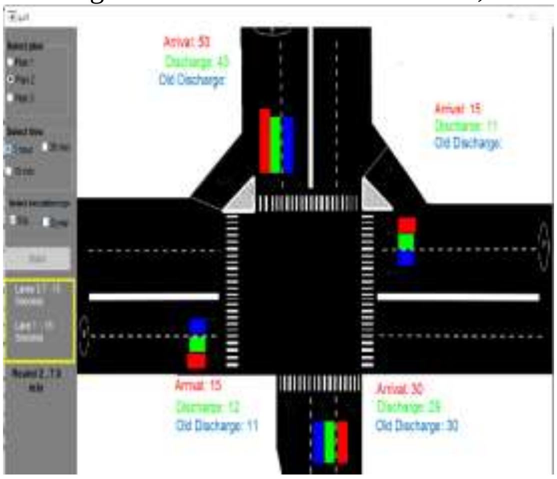

Fig. 7 Plan 2- 1 Hour- Simulation Static

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.

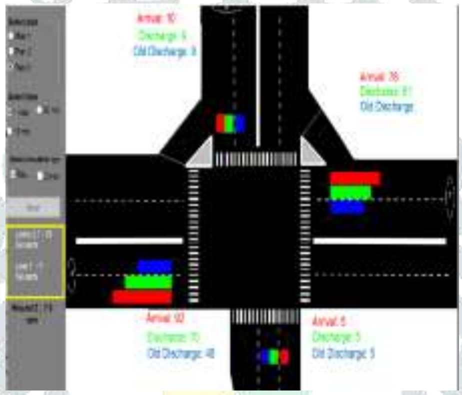

Fig. 8 Plan 3-1 Hour-Simulation Static

As the above figure come out after the simulation execution as arrival, discharge and old discharge has been planned 3 in selected time 1 hours. As the above figure has static option on in GUI. There are four sections as one (top left) has 10-arrival, 9-discharge and 9-old discharge, second (top right) has 76-arrival, 61-discharge and 0-old discharge, third has 92-arrival, 70-discharge and 48-old discharge and the last one has 5-arrival, 5-discharge and 5-old discharge.

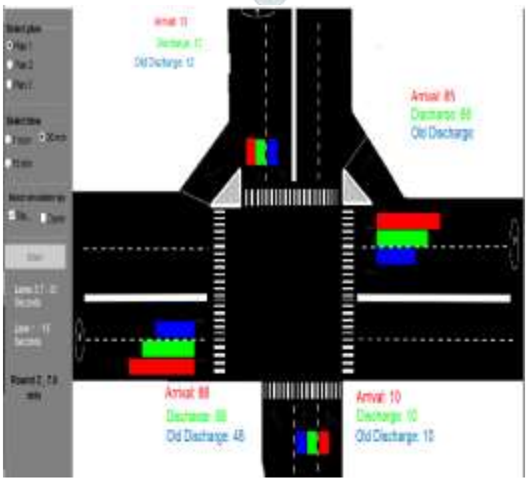

Fig. 9 Plan1 Time 30 Min- Simulation Static

As the above figure come out after the simulation execution as arrival, discharge and old discharge has been planned 1 in selected time 30 mins. As the above figure has static option on in GUI. There are four sections as one (top left) has

13-arrival, 12-discharge and 12-old discharge, second (top right) has 85-arrival, 66-discharge and 0-old discharge, third has 88-arrival, 68-discharge and 48-old discharge and the last one has 10-arrival, 10-discharge and 10-old discharge.

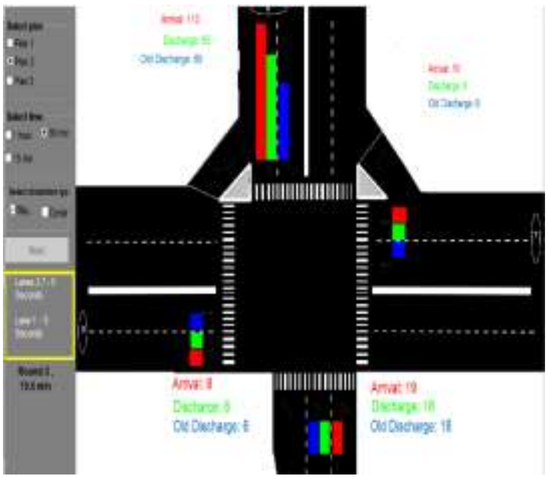

Fig. 10 Plan2 Time 30 Min Static

V. CONCLUSION AND FUTURE SCOPE

In order to use multi functionality of components in IoT, the intelligent traffic management 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 Management 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 management 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.

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