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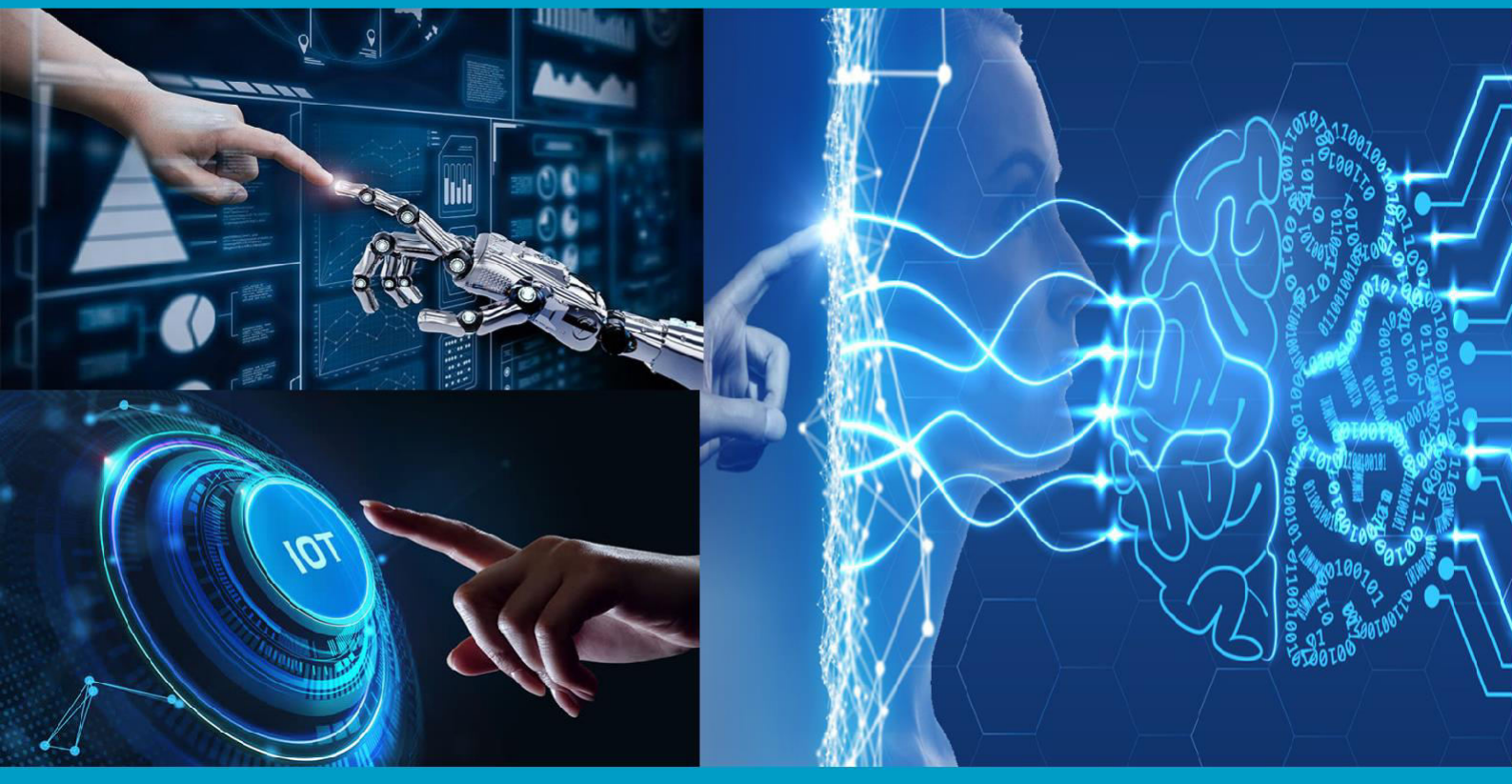

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Analysis and Optimization of Road Traffic through VANET

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ABSTRACT: The routing in a VANET has to be trustworthy, protected, and as efficient as possible. Therefore, further research is required before the VANET's future use can be accurately predicted. The unpredictable nature, mobility, and speed of vehicles increase the need of meticulous route planning. VANETs are a new kind of high-tech networking that incorporates Ad-Hoc networks, wireless LANs, and cellular technologies; they are crucial to the implementation of an intelligent vehicle communication system (ITS). A VANET functions in a manner similar to that of a mobile ad hoc network (MANETs). When compared to MANETs, VANETs use a more complex and flexible hybrid design. A VANET facilitates interaction and data exchange between vehicles. Ad hoc networks are defined as those that operate without a dedicated router or a network of access points. The use of wireless connections between vehicles, known as vehicle-to-vehicle (VANET) networks, has grown rapidly in recent years. Recent uses of VANET include enhancing road safety, making highways simpler to travel, and reducing congestion and delays. Research into vehicle ad hoc networks (VANETs) has swiftly become one of the most significant subfields of study in the area of intelligent transportation systems due to the advantages they provide to drivers and passengers (ITS). Today, MATLAB is powering an analysis- and VANET-based solution for optimizing road traffic. The goal of transportation research is to make travelling both easier and more pleasant for passengers and freight. There are various reasons why VANETs have become more popular in recent years. Commuters may benefit from VANET technology in a number of ways, including increased safety, comfort, and tranquilly. There has been a frenzy of study, regulation, and improvement work on VANETs in recent years. Considering the substantial potential benefits to traffic safety, efficiency, comfort for drivers and pedestrians, and convenience of commuting. There has been a lot of recent study on the frameworks and implementations for constructing VANETs.

KEYWORDS: VANET's routing, MANETs, Intelligent transportation system research (ITS)

I. INTRODUCTION

1.1 VANETs Characteristics

VANETs are distinguished from MANETs by a number of characteristics. Here's a quick rundown of the main ways in which they differ:

High mobility: The environment of a VANET is very dynamic since nodes are classed by their higher relative speed.

Predictable and restricted mobility patterns: Unlike the unpredictable mobility of MANETs, the predictable behavior of VANETs is predicated on the predictable behavior of vehicles. Faster cars in a VANET mean more frequent topology shifts, which means more work for network nodes to provide up-to-date location data.

Localization: Vehicles may pinpoint their exact position with pinpoint precision using GPS.

Abundant network nodes: Due to the concentrated nature of the road network, VANETs may span vast distances.

Hard delay constraints: The major purpose of VANETs is the rapid transmission of emergency communications.

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1.2 Overview of VANET

In a subset of mobile ad hoc networks known as V2V networks, automobiles serve as nodes (VANETs). The primary objective of this VANET is to ensure the safety of all road users and reduce anxiety among passengers. This network, known as a wireless network, relies on wireless connections at each node (vehicle) in order to transmit and receive data (vehicle). Each node in VANET serves as a participant and a network router since the nodes, or automobiles, communicate with one another through other intermediate nodes located within their own transmission range. Because it is not dependent on a central networking node, a VANET is also often referred to as a self-organizing network. In order to better deliver geographical information to users, the network makes use of certain nodes that act as roadside kiosks. The characteristics, topological changes in networks may be implemented rapidly.

Briefly reviewing, this is a subset of the mobile ad hoc network (MANET) in which the vehicles function as nodes. In contrast to a mobile ad hoc network (MANET), all automobiles in this scenario adhere to predetermined routes, with speeds determined only by posted speed limits and indicators. There are other issues with VANET that need fixing before reliable services can be offered. For a VANET's routing to be successful, it must be reliable, secure, and as efficient as feasible. Therefore, additional study is needed to predict the VANET's potential for greater use. The requirement for careful route planning is heightened by the unpredictable nature, mobility, and speed of vehicles. Distance vector (DSR) and alternative directed shortest path (ADSP) are two of the most used classical MANET routing protocols that were first used to set up VANET routing (AODV). The effectiveness of AODV and DSR in enhancing the functionality of MHNs has been investigated. Numerous protocols have been developed to enhance the stability and performance of VANET routing strategies. It is the nodes or vehicles on the road that are used to carry the packets in multi hop routing, which also includes VADD and MDDV. The SADV relies on the fixed nodes for routing traffic in particular. More VANET communication protocols were also created to allow for scalability. For route traffic management, RBVT has been relying on RT data or statistics.

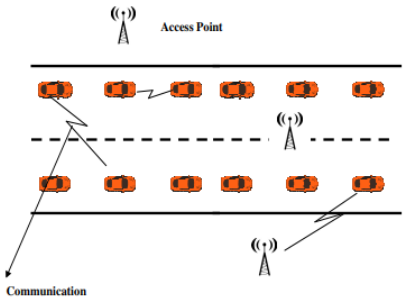

Figure 1: The routing strategy

1.3 Routing and the requirements of ITS applications

The ITS focuses primarily on two goals: traffic safety and efficiency. Their needs may be broken down into three categories. There are three types of apps: (i) those that improve safety, (ii) those that improve traffic flow, and (iii) those that provide entertainment (non-safety).Beneficiaries of road vehicle safety are a typical focus of this application. These are worries for safety-related apps in case of an accident or hazardous traffic conditions. The AU of the vehicle is the source of the identification of safety-related incidents.Increasing surface transportation efficiency is a frequent use of traffic efficiency, which is achieved by making traffic-related data available to individual cars or networks of vehicles. Green Light Optimal Speed Advisory, Enhanced Route Navigation and Guidance, and V2V Merging Assistance are just a few examples of how these technologies might be put to use.Information and entertainment systems let motorists relax and enjoy the ride. More specifically, it is worried about how ITS may be used for things other than safety. Internet-based vehicle assessments, PI-notification, and remote diagnostics are a few examples.

II. REVIEW OF LITERATURE

Cherkaoui et al. (2019), VANET network detection of traffic congestion on roads. In this study, they provide a method for using Big Data technologies to identify the flow of traffic in congested metropolitan regions. Congestion in road traffic is an extremely pervasive issue in metropolitan areas, necessitating the development of methods to alleviate the problem. A traffic gridlock wastes time, gas, and other valuable resources. They can ensure smooth and simple movement by sharing information about the traffic situation using VANET networks. This data may be sent in a

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VANET via vehicle-to-vehicle (V2V) communication. This study proposes a way for processing vehicle data using Big Data techniques. With this strategy, they were able to identify the roadways with the highest levels of congestion. They were able to see vehicle activity in the region and traffic information for each route after running our three scenarios, which allowed us to identify peak times throughout the simulation.

Paul et al. (2012), Examining the Routing Protocols Used in V2V Communications In this study, they examine the strengths and weaknesses of existing routing protocols to pave the way for the development of brand-new routing protocols and the improvement of existing ones. VANETs (Vehicular Ad-hoc Networks) differ somewhat from standard ad hoc networks in a few key respects. Building a reliable data routing system for communication between V2V (vehicle-to-vehicle) and V2I (vehicle-to-infrastructure) vehicles is difficult (vehicle-to-infrastructure communication). With so many incidents happening on the roads, VANET is a key area for the development of ITS, which might improve road safety and provide traffic information, among other advantages. The existing protocols for routing in a VANET are inadequate for all practical purposes. Future road safety relies heavily on vehicle-to-vehicle communication, which in turn requires reliable routing systems.

Wegener et al. (2008), A Protocol for Interfacing Traffic and Network Simulators (TraCI). To bridge the gap between traffic and network simulations, they provide the Traffic Control Interface (TraCI) here. As a result, they can control the behavior of vehicles in real time while conducting simulations to learn how VANET applications impact traffic patterns. Vehicular ad hoc networks allow vehicles and roadside infrastructure to communicate with one another (VANETs). Current software tools for VANET research are unable to assess the usability of vehicular applications. Instead of using static input files to provide mobility traces to a network simulator, as is done in traditional techniques, online coupling allows for the adjustment of driver behavior during simulation runtime. It is possible to execute this technique without resorting to the use of a dedicated traffic or network emulator. They provide a general-purpose, malleable architecture for mobility control with applications across several domains.

Anwer et al. (2014), Review of VANET Methodologies and Tools. This article provides an overview of the foundational wireless access technology standards that underpin both safety and non-safety applications in vehicles, including 802.11p, P1609 protocols, the Cellular System, CALM, MBWA, WiMAX, Microwave, Bluetooth, and ZigBee. It also analyses and contrasts the different wireless protocols based on criteria including bandwidth, usability, affordability, setup, accessibility, range, interference, and safety. Finally, certain problems with the compatibility of various protocols are discussed. Intelligent Transport Systems (ITS) have developed in response to recent developments in wireless communication technologies and vehicles, and they help to alleviate problems with traffic congestion, information transmission, accidents, and so on. An essential part of intelligent transportation systems (ITS), vehicular ad hoc networks (VANETs) allow cars in motion to connect and communicate wirelessly. VANETs are a subset of MANETs. Both V2V and V2I communication in a VANET are supported by wireless communication technologies.

Sheikh et al. (2019), Security Services for VANETs in Transport Management Networks: A Systematic Evaluation. In this research, they detail the current best practices for VANETs, including their architecture, security, and common issues. Second, they delve into security systems and the practical solutions that may be implemented to make VANETs safe enough for confidential communication. They cover the authentication procedures that may prevent fake nodes and forged communications in VANETs at length. They begin with a discussion of authentication protocols then go on to a discussion of the different simulation tools available, such as mobility and network simulators. Finally, they discuss potential applications of VANETs in the realms of convenience and safety.

Younes et al. (2014), This paper presents a VANET-based intelligent traffic light scheduling technique. Safe driving at junctions cannot be guaranteed without the use of traffic lights. However, they impede traffic flow because of the delays caused by the queues at each intersection. A new Intelligent Traffic Light Controlling (ITLC) method is presented in this paper. This algorithm takes into account the real-time traffic characteristics of each traffic flow that aims to cross the road junction of interest while planning the time phases of each traffic signal. By minimizing motorists' wait times at signalized road crossings, the presented algorithm hopes to improve traffic flow. Additionally, the goal is to enhance the rate at which cars may pass through the junction. For several simulated cases, they report on ITLC's performance and compare it to that of other algorithms in this area. Based on our findings, they conclude that ITLC improves traffic flow and decreases waiting times by 25% compared to conventional traffic light timing. In addition, ITLC boosts traffic flow at signalized intersections by 30%.

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III.SIMULATION AND RESULT

In the context of vehicle networks, the flexibility, scalability, and simplicity of administration offered by a Vehicular Ad-hoc Network, or VANET, are all significant benefits. However, even in the event that the communication connection between the automobile nodes and the central controller is destroyed, safety alerts must be sent with the greatest haste. Traditional routing approaches may be able to maximize the forwarding of unicast traffic, but they could also impose needless overhead on the traffic that is produced by safety applications.

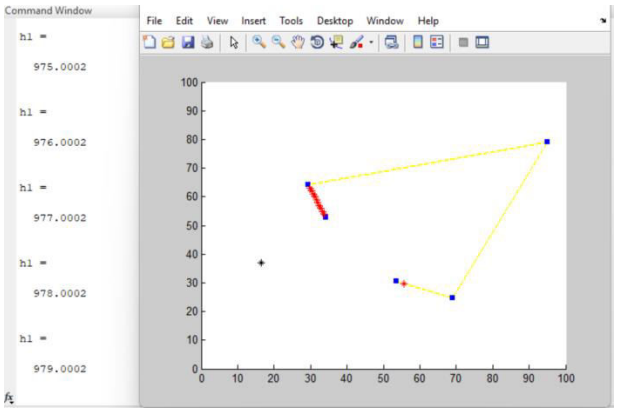

Figure 2:VANET layout in general constructed in MATLAB, scenario -1

The most important category of apps is safety applications since they help lower the number of people who are killed in car accidents and the number of people who are injured. Worldwide, the most common way people are killed or injured is in motor vehicle collisions. This category of mobile applications is designed to assist drivers in maintaining a safe driving record by delivering timely and relevant information to the user. The information that is transferred between automobiles and roadside devices makes it feasible to predict car accidents.

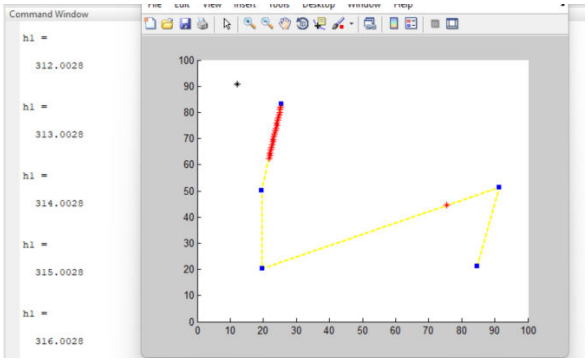

Figure 3: VANET layout in general constructed in MATLAB – scenario -2

As the above figurerepresent the node point of VANET and the user move from source to destination. This system is in testing phase of VANET scenario of 1 and 2.

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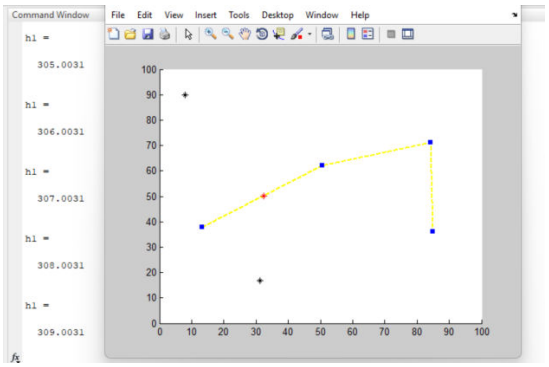

Figure 4: VANET layout in general constructed in MATLAB – scenario -3

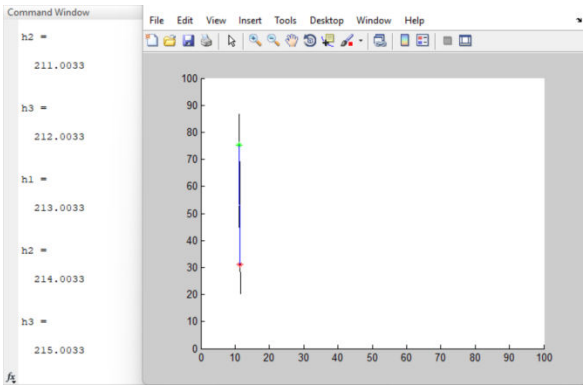

Figure 5:VANET layout in general constructed in MATLAB – scenario -4

The node points that are shown in the diagram above that is located above represent VANET, and the user moves from the source to the destination. The VANET scenario testing phase 3 and 4 are now being performed on this system.

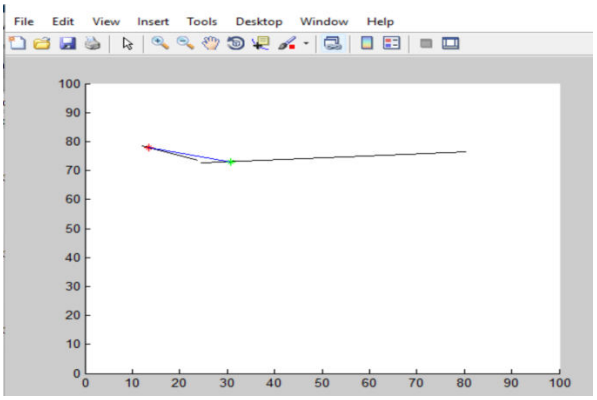

Figure 6:VANET layout in general constructed in MATLAB – scenario -5

This VANET layout above is also the extension of the test as considered the scenario of 5. The Source and destination is as presented in the figure 6.

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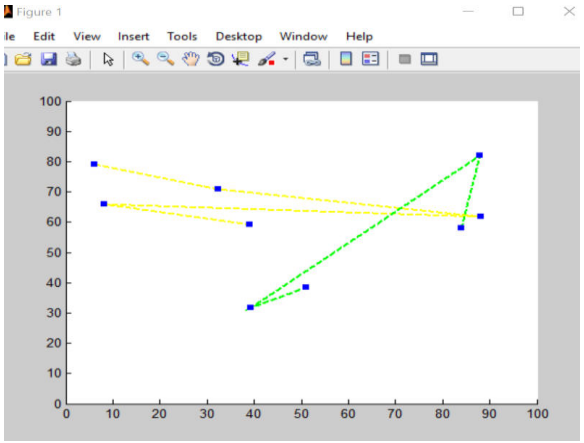

Figure 7:VANET layout in general constructed in MATLAB – scenario -6

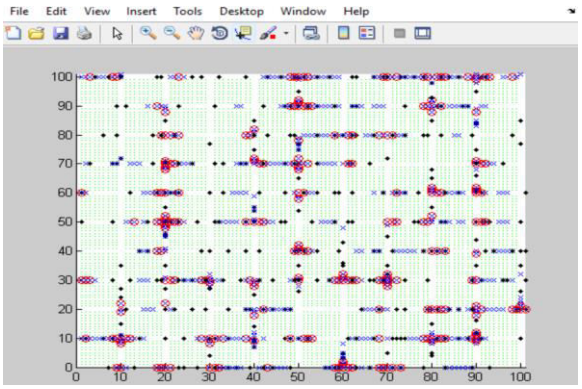

Figure 8: VANET layout with nodes constructed in MATLAB – Optimization scenario

As the above is the optimization of road traffic through VANET. The various VANET nodes has been implanted in the above structured which has rectangular cross section at each step of path. Various moveable node has been deployed and run the simulation in time optimization zone for certain time.

IV. CONCLUSION AND FUTURE SCOPE

The routing in a VANET has to be reliable, secure, and efficient. As a result, further study is required so that models may be developed to enhance the VANET's efficiency. Vehicles' instability, mobility, and speed need more meticulous route design. The technologies used in VANETsAd-Hoc networks, wireless LANs, and cellular networks—come together to provide a sophisticated network for in-vehicle communication. They're crucial to the functioning of the ITS (Intelligent Transportation System) (ITS). One may see the similarities between a VANET and a Mobile Ad-Hoc Network by comparing the two (MANETs). The VANET's hybrid design sets it apart from the MANETs. A VANET facilitates data and information exchange among vehicles, or to rephrase: it enables vehicles to communicate with one another. Ad hoc networks are a kind of wireless network architecture in which no fixed devices, such as routers or access points, are required to establish connections between users. Ad hoc networks may be centralized or decentralized depending on the situation. Recent years have seen VANET used to a variety of traffic-related concerns, including the improvement of traffic flow, the decrease of congestion, and the provision of driver advise. Also, they are quickly becoming a focal point of innovation in the field of intelligent transportation systems (ITS). MATLAB is being used to create analyses and VANETs for optimizing highway traffic. Research in the subject of vehicle technology focuses primarily on improving transportation methods for both humans and the goods they move. The network's prospective future as a supplier of various important services has increased interest in VANETs and the number of individuals using them. The use of VANET technology may provide several advantages to commuters, including as safer travel, less time spent waiting at stops, and less stress. In recent years, researchers, regulators, and innovators have paid a great deal of attention to VANETs and their associated studies, laws, and developments. because it has the

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ability to significantly enhance traffic efficiency, pedestrian safety, driver comfort, and travel convenience. Recent research has focused on both the theoretical foundations of VANET architecture and its practical implementations.

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