An Exploration of Smart Traffic System Optimization through IOT: A Review

[1]Sakshi Kathuria, [2]Dr. Kailash Aseri

[1]Ph.D. Scholar, [2]Assistant Professor
Department of Computer Science
Sunrise University, Alwar, Rajasthan

***Abstract*: Modern cities may rely on a traffic control scheme to reduce traffic congestion and its detrimental consequences in this sense. Traffic management systems consist of a series of applications and management devices aimed at enhancing the overall performance and protection of transport systems in terms of traffic. In addition, the traffic management framework gathers information from heterogeneous sources to get around this issue, utilizes the information to detect threats that could contribute to traffic efficiency deterioration, and then delivers services to monitor it. This article explores a classification, analysis, problems, and potential opportunities for incorporating a traffic management scheme with this issue in mind. In modern society, quick mobility is one of the most important needs.**

***Keywords*: Smart Traffic System, Traffic Control, IOT**

I. Introduction

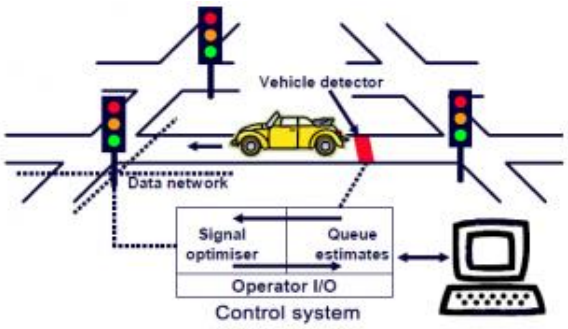
Traffic is the passage from one location to another of persons and goods. Generally, the travel takes place in a facility or road that may be considered a pilot route. As in the case of railways, it can be a physical path or it can be a negotiated or specified route, labelled electronically (as in aviation) or geographically (as in aviation) (as in the maritime industry). With the example of foot traffic, which needs only manpower, the flow entails an automobile of some type that may support persons, commodities, or both. Types of automobiles, also referred to as modes of transport, may be defined generally as road, rail, air and marine types (i.e., water-based). Traffic is increasing due to the need to transfer individuals and products from one location to another. As such, the migration is caused by the choice's citizens create to switch themselves or other persons from one location to another to partake in behaviors in that second location or to switch items to a position where they have a stronger advantage. Traffic flows are also radically distinct from physics and other physical sciences (such as the passage of electrons in a wire), since they are largely regulated and defined by human behavioral rules. Although physical characteristics are essential in the activity of all conditions (for example, maintaining an aircraft in the air), the need to shift position derives from the need or urge to fly that creates traffic. Safely and successfully accommodating traffic is one of the key problems in traffic management. Performance can be used as a calculation of the volume of traffic in comparison to the goals of the transportation infrastructure in question and to the financial capital sufficient to run it. For example, if a railway can respond to its customers' travel needs at the lowest cost, it can be deemed effective. If the solution (e.g., trucking service) will not satisfy consumer demands, but at a reduced rate, it would be deemed inefficient.

1.1 Recent Traffic Systems

The problem of transporting humanity is only likely to get worse, as the United Nations recently predicted that by 2050, the world population would hit 9.8 billion people, a rise of about 2.2 billion over the next three decades. Furthermore, as more residents migrate to metropolitan centers and towns that hold more than 50 percent of the world's population, there is a continuing mass urban migration. When more residents converge in towns, the existing ageing and capacity-approaching metropolitan system poses more difficulties in serving the rising population.

1.2 Intelligent traffic management system

There is little flexibility for existing traffic control schemes to respond to real-time traffic situations. Traditional timing systems for traffic signals, for example, are designed based on historical traffic data and, due to unusual occurrences such as traffic collisions and building accidents, do not dynamically change timing. A synchronous traffic signal system was adopted by several big cities with the aim of growing traffic congestion at major traffic intersections, which saw a reduction in travel time in Los Angeles. These frameworks do depend on a centralized approach, though. If the flow is broken inside the device at some stage, such as a traffic crash, it causes a domino effect and the synchronous traffic lights do not change their pre-programmed times accordingly.
Traffic signs, alarms and/or cameras for queues, and a central control mechanism. Queue detectors notify all main roads in the city of the traffic status control device. In exchange, the device regulates the lights in order to ensure the free flow of traffic inside the area.



The machine uses a simulator of real-world situations every two seconds to determine if adjusting the phase of either of the lights will be beneficial. It is possible to identify what the machine learning finds a "advantage" as punctual buses, less pollution in a given area, or less cars queuing on a highway entry road. If flow control is used, external traffic lights on arterial or radial roads perform a special function and are technically known as "gates" or "checkpoints". These regulate the flow of vehicles entering the city.

1.3 Smart Traffic System

Urban population has seen an unimaginable growth in the modern era, and consequently it directly affects their mobilization in huge cities. According to a United Nations report, the percentage of urban population in the whole world constitutes about 56% in 2015, with a steep increase of 1.84% every year. According to the predictions, by 2050, about 64% of the developing world and 86% of the developed world will be urbanized. With this astounding increase in urban population, there is a necessity for an effective system to combat with one of the unprecedented challenges, which is traffic congestion in big cities.

In the traditional traffic management system, ineffective traffic lights with predefined timers are used, along with manual control by police officers. Without taking an account of real-time traffic data for consideration, it can happen that a “green light” is granted to an empty lane while a lot of cars are lined up at a “red light” on the other lanes because the same time interval of green lights is granted to every lane.

Data analytics is used for processing the terabytes of data received from the vehicles. The proposed system is quite advantageous with the use of local workstations consisting regional processing units that receive data from each vehicle pertaining to a specific regional radius. These data are then reallocated based on volume of incoming data using MATLAB. This drastically reduces data traffic which would occur when a single centralized control unit is used for analyzing the data from each vehicle. Hierarchical clustering and density based clustering techniques are used to process the data. Frequent pattern mining is used in order to derive results to enable efficient traffic management.

1.4 Applications

- A simple traffic light controller is implemented in this project with a real chance of expansion.
- An external memory can be interface with the main controller so that the timings are not fixed during its programming but rather can be programmed during operation.
- An efficient traffic light controller system will include a pedestrian signaling system.

II. Reviews of Literature

One of the main facets of a smart city is the traffic control scheme. Traffic pollution is frequently seen on the highways, with rapid population development and urban migration in major cities. This paper suggests an intelligent traffic control scheme utilizing the Internet of Things to solve numerous problems relevant to road traffic management and to assist officials with careful planning (IoT). To boost road traffic flow, a hybrid solution (a mixture of centralization and decentralization) is used and an algorithm is developed to effectively manage multiple traffic scenarios. The machine takes the traffic density from a) the cameras b) and the sensors as data, and switches on the traffic lights to do this. In order to minimize traffic congestion, another AI-based algorithm is being used to forecast potential traffic intensity. A town is a complex structure composed of several interconnected subsystems of which one of the major sub-systems is the traffic system. It is the backbone of the global economy [1], one study states. In addition, one of the main measurements of a smart city has already been declared [2]. As the world population grows growing exponentially, the number of cars on the roads is the accordingly, and traffic congestion rates are the in the same way [3] [4]. Not only are traffic delays a waste of time, but it has been shown in several instances that illegal practices such as robbery of mobile phones from traffic signals often exist in big cities [5]. On the other side, it is not just significantly impacting the ecosystem [6], it is also affecting the productivity of industries [7]. Active control of traffic is also defined as a requirement. Traffic is handled by fixed time signals in most nations, whereas traffic is managed by centrally operated networks in major towns in certain developing countries. In traffic management systems [8], the Internet of Things (IoT) paradigm has been adopted. It has been decided, according to our experience and opinion, that the current traffic control structures are, to date, centralized. These systems will malfunction if network issues arise. Also, less consideration is given to traffic volume variations. The suggested framework therefore handles traffic on local and central servers, using the IoT and Artificial Intelligence principles together. Representing traffic statistics in statistical form may also be useful for real-time traffic control and management by the authorities. Additionally, for future plans, it may also be useful.

The remainder of the essay is organized into four sections. The second portion analyses the state of the art. In Section Three, the proposed system is introduced and evaluated, while in Section Four, a discussion of the outcomes is carried out. RFID's are often used to priorities emergency services during road jams, such as ambulances and fire trucks. To diagnose this condition, smoke alarms are also part of this device in the case of a road fire. A concept was built to show the reliability of the proposed traffic management framework, which not only optimizes traffic movement but also links nearby fire departments with a central server. Moreover, it also extracts valuable knowledge displayed in visual formats that will help authorities prepare roads in the future. [9]

III. IOT system and vehicle in commutation

The IOT system consists of a circuit embedded in each vehicle in commutation. The users can interact with the system either through wired or wireless connection of their smartphone with mounted board. This system uses Radio Frequency Identification (RFID) which plays a vital role in the research paradigm of Internet of Things (IoT). Instead of using GPS (Global Positioning system), this system uses a more efficient LPS (Local Positioning System) for locating a vehicle with the help of localized workstations situated at optimal points. Data analysis involves the implementation of big data analytics with clustered workstations constituting a regional computing unit, which maximizes the throughput. Data analytics is used for processing the terabytes of data received from the vehicles. The proposed system is quite advantageous with the use of local workstations consisting regional processing units that receive data from each vehicle pertaining to a specific regional radius. These data are then reallocated based on volume of incoming data using simulation platform. This drastically reduces data traffic which would occur when a single centralized control unit is used for analyzing the data from each vehicle. Hierarchical clustering and density based clustering techniques are used to process the data. Frequent pattern mining is used in order to derive results to enable efficient traffic management.

IV. Conclusion

The traffic density which will be specified in the application will be static and at the time of user's routes will be shown in terms of traffic light so that user can choose which path to be better for him to reach the destination. The explored theory is a rather bizarre idea that has not been applied to date. Developing a very small prototype restricted our features but we feel our application will deliver the services citizens need and it is a successful use of the available capital. Although this paper has deeply explored Smart Traffic System Optimization through IOT. Traffic Control Services must be composed of a range of important implementations. Under traffic management system, knowledge gathered from heterogeneous sources and used to identify risks that may have a detrimental effect on traffic performance. It also includes services that track danger. This paper investigates a classification, study, challenges, and possibilities for a traffic management planning with this topic in mind. People need easy mobility in urban society because of modern technologies.

References:

Rghioui Anass et.al. IOT for ITS: A Dynamic Traffic Lights Control based on the Kerner Three Phase Traffic Theory, Volume 145 – No.1, July 2016, pp. 40-48.

Dr. Sanjeev Sharma et al. IOT Based Traffic Light Controller in Smart City, Vol. 7, issue 1, January 2018, pp. 117-123.

S.N. Sivara et al. IOT Ambulance with Automatic Traffic Light Control, issue- March 2017, pp. 12-18.

N. Choosri et al. IOT-RFID Test bed for Supporting Traffic Light Control, Vol. 5, No. 2, March 2015, pp. 102-106.

Rghioui Anass et al. IOT for ITS: A Dynamic Traffic Lights Control based on the Kerner Three Phase Traffic Theory, Foundation of Computer Science (FCS), NY, USA, Volume 145 - Number 1 Year of Publication: 2016, pp. 1-3.

Harshini Vijetha H et al. IOT Based Intelligent Traffic Control System, Volume 5 Issue V, May 2017, pp.707-711.

Ashok. P.V et al. IOT Based Traffic Signalling System, Volume 12, Number 19 (2017), pp. 8264-8269.

Shilpa Telang and Sujatha Terdal, An Internet of Things Based Real Time Traffic Light Control to Reduce Vehicles CO_2 Emissions, Volume: 03 Issue: 07 | July-2016, pp. 713-717

Gandharv Sehgal et al. IOT Based Red Light Crossing Monitoring Over Android Mobile App, Vol.5 Issue.5, May- 2016, pp. 726-730.