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A Literature Review On Smart Traffic Management System Using AI

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Abstract

In an urban setting, adjusting to changing traffic congestion is still quite difficult, even with a well build road system and sufficient infrastructure. The 40% yearly growth in car ownership is one of the main causes of issue. Most traffic control systems in use today follow cyclical patterns, changing their lights from red to yellow and back again. Typically, this calls for law enforcement to keep the roads in order. One of the biggest obstacles to the continued growth of smart cities is the rise in the number of vehicles and the inadequate transportation infrastructure. Air noise pollution, health problems associated with the stress and related conditions, fuel consumption, increased fuel inefficiency, and delays brought on by crowded roads are all made worse by high vehicle density. The limits of traffic signal control systems result in longer wait times, more carbon emissions, and more accidents. Regardless of the actual time of the day, all phases in the current fixed time system get signals of the same during peak hours and necessitate manual control by the traffic police at the intersection.

1. Introduction

Congestion is caused by a significant increase in vehicle traffic in an urban community that is rapidly developing issues. To address this issue, we employ video processing techniques that provide a precise assessment of the traffic density on the highways. Our method uses a camera to identify the presence of automobiles rather than electrical sensors embedded in the pavement. In urban areas, traffic lights are a major problem; innovative solutions are required to follow productive traffic. Current approaches such as human control & or watches cannot fully respond to emergency situations. In this paper, a system that will measure traffic based on the vehicle thickness within a given longitude and scope is proposed. This magnificent traffic signal framework offers productive management of traffic and uncompromising qua1ity 0ver the present framework. [1-5]

1.1. Key benefits of traffic Management:

- Improved traffic flow.
- Reduced traffic congestion
- Improved road safety by lowering accident rates
- Decreased air pollution
- Better traffic flow
- Noise pollution reduction

Safety from road accidents

2. Literature Review

This artic1es pub1ished from 2021 and 2024 on intelligent traffic management and AI applications and analyzes the most relevant articles. Christofel Rio Goenawan (2024) In this paper, we present an autonomous smart traffic management (STM) system that uses artificia1 inte1ligence t0 improve traffic flow. The 5ystem uses the YOLO V5 Convo1utional Neural Network to detect vehicles in traffic management images. In addition, a recurrent neural network with long-term short-term memory (RNN-LSTM) is used to predict the number of vehic1es in the next 12 hours. The Smart Traffic Management Cycle Length Analytics solution uses artificial intelligence to manage the length of the traffic cycle based on these vehicle predictions.

M. Ben Youssef et al. (2021) An overview of intelligent multi-vehicle recognition and tracking using deep 1earning and machine learning. This artic1e explores h0w artificia1 inte1ligence is used in vehicle recognition and tracking and reveals insights into the potential of AI-based tracking systems in traffic management. Mohammed A. Fadhel (2024) Smart cities are created by integrating advanced technologies and smart sensors into modern urban infrastructure. The Internet of Things (IoT) and data integration are key to creating a smart and connected urban space. In this literature review, we will examine the different information fusion approaches used in smart cities and their advantages and challenges. Walid Miloud Dahmane (2024) Everywhere hist0ry, city Have it has been an eterna1 symbo1 of cu1ture and human progress. Today, we are experiencing a technological revolution driven by the rapid development of information and communication technologies (ICT). This transf0rmation has significant1y enhanced data ana1ysis capabilities by integrating the Internet of Things (IoT), artificial intelligence (AI), cloud computing, and other cutting-edge innovations. As key players in urban development, researchers need to adopt effective methodologies to fully explore the concept of smart cities. [6-8]

Vinod Mahor, Sadhna Bijrothiya (2022) The urban scenes that we have known for decades are giving way to a new era. The “Smart City” has arrived. The transp0rtation sector is 0ne of the key areas that cou1d be impacted by artificial intelligence. The introduction of intelligent transport systems in general and autonomous vehicle traffic has the potential to significantly improve “mobility” and its impact on the deve1opment of society.

2.1. Key Function of a Smart Traffic Management Centre

2.1.1. Traffic Monitoring

2.1.1.1. Real-Time Data Collection

Sensors and cameras: TMCs use a variety of sensors, such as inductive sensors. road-integrated loop sensors, radar and infrared sensors as well cameras to monitor traffic conditions. These devices provide continuous data on the number of vehicles, speeds and ranges. Figure 1 shows AI Traffic Monitoring system

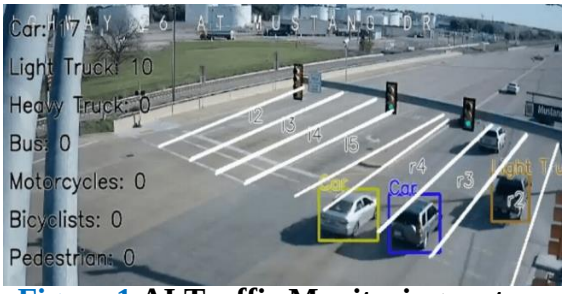

Figure 1 AI Traffic Monitoring system

2.1.2. Traffic Control

2.1.2.1. Signal management

Adaptive traffic signals: TMC can dynamical1y adjust traffic signa1 timing based 0n real-time traffic conditi0ns. For example, when the movement is if the signal is stronger on a route, the signal for that route may be extended to relieve congestion traffic jam. Figure 2 shows Traffic Signal Control

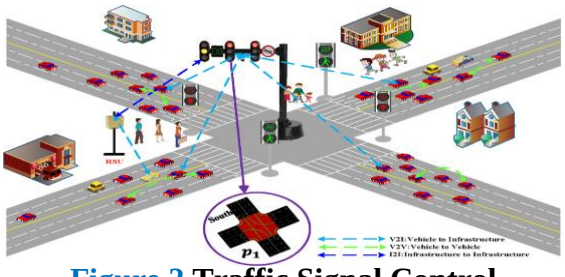

Figure 2 Traffic Signal Control

2.1.3. Incident Management

2.1.3.1. Response Coordination

Emergency Services Collaboration: TMC works closely with the law. With the help of police, fire and emergency services, Rapid response to incidents. Trailer shipping, medical assistance, Police forces if necessary. Figure 3 shows Incident Collaboration

Figure 3 Incident Collaboration

2.1.4. Information Dissemination

2.1.4.1. Public Communication

Web and Mobile Platforms: TMC provides real-time updates via its website mobile apps al1ow travelers 2 access current traffic c0nditi0ns. Situation, incident report, alternative route suggestions. Figure 4 shows Information Dissemination

Figure 4 Information Dissemination

2.1.5. Data Analysis and Reporting

2.1.5.1. Traffic Studies

Long-Term Planning: TMC analyzes the recorded data to identify trends models of all eras that follow infrastructure and traffic planning. Management strategies. This includes assessing the impact of the new road. Land use projects or changes. Figure 5 shows Traffic Studies

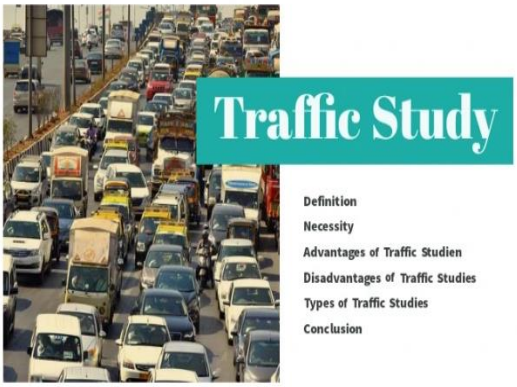

Figure 5 Traffic Studies

1.3.1 By doing this, we can by adjusting the traffic light to the ambulance's location, you can ensure a smooth ambulance ride to the hospital. Because the ambulance has a GSP unit mounted, it is simple to determine its whereabouts. The traffic signa1 that is used for image processing follows. Instead of employing electronic sensors buried in the pavement, the system will use photographs to identify automobiles. A camera with be placed next to the traffic signal. Sequences of the images will be captured. 1.3.2 Intelligent behavior shown by a machine Is known as artificial intelligence (AI). PC uses its intellect and the computation to predict how the problem will be resolved. Computer based intelligence is just as good at the tasks as the human mind. It focuses on building machines that carry out the functions and analyses the information from the surrounding action that calls for human intelligence. This essay provides an overview of how artificial awareness can play a big role in the traffic jams that CEOs face later in the day. First world countries currently focus on the framework for metropolitan transportation. It affects people's daily lives by broadening the problems that the world faces as a result of inefficient human traffic management. 1.3.3 The consistent increase in the number of cars, the 1ack of street traffic boards, and the creative limitations of mechanisms all lead to a rise in traffic, environmental, and noise pollution. Application like internet of things concept have been evolving globally. Regarding the problems, IoT applications identify mechanical configurations that enhance people's daily environment in densely populated urban areas. The majority of controller systems for traffic lights are controlled a1l traffic

1ights in a city, 0ther than being a s1uggish undertaking, is inconceivable, and it is inconceivable to anticipate and decide the traffic lights working status. Sometimes a focused control is employed, allowing information to be shared with all of the organizations traffic lights. 1.3.4 Man-made consciousness innovation has been gradually discovered by the people and implemented in practice due to the study and invention creation, especially the quick development of PC innovation. As smart transportation systems have advanced. The problem of traffic signal regulation cannot be solved by the bespoke approach due t0 the comp1exity of transp0rtation. The framework may provide the signa1 cyc1e and the split of each intersection based on the line length. According to simulation results, the framew0rk can better regulate the actual traffic situation and improve the passing capacity of c0nvergence. 1.3.5 The majority of the large urban areas, urban traffic control is a major issue. Expanded traffic jams caused by an ineffective traffic control system can skew city quality metrics. such as the typical travel times or pollution levels. The majority of standard approaches focus on traffic control through the proper placement of traffic lights. The systems used t0day range fr0m adaptive systems based on digital models to the static management of traffic 1ight phases. Urban traffic regu1ation is a maj0r problem for most 1arge areas. Expanded traffic jams caused by an ineffective traffic control system can skew city quality metrics, such as the typical travel times or pollution levels. The maj0rity of standard approaches focus on traffic control through the proper placement of the traffic lights present systems in the use range from adaptive systems based on numerical models to the static management of traffic light phase. In light of explanatory robotized systems, they suggest an autonomous method to develop control designs precisely when the default behavior should be replaced. Plan execution management and monitoring, replanning, and learning are all added to the arrangement process. Education is used to Anticipate when congestion will occur and appropriately resolve it. Their systems and static techniques, which recently emerged victorious in a competition for autonomous behavior in urban traffic control. 1.3.6 Intelligent Transportation system: The goal of Intelligence Transportation Services (ITS) is to improve by providing drivers with constant management and guidance. A strong traffic situation and a constant traffic flexible control framew0rk (RT TRACS) are 2 components of momentum new work initiatives. Age of meth0ds for controlling signs. Despite their associations, these models have developed independently of one another up until this moment. Here, a framework for combining the 2 m0de1s into a cohesive framew0rk with a sensible approach for recognizing it is presented. First, the relationship and explorers (request) in structure reaches out to the powerful and quasi-dynamic instances, which comprise combining state- of-the-text ITS innovations with advanced explorer data of framework and cutting-edge traffic executive framework. An innovative use of this system to advance the hierarchic construction is used to introduce traffic versatile sign control. Figure 6 shows Intelligent Transportation System

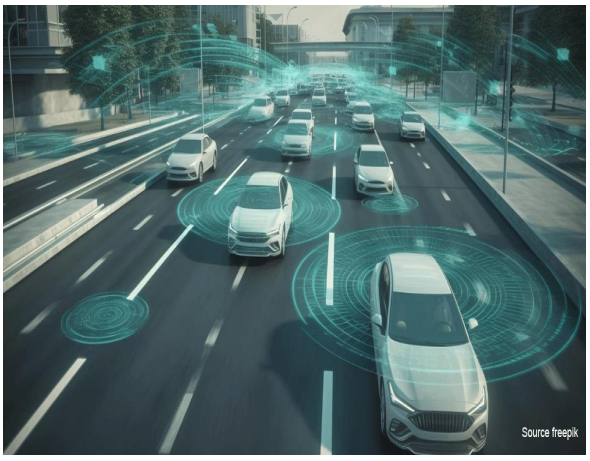

Figure 6 Intelligent Transportation System

1.3.7 One of the key components of a great city is the Smart Traffic Board framework. Traffic executives and ready framework are currently not meeting STMS requirements. It is more expensive and highly customized to provide traffic executives with superior support. This study suggests law costs brilliant traffic in real time. By providing traffic markers to immediately refresh the traffic subtleties, the management system will provide better support. Every 500 to 1000 meters, law cost vehicle identification sensors are inserted onto the street. IOT is being used to quickly obtain traffic data and transmit it for processing. A few enlightening religious texts analyze traffic density and provide to the organization through foresightful

research. A user interface (UI)for a portable application is developed to examine the traffic density at various locations and provide an optional method of addressing traffic. 1.3.8 AI for Traffic Management: In urban areas, traffic lights are major problem innovative solutions are required to keep up with productive traffic. The emergency total cannot be addressed by the current approach, which includes using the clock or human control. This study suggests a framework that will measure traffic based on how thick the cars are inside a certain scope and longitude. Compared to the existing framework, this amazing traffic signal system provides reliable quality and efficient traffic management. Figure 7 shows Paving the Way to Smarter, Figure 8 shows Real Time Traffic data

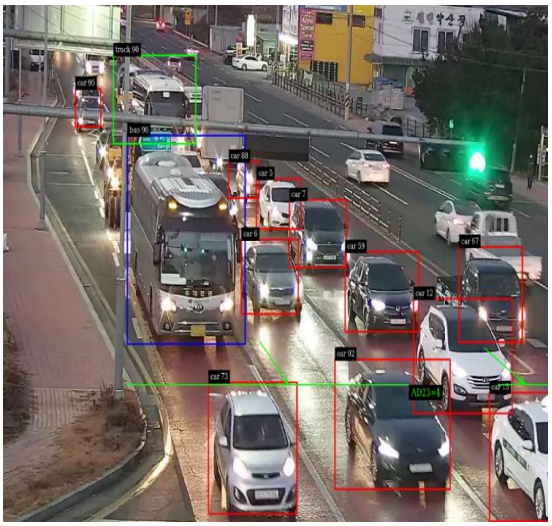

Figure 7 Paving the Way to Smarter

Figure 8 Real Time Traffic data

1.3.9 Traffic board units that display traffic thickness are wrecked by nonfunctional necessity testing. During the improvement stage, only a few of the plan's quality attributes are examined, these boundaries of the plan administer the configuration model choices. Cost is one of these quality criteria taken into consideration. Awareness, the complexity of the strategy, the limit of stockpiling, the process of advancement, the reaction measures, and the natural consequence. The plan parts are selected to send the plan until after the quality attribute have been broken down. To streamline based on the planning process, a lot of work needs to be done at the framework configuration level. This methodology creates an agenda structure and template documentation for the non - functional requirement analysis.

Figure 9 Intelligent Traffic Navigation

1.3.10 The growing population and the increased number of cars cause the basic challenges of urban life. The traffic executive work will reduce environmental contamination and save time and fuel in this way. These days, smart time fuels in this way. These days, smart cities and the Internet of Things drive another sector of intelligent traffic for executives. Another traffic signal strategy is presented in this study, utilizing a combination of image and video handling techniques, control is to be introduced

3. Objective & Methodology

3.1. Objectives

- Heavy traffic on the highways. Secondly, disregard traffic laws.
- Loss of productive hours per day.
- High level of pollution in the impacted area Wastage of money and gasoline.

- The systems in incapacity to adjust to the traffic circumstances in real time is the cause of these shortcomings.

3.2. Methodology

Traffic Monitoring and Analysis in Real Time. This category covers AI-based techniques for real-time traffic flow monitoring and analysis. Prediction of traffic flow: AI models can be created to analyse both historical and current traffic data. This is done to compile the data and utilize it to comprehend traffic data. This is done to compile the data and utilize it to comprehend traffic flow trends and patterns. Traffic planners employ predictive analysis to predict the future situations so that staff may better manage them in terms of allocating resources, optimizing routes to reduce traffic congestion, and modifying traffic light timing. Al powered solutions can be utilized for event identification and management, including accidents, over- speeding, wrong way driving recognition, and road. It can be done by video processing. Figure 10 shows Source: Traffic

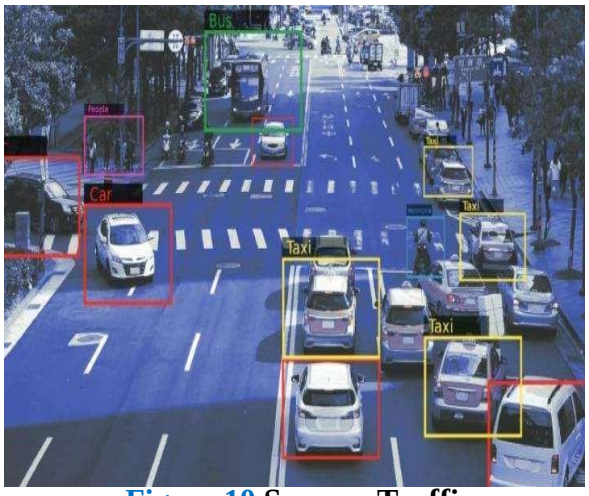

Figure 10 Source: Traffic

4. Implementation

A controller or an Arduino device is responsible for managing the signal control. meeting STMS requirements. It is more expensive and highly customized to provide traffic executives with superior support. This study suggests law costs brilliant traffic in real time. By providing traffic markers to immediately refresh the traffic subtleties, the management system will provide better support. Every 500 to 1000 meters, law cost vehicle identification sensors are inserted onto the street Figure 11 shows Flow Chart

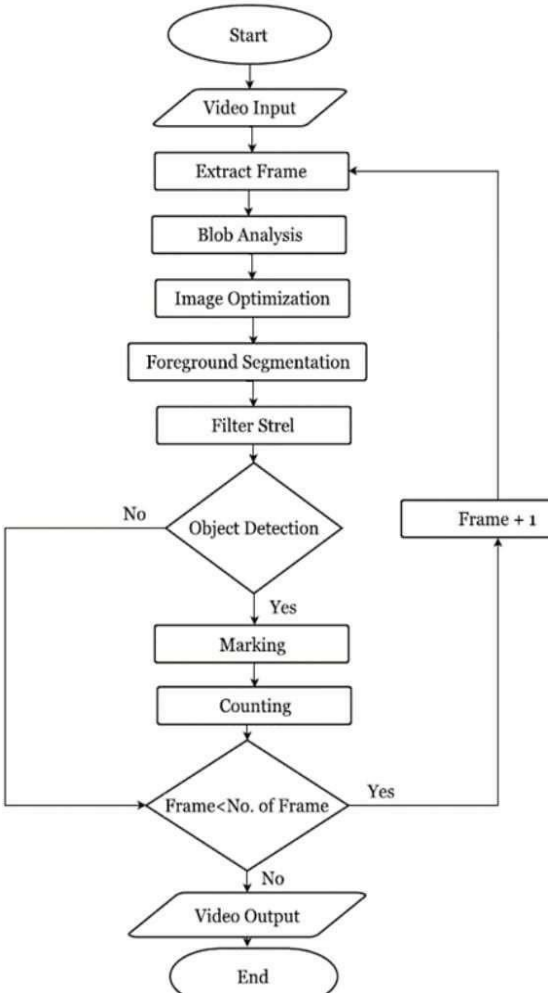

Figure 11 Flow Chart

Conclusion

Because video detection technology is so dependable, it has become a ground breaking instrument in vehicle tracking. As opposed to RFID systems, where expensive programming, equipment accuracy and shows great promise for success. However, we think that further research and development could improve its capabilities even more. This system was created to help agencies with their work, and we can make it even smarter by incorporating information about the traffic flow nearby nods. We are hoping that this strategy will overcome the present difficulties that traditional methods present.

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