Implementation of high performance traffic management system using novel blockade mechanism

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Abstract: Traffic in cities is one-sided during peak hours in a day, these traffics are uncontrollable with traffic management alone because it might cost fuels for opting long distance. Mainstream roads which connect important areas come under non extendable category, government spends a lot of money to buy the lands from the public and make alterations in electric cables, drainage system, platforms etc. Heart areas of cities need investments which take a big part in development budget. So in the proposed work, a novel method is introduced where movable pole blockades are controlled using IoT & intelligent traffic monitoring. As per survey, the two way roads having three lanes on each side can be used in 2:4 and 4:2 ratios, this method is cost efficient as it consumes only one third the amounts of usual practices. The traffic congestion is detected using video cameras incorporated in ATS (Area Traffic System). When the density of the vehicles cross the threshold for more than a period of time then an adaptive method is implemented to overcome one-sided traffic congestion. It can pave the way to delegates (VIP's) and even national emergency teams/ ambulances/ fire extinguishers to cross an area without disturbing the public. These poles are a one-time investment and digital signboards on it will indicate the subject change like converging/ diverging of roads, VIP usage etc. the other two lanes can be used by the public for LMV (Light Motor Vehicle) and HMV (Heavy Motor Vehicle) including public transportation. This method can be altered from signal to signal and also in between the signals in case of roads meeting perpendicular to the lanes. Mono directional traffic is common in and around the world where population densities are highly influential in time and fuel wastage.

1. Introduction
1.1 General introduction
Road traffic is a daily problem faced by all age groups of people daily irrespective of city. Many number of vehicles due to inadequate transit options or other reasons where non-extendable roads play a star factor. Causes of obstacles on the road which leads to blockage like lane closure, road narrowing down, road work, accident. Problems like inadequate green time could be solved by smart trafficking (IoT).
Overdeveloped areas where overcrowded and road systems are inadequate. Banning parking along the roadside is practiced in many cities to increase the traffic flow. The pedestrian crossing also causes congestion during peak hours which are solved by building a pedestrian overpass or mid-block crossing. Scheduling roadwork in the middle of the night which causes less traffic fever, although there are some road works which have to be scheduled during the day time also in an emergency or rework purposes. Many cities have split lanes for motorcycles to avoid traffic clogging. Several roads are interconnected in bottleneck pattern where gridlock is practiced to relieve areas with traffic congestion and it eventually increases fuel consumption and distance travelled by the vehicles. These trafficking systems can be deployed to save time and fuel factors. A traffic system gets congested if the demand exceeds the capacity section. Congestion is a travel time delay which exceeds the normal incurred time.

A major source of anxiety, stress and anger is traffic on roads; Traffic delays are caused by clogging in highways on an average make rush-hour. The number doubles to 84 hours on the nation’s 10 most clogged roads. Traffic congestion can be identified using software like MATLAB and python with the help of OpenCV. Congestion in both image and Video can be detected. The vehicles in the Image are detected based on parameters like boundary description, the motion vector, edge detection and so on, whereas in Computer vision on python, various data sets of vehicles are given as pre-input and various techniques like cascade method are used to identify the traffic. In general, western countries use traffic cameras for image or video input for identification of traffic congestion. Separate systems and Cameras are also installed to detect vehicle owners with number plates and control the violation based on speed, pollution regulation, and signboard rules etc.

1.2 Existing problems

In the construction sector, transport management can be more of a headache than in other industries. The construction problem is that each site is different, different layout of the site, different access points, different requirements, and different tasks. Traffic management designed with the concrete blocks which is cost-effective. Once after Implementation of concrete blocks further change can’t be made.

Traffic affects many aspects of modern society which includes economic upliftment, traffic collision, greenhouse emission increases, time and damage to immunity. Modern societies can rely on the traffic management system in this context to reduce traffic jam and its ill effects. Traffic incidents happen for several reasons. While problems with roads or safety facilities lead to some accidents. Increased travel time caused by traffic congestion causes costs on public, in terms of both economic loss and drops quality of life and immovability as well. Due to increased traffic volume, this peaks traffic congestion leads to more accidents; however, these accidents may be less serious. Transport operations are among the main contributors to Green House Gas (GHG) emissions and the outlook is still favourable given other sectors of the economy. Transportation is directly due to an additional 30 per cent of regional
GHGs. Many transport infrastructure environmental effects include traffic jams and automotive-oriented urban sprawl, which can destroy natural farming. By reducing transport emissions globally, it is predicted that the air quality, acid rain, smog and climate change will have significant positive effects on Earth.

\[ \text{Figure 1.1.b Statistical representation on expenditure for the consumption of fuels} \]

2. Literature Survey

2.1. Literature Survey on Image Processing in Traffic management

Al HussainAkoum [1] recommended the usage of a brilliant traffic framework utilizing picture preparing. The camera succession is analyzed utilizing different edge discovery calculations and techniques to tally objects. Beforehand they utilized a coordinating technique which implies that the camera and traffic signal will be introduced together. It catches a succession of pictures. To set a picture of an unfilled street as a source of perspective picture, the caught pictures are arrangement analyzed utilizing picture coordinating method; however in this article sifting approach that channels the picture and delivery all the waste things and just indicated the vehicles, and afterward shows the quantity of vehicles in the picture. This work is a product program that snaps a photo or a video. It is tweaked for later use to control the traffic signal signs by offering adequate opportunity to each hint, which relies upon the include of vehicles in each roadside.

\[ \text{Figure 2.1.a Traffic control system} \]
R. Krishnamoorthy [2] proposed to robotize traffic lights with the guide of a few web associated CCTV cameras to follow different intersections of streets. The cycle has two essential stages: a framework for vehicle distinguishing proof and calculation for traffic plot. Vehicle Detection in Digital Image Processing (DIP) will be done by executing a basic part based Edge Detection in Spatial Domain followed by a calculation to recognize the border of shut items in the interim actualizing the standards of Machine Learning so as to distinguish the vehicle type in the accompanying classifications of bikes; light engine vehicles and weighty engine vehicles. Ensuing techniques are done in a novel Traffic Scheduling Algorithm with the guide of a crossover Round Robin with an unpredictable time-segment acquired by utilizing Longest Remaining Job First to consistently refresh traffic light lights to ease traffic. Or maybe turning on green light for a set range of time, the range would be controlled progressively relying upon the segment of traffic on each course. This program was wanted to lessen street sticking to a noteworthy degree.

2.2. Smart Traffic Management System

Abida Sharif et al.[3] recommended that Smart Traffic System (STS) is one of the key parts of a future brilliant city. STS is all the more expensive and exceptionally configurable to give improved nature of administration to metropolitan traffic the executives. This paper proposes a minimal effort future STS to offer better assistance by promptly conveying traffic cautions. Ease vehicle sensors are fixed each 500 meters in the street. The Internet of Things (IoT) is actualized quickly gather and submit public traffic information for formulating data. Ongoing streaming information is submitted to Big Data Analytics. There are numerous experimental sacred texts to distinguish traffic power and give an answer by prescient investigation.

VidyaBilawade et al.[4] has recommended that there has been an uncommon increment in number of vehicles and there are around 1 million authorized vehicles in the most recent year since traffic issues have crested over the previous years and the current traffic signal frameworks have disadvantages because of the utilization of default equipment. Traffic the executives frameworks don’t have the versatility of continuous alterations. The time ranges of the green, orange and red signs are set, so the postpone period is longer. Insightful Traffic Control System is rising; this uses sensors and implicit innovation. The traffic signals timings will be shrewdly chosen dependent on street traffic. This new framework is more dependable and versatile contrasted and past fixed mode traffic signal regulator. It likewise has the additional component to pass crisis vehicles and can likewise to recognize and follow the vehicles that are taken. This plan has space for additional development, as well.

Rizwan P [5] has talked about how the current traffic the executives and security frameworks are not skilled to address the issues of STMS. They are costlier and profoundly configurable to give better traffic the board administration. Creators likewise examined the ease shrewd traffic the executives framework Real-Time for offering better support by immediately demonstrating traffic signs to refresh. Cost productive vehicle recognition sensors are implanted in the street each 500 meters or each 1000 meters. The Internet of Things (IoT) is utilized to rapidly gain and send traffic information for preparing. Continuous streaming information is submitted to Big Data Analytics. There are numerous exact sacred texts to recognize traffic force and give an answer by prescient examination. A portable application is created as a UI for investigating traffic thickness at various areas and giving a substitutive method to deal with the traffic.

Dr.B.Prakash et al [6] recommended that every information is essentially easily accessible. However, the development signals checking are yet done genuinely. The action signals are watched truly from the control room by the heads or an anticipated time is agreed to signals rising. Instead of this, an orderly regulator based strategy checking structure will be helpful for influencing the development. This arrangement of development establishment will be valuable in diminishing the action obstruct issue in metropolitan networks. Creators proposition portrays a structure where IR sensors are consolidated with an Arduino to work the ways which measure the development thickness. This joined course of action of
development is the Internet of Things (IoT) based which similarly enables to clear the action for crisis vehicles by giving a catch in a salvage vehicle so the movement gets cleared on that side. It moreover enables the vehicles count that moves over the sensors. Consequently, development controlling gets redesigned adequately, which in the end prompts a huge change in busy time gridlock system. TejTharangDanda [7] said that Internet of Things (IoT) is an overall organization which associates every savvy hub. The strategy expresses how everything is made to have the option to converse with one another. At whatever point those keen things associated with the Internet are restricted to vehicles just, they are called Internet Vehicles (VI). With an ever-expanding metropolitan populace and developing urban areas, vehicle proprietorship developed at an exponential rate [9]. Traffic the executives has in this way become a significant issue in the present life today. The creators work gives a traffic the board arrangement dependent on Internet of Vehicles to beat the difficult that wins in our day by day lives.

2.3. Case Study
Gridlock and mishaps are serious issues in Phnom Penh, the capital of the Kingdom of Cambodia. Gotten on 27 April 2018, an inconsistent framework and an absence of traffic signal prompted negative traffic mayhem. A region traffic light framework, which controls traffic lights in the city dependent on traffic conditions, has been actualized and different changes in rush hour gridlock the executives, for example, asphalt markings, street signs and medians, have been presented Phnom Penh Capital City it's a complete traffic the board venture comprising of a territory traffic light organization and other traffic the board works. Traffic in Phnom Penh is tumultuous, with different kinds of vehicles running on a similar street, from extravagance SUVs to bikes and cruiser drawn. These kinds of vehicles, most of which are cruisers, represent 70–90% of the volume of traffic. Different vehicle types have conflicting productivity and capacity to explore, leads wasteful development and hazardous gridlocks.

Phnom Penh has been growing more and the traffic conditions have changed significantly in past years, with the check of vehicles expanding. Built up traffic signal frameworks and offices are not in a situation to adapt to the evolving situations. Be that as it may, the circumstance has as of late improved through the execution of the task and the exchange of innovation to neighbourhood partners as a major aspect of the venture. At the point when the venture was controlled there were diverse traffic the executives’ offices in the task zone, for example, traffic lights, asphalt markings, traffic signs, and middle dividers. As there were no characterized rules or techniques for signal plan, the traffic light and configuration were not discerning and sometimes fell short for the interest traffic at convergences, bringing about wasteful sign help. That downside of the styles is that the detecting territory is set once the locator is mounted and cannot be altered. The progression of traffic in Phnom Penh is recognized by variegated traffic of different verities of vehicles. Vehicles are disregarding path markings and taking any position and bikes are weaving between traveller vehicles. A vehicle identifier that has a fixed detecting region doesn't identify and precisely tally vehicles under these conditions.

3. Need for Study on Traffic Management systems
The safety is very important as is the smooth flow of traffic. It not only makes people feel safe but it also providing them security. So traffic management is required that will help coordinate traffic flow on the roads. Traffic management centres main task is to programme, receive and transmit the required details about a certain traffic situation. It also helps direct and control the traffic on various highways. Every day of the year these traffic control centers are all staffed around the clock. Traffic management is essential because it keeps pedestrians and vehicles away from each other and it is necessary to use the right signs and equipment to reduce the risk of accidents, especially if major construction is taking place. It may include equipment such as speed bumps, flow plates, cones, traffic mirrors and separator bollards.
Ensuring the traffic for a span of time at the moment helps to reduce the incidence and extent of those kinds of incidents. A minute delay in traffic in any high traffic volume road creates pilling up of vehicles. A successful strategy for traffic management will reduce the delay in any part of the road network.

4. Proposed method

- Identification of traffic is feasible to work on Computer vision with python to detect traffic congestion.
- To implement high performance traffic management system with adaptable blockades that can be used to utilize lanes productively and thereby overcome the one sided traffic congestion using internet of things
- The stimulus digital output is taken if the congestion detected is above threshold (which is set on various parameters like Number of vehicles, slow movement or stagnant traffic, time period). Controller receives digital input to trigger the adaptable blockade system to pop up and pop down the movement of blockades with prior information is digital sign boards and proper trafficking of signals.

![Block diagram of proposed system](image)

4.1 Adjustable blockade system

The adjustable blockade systems are cost efficient system when compared to concrete blockades. The concrete barricades laid along the roads are practically immovable and it costs from 1500 INR to 4500 INR per running feet based on the size. This system is one time investment and manufactured using heavy recycled plastics which are eco-friendly. Implementation of Adaptable blockades in every junction in cities can free mobility of vehicles giving a lot of space. Replacing the damaged blockades can be done with ease. The bases of the blockades are shunted with motor to pop up and down for lane shifting action.
The motions of the motors are controlled by the traffic control system for lane shifting purposes. The following images show the isometric and side view motion of novel design of blockade.

**Isometric view**

**Figure 4.1.1** Pole below the road level

**Figure 4.1.2** Pole popping up when triggered

**Figure 4.1.3** Arms of the pole fapped once the height reaches beyond half

**Figure 4.1.4** Pole blockade in ON state

**Side view**
4.2 Traffic camera unit
The traffic camera unit’s main role is to play surveillance and many cities have adopted to use the cameras for detection of traffic congestion. For simulation purposes, program in python can be programmed to identify the amount of traffic congestion based on the following parameters:

- Number of vehicles
- Slow movement or stagnant traffic
- Time period

With these parameters the traffic scenario is monitored by the controller and stimulus is generated for lane shifting.
Figure 4.2.a Energy flow diagram of the system

Steps
1. The CCTV processed trigger is checked by the control system for the traffic congestion and if the congestion is identified by the factors Number of vehicles, slow movement or stagnant traffic, Time period (span of time is set by the programmer and it also depends local factors).
2. Once the controller receives the intimation, the necessary traffic lights are turned OFF (RED) for predefined delay time. This delay time is utilized to shunt lanes for wide usage.
3. The process of shifting lanes are displayed on the digital sign boards and Arch towers in order to maintain safety of the trespassers and vehicles nearby/
4. For the secondary safety purposes the lanes that are to be shifted on the other side of the road are ensured for the absence of vehicles so that poles can pop up without any obstacles.
5. After ensuring above measures the adaptable lanes are popped up, they are specially designed with flap wings to avoid trespassing of the two-wheelers.
6. Once after popping of lanes the road is added with additional lane from the other side as an advantage and the signals are turned ON (GREEN).
In Figure 4.2.1 portrays the normal traffic condition, where there is no traffic on the either sides of the road lasting more the threshold time. Whereas in Figure 4.2.2 Heavy traffic is detected in the cameras incorporated, the cloud synced with the controller commands the digital signboards and displays ‘Heavy traffic detected’ on both sides and the signals are turned red. The lane next to the middle blockade is cross verified for the absence of vehicles. Once after evacuating the lane the trigger is set to switch the operation.

The pop up and down of poles are operated in the respective side of the lane, in addition to the system, displays can be added to the sides of the road to describe the operation clearly. Figure 4.2.3 shows the shifting of lanes. Once a lane is added to the less traffic side then the signals are turned green. Pervasive of vehicles can be operated on four lanes so that the traffic width widens and the density decreases over a period of time. This lanes can be expanded as per it is deployed. The blockade has flap wings as additional advantage and it avoids the crossing of two wheelers. By implementing this distance between two blockades can be increased and the cost is reduced eventually. The digital sign boards display the lane allotted shown in Figure 4.2.4.
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5. Conclusion

Various Image processing techniques have been identified to detect traffic congestion. Redirecting vehicles to various other routes will consume more fuel than the threshold of actual consumption. Pre-processing images usually involves eliminating low-frequency background noise, normalizing the size of the images of the individual objects, eliminating shadows, and masking image portions. Pre-processing of images is the technique used to enhance data images before computational processing. The initial task of detecting vehicles is to transform the true colour input image into a grey image form. Traffic causes thermal & air pollution, mental stress and illness. This also limits the leverage of emergency vehicles like Ambulance, Fire service, Police patrol etc. The US spends around 416 billion dollars for maintenance of roads per year out of which 181 billion dollars are invested just to extend the road. Abolishing parking lots along the roadside, constructing alternate paths to overcome traffic add on to the extending budget. To summarize the ill effects of congestion, lack of productive energy, increased fuel usage, increased wear and tear of car engines, increased fuel burning, high traffic accident risk, and adverse impact on the psychological condition of people, sluggish and inefficient emergency response and distribution status. The need to research those things is essential to overcome depleting petroleum resources, which is mandatory in conserving nature for the future. Though renewable energy is implemented in vast areas, traffic congestion tarnishes fuels with no valid reason. Adaptable blockades are the only solution to overcome these problems.

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