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DENSITY BASED SMART TRAFFIC CONTROL SYSTEM USING CANNY EDGE DETECTION ALGORITHM ALONG WITH OBJECT DETECTION.

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ABSTRACT- The introduction of cutting-edge equipment and technology is urgently needed to improve the state-of-the-art in traffic control as the issue of urban traffic congestion worsens. Due to the growing number of vehicles and the limited resources offered by the current infrastructures, traffic difficulties are becoming more frequent these days. Using a timer for each phase is the most basic method of traffic light control. Utilizing electronic sensors to identify automobiles and generate a cyclic signal is an other method. We suggest an image processing-based traffic signal control system. Rather of employing electronic sensors set into the pavement, the system will use photographs to identify automobiles. The traffic light will be accompanied by a camera. It will record sequences of images.

INTRODUCTION-

Modern cities' growing populations result in an increase in vehicle travel, which exacerbates traffic congestion. In the largest and most populous cities, traffic congestion has been the root cause of numerous serious issues and difficulties. More time is being wasted as a result of this traffic jam. The importance of effectively regulating traffic flow to maximize the use of available road capacity has increased due to the continual rise in the number of cars on the road. Significant incentives for reducing traffic delays are also provided by high fuel prices and environmental concerns. Therefore, a proper control traffic signal timing sequence is required. To update traffic statistics, a variety of sensors have been used to estimate traffic parameters.

Controlling by Hand

In order to manually control the traffic, manpower is needed for the name instance. The traffic policies assigned to a necessary area or city to control traffic vary by country and state. To regulate traffic, the traffic police will have a sign board, a sign light, and a whistle. To manage the traffic, they will be told to wear particular uniforms.

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LITERATURE SURVEY-

Topic: Dhaka's average traffic speed now 7 km per hr WB report

Author: Siddique. A

In Bangladesh's capital city of Dhaka, traffic congestion has emerged as a major problem. Even though Dhaka is a megacity, its high population, uncontrolled traffic, and inadequate road space have left it trapped. The majority of Dhaka's streets are lined with rickshaws, a sluggish, three-wheeled, pedal-powered vehicle that is well-known among city people. Therefore, rickshaws are essential for determining Dhaka's average traffic speed. This study thoroughly examines Dhaka's traffic patterns and determines the town's average speed while taking into account two important factors: 1) the three road classes (main, secondary, and tertiary) and 2) the four timestamps of the day (midnight, morning, afternoon, and night). Based on the daily activities of the urbanites, the timestamps are selected to accurately depict the state of traffic intensity in Dhaka city. This study uses 1,56,630 records traced from 25 different road segments over 15 days to determine the average traffic speed on those three road classes for each of the four timestamps. The average speed of rickshaw-free roads and non-rickshaw-open roads is estimated in the paper to be 20 km/h and 11 km/h, respectively. Despite the fact that not every street has the same infrastructure, the results in this study provide a good estimate for each road as well as the entire city.

Merits:

Provides comprehensive traffic analysis, estimates average speed on various road classes and timestamps, accounts for rickshaw impact, and offers valuable insights for urban planning**.**

Demerits:

Limited to Dhaka city, relies on 15-day data, assumes consistent rickshaw presence, and lacks consideration for seasonal, weather, or special event-related traffic variations.

Topic: Smart Traffic Control System Using Image Processing, International Journal of Emerging Trends & Technology in Computer Science (IJETTCS).

Author: Vismay Pandit

Traffic congestion at intersections has become a major issue in India as a result of the rise of automobiles. Adaptive traffic signals that can monitor traffic density in real time must be installed immediately due to the continually increasing vehicle density. This method effectively uses image processing to regulate traffic flow by capturing a picture of the traffic at a junction. The traffic light's duration is adjusted based on the number of vehicles on various routes at the traffic signal after a methodical process of image collection, analysis, and algorithm implementation.

Merits:

Efficiently manages traffic congestion, reduces waiting time, and optimizes traffic flow using real-time image processing and adaptive traffic signal control.

Demerits:

Susceptible to image quality issues, lighting variations, of algorithm using inaccuracies, maintenance requirements, and potential system failures or hacking vulnerabilities.

TOPIC: Implementation of Digital Image Processing in Real Time Traffic Light Control

AUTHOR: Pallavi Choudekar

The introduction of cutting-edge equipment and technology is urgently needed to improve the state-of-the-art in traffic control as the issue of urban traffic congestion worsens. Due to the growing number of vehicles and the limited resources offered by the current infrastructures, traffic difficulties are becoming more frequent these days. Using a timer for each phase is the most basic method of traffic light control. Utilizing an electronic sensor to identify automobiles and generate a cyclic signal is an other method. We suggest an image processing-based traffic signal control system. Rather of employing electronic sensors set into the pavement, the system will use photographs to identify automobiles. The traffic light will be accompanied by a camera. It will record sequences of images.

Merits:

Efficiently controls traffic flow using image processing, reduces infrastructure costs, enhance accuracy, and adapts to real-time traffic conditions

Demerits:

Susceptible to image quality issues, lighting variations, weather conditions, camera maintenance, and potential algorithm inaccuracies or processing delays.

Topic: Video sensor network for real- time traffic monitoring and surveillance, The Institution of Engineering and Technology

Author: T. Semertzidis

The growing demands on traffic in terms of safety and congestion make sensor networks and related infrastructures increasingly crucial to traffic monitoring and control. These systems give authorities access to real-time information about traffic conditions, such as traffic loads, in addition to monitoring the traffic situation at the detection sites. A network of autonomous tracking units that take and process images from one or more pre-calibrated cameras forms the basis of the real-time vision system for automatic traffic monitoring presented in this study. The suggested system is adaptable, scalable, and appropriate for a wide range of uses, such as tracking traffic in highway tunnels and airport parking lots. Testing and assessing various image processing and data fusion methods in order to integrate them into the finished

system is another goal of this project. With very low bandwidth needs, the image processing unit's output is a collection of data for every moving object in the scene, including target ID, position, velocity, and categorization. This data is sent to a remote traffic control center. Both valuable statistical data (traffic loads, lane changes, average velocity, etc.) and real-time output (e.g., warnings, electronic road signs, ramp meters, etc.) are extracted from this data.

Merits:

Real-time traffic monitoring, flexible/scalable architecture, low bandwidth requirements, accurate object tracking/classification, and enhanced safety/congestion management.
Demerits:

High initial infrastructure costs, reliance on camera calibration and maintenance, vulnerability to weather and lighting, and the possibility of inaccurate picture processing.

TOPIC: An improved Prewitt algorithm for edge detection based on noised image, in 4th International Congress on Image and Signal Processing**.**

AUTHOR: Lei Yang

In this paper, an improved Prewitt algorithm for edge detection is proposed for the reason that the traditional Prewitt edge detection algorithm is sensitive to the noise. The traditional Prewitt edge detection operator only has two templates with horizontal and vertical directions. While the edge is in a plurality of directions, so operator with eight templates of different directions is put forward and it can detect more edges. In order to improve the capability of resisting noise, this paper put forward three improvements. First of all, the mean value rather than the maximum value of the gradient magnitude of the eight directions is used as the final gradient magnitude. Secondly, OTSU automatic threshold is used to set the gradient magnitude threshold.

Merits:

Enhanced edge detection accuracy, improved noise resistance, and adaptability to multi-directional edges through 8-template approach and OTSU thresholding.

Demerits:

Increased computational complexity, potential oversmoothing, and sensitivity to parameter settings in OTSU thresholding and gradient magnitude calculation.

Topic: IEEE International Conference on Mechatronics and Automation, "An enhanced clever edge detection algorithm."

Author: Weibin Rong

The traditional Canny edge detection algorithm is sensitive to noise, therefore, it’s easy to lose weak edge information when filtering out the noise, and its fixed parameters show poor adaptability. In response to these problems, this paper proposed an improved algorithm

based on Canny algorithm. This algorithm introduced the concept of gravitational field intensity to replace image gradient, and obtained the gravitational field intensity operator. Two adaptive threshold selection methods based on the mean of image gradient magnitude and standard deviation were put forward for two kinds of typical images (one has less edge information, and the other has rich edge information) respectively. The improved Canny algorithm is simple and easy to realize. Experimental results show that the algorithm can preserve more useful edge information and more robust to noise.

Merits:

Enhanced noise robustness, preserved weak edge information, adaptive thresholding, and improved edge detection accuracy.

Demerits:

Potential computational complexity increase, dependence on image type classification, and sensitivity to parameter settings in gravitational field intensity operator.

Topic: Traffic Congestion's Economic Impacts Evidence from US Metropolitan Regions

Author: M. Sweet

Traffic congestion alleviation has long been a common core transport policy objective, but it remains unclear under which conditions this universal by product of urban life also impedes the economy. Using panel data for 88 US metropolitan statistical areas, this study estimates congestion's drag on employment growth (1993 to 2008) and productivity growth per worker (2001 to 2007). Using instrumental variables, results suggest that congestion slows job growth above thresholds of approximately 4.5 minutes of delay per one-way auto commute and 11,000 average daily traffic (ADT) per lane on average across the regional freeway network. While higher ADT per freeway lane appears to slow productivity growth, there is no evidence of congestion-induced travel delay impeding productivity growth. Results suggest that the strict policy focus on travel time savings may be misplaced and, instead, better outlooks for managing congestion's economic drag lie in prioritising the economically most important trips (perhaps through road pricing) or in providing alternative travel capacity to enable access despite

Merits:

Provides empirical evidence on congestion thresholds hindering employment and productivity growth, informing targeted policy solutions.

Demerits:

Limited by outdated data (1993-2008), potential over simplification and unclear generalizability to diverse urban contexts.

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EXISTING SYSTEM-

Traffic control is a very challenging task, and only the conventional system is unable to manage this important system. To address this severe issue more successfully, we want an automated system. Pakistan requires a dynamic system that can monitor and manage traffic issues as well as road congestion. Basically, the recognition and organization of traffic transportation are very fundamental for controlling the traffic effectively by this the traffic vehicle-related data is to be analyzed and collected. traditionally the traffic is controlled manually which requires more man-power and other resources since it is very difficult to control over the traffic manually. Some of other traffic controlling system is an automatic traffic control system which focuses on time for each step, In which electronic wireless sensors are used to detect the traffic and generate the indicating signal. But the main delay of this system is that the green light may effect to waste the time when the road is empty. The image processing can be used to eliminate all of these drawbacks effectively which focuses to detect the vehicles through images rather than wireless sensors. Initially, the traffic compactness will be measured for a signal and accordingly to time.

The system depends on the main six steps: A)capture image B)color image conversion to grayscale C)image enhancement D)Thresholding E) Foreground and count vehicles F) Time Assigning. Some of these steps are considered as image morphological operations. The Matlab tool has been used to implement the proposed system. The webcam has been used to record the series of frames (video) of the lanes of the road and each frame of the video is compared with the image captured initially. Image processing algorithms have been used to find out the total vehicles available in the video. Some conditions have been used to identify if the number of vehicles increased from the predefined threshold value and the huge traffic message is displayed.

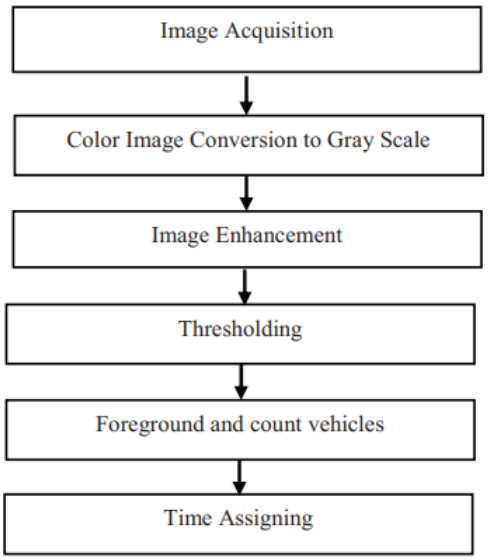

Fig 3.1 Block Diagram of existing System

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3.2 Image Acquisition / Capture Image

very initial phase in image processing is to capture the image of an object. Normally, image is an array of pixels which can be defined For processing images through the digital computer the values of spatial coordinates a and b must be changed into finite discrete. Every digital image has finite elements called tiny dots (pixels). Webcam captures a series of frames in video format and further, they are extracted in images of each frame.

3.3 Color Image Conversion to Gray-Scale

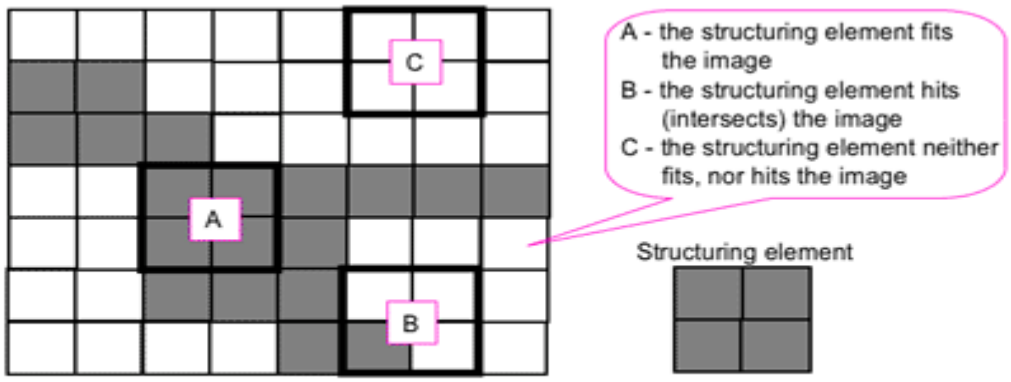
The second stage involves converting the first image to an RGB image, which is a color system that employs three channels to describe the intensity of each pixel. Using an image processing method, this color image has been transformed into a grayscale image.

3.4 Image Enhancement

Image enhancement is the process of altering the pixel intensities in the frequency of the digital image to improve its visual appeal. In the suggested system, when step 2 is finished and the final image is in grayscale, we utilize the Matlab program to improve the grayscale image's included in a picture. The system receives the two input images—one of the road with no cars and the other with—in order to count the number of vehicles. The RGB color input image is converted to grayscale.

PROPOSED SYSTEM-

There is technique which is used for the traffic light control based on image processing which measure the traffic density on the road and according to the traffic density measurements, it decides the cyclic time of the traffic light signals.



Probing of an image with a structuring element
(white and grey pixels have zero and non-zero values, respectively).

Due to the growing number of vehicles and the limited resources offered by the current infrastructures, traffic difficulties are becoming more frequent these days. Using a timer for each phase is the most basic method of traffic light control. Utilizing an electronic sensor to identify automobiles and generate a cyclic signal is an other method. We suggest an image

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processing-based traffic signal control system. Rather of employing electronic sensors set into the pavement, the system will use photographs to identify automobiles.

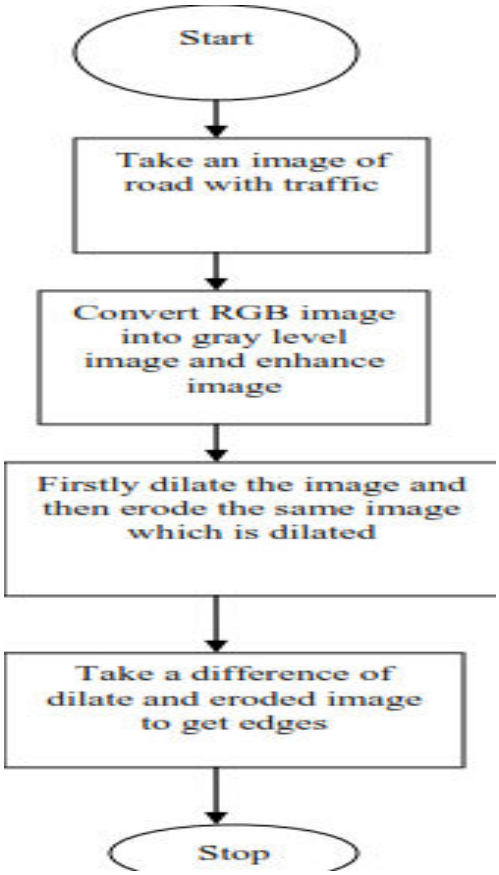

Fig 4.1 Flow chart of proposed system

Following are the steps involved:

- Image acquisition, in which empty road and image with traffic on road is captured; empty road image is saved as a reference image.
- RGB to gray conversion of both the images
- Image enhancement
- Image matching using Morphological edge detection, which matches the edges of the reference image and the image with traffic on road.

4.2 Image enhancement

Traffic images often suffer from poor lighting conditions or low contrast. Histogram equalization can help in making important details such as road signs, vehicles, or pedestrians more visible. Histogram equalization can be used as a preprocessing step in a larger image analysis pipeline to improve the quality of images before further analysis or recognition tasks.

4.3 Design consideration:

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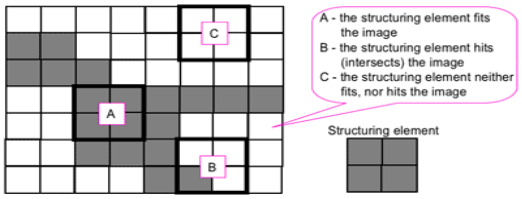
Traffic from north, south, east, west, from north to west, south to east, west to south and east to north is allowed

1. Right turns are considered
2. Two fuzzy inputs are used : the weight of the traffic on the arrival side (Arrival) and the weight of traffic on the queuing side (Queue).If the north and south side is green then this would be the arrival side while the west and east side would be considered as the queuing side, and vice-versa.
3. Signal time is already predefined in the controller based on average traffic condition;extension of the green light is done over already determined time.

Input and Output Membership Functions and fuzzy rule base

For the traffic lights control, there are four membership functions for each of the input and three membership functions for output fuzzy variable of the system. Figure 3 shows the fuzzy variables of Arrival, Queue and Extension of the system control.

Morphological techniques probe an image with a small shape or template called a **structuring element**. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighbourhood of pixels. Some operations test whether the element "fits" within the neighbourhood, while others test whether it "hits" or intersects the neighbourhood:



Probing of an image with a structuring element
(white and grey pixels have zero and non-zero values, respectively).

A morphological operation on a binary image creates a new binary image in which the pixel has a non-zero value only if the test is successful at that location in the input image.

The **dilation** of an image f by a structuring element s (denoted $f \oplus s$) produces a new binary image $g = f \oplus s$ with ones in all locations (x,y) of a structuring element's origin at which that structuring element shits the the input image f, i.e. g(x,y) = 1 if s hits f and 0 otherwise, repeating for all pixel coordinates (x,y). Dilation has the opposite effect to erosion -- it adds a layer of pixels to both the inner and outer boundaries of regions.

Binary image

Dilation: a 2×2 square structuring element

The holes enclosed by a single region and gaps between different regions become smaller, and small intrusions into boundaries of a region are filled.

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SIMULATION RESULTS

This section describes the simulation results that have been tested with various traffic images. All the experiments have been done in MATLAB 2014a version.

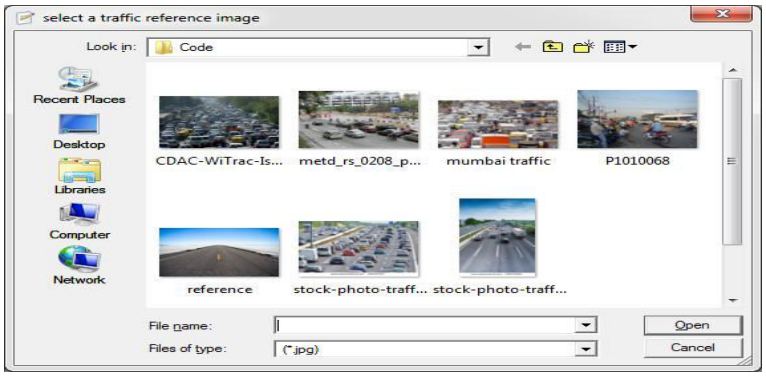

Fig 5.1 Select a reference image

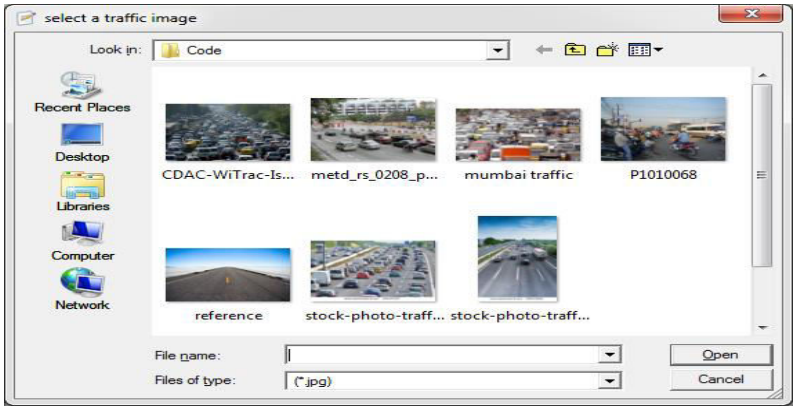

Fig 5.2 Select a traffic image

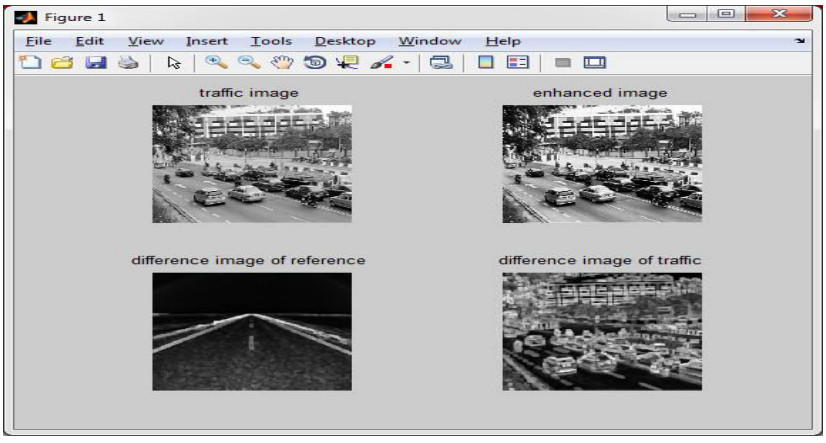

Fig 5.3 Enhanced and difference images after morphing

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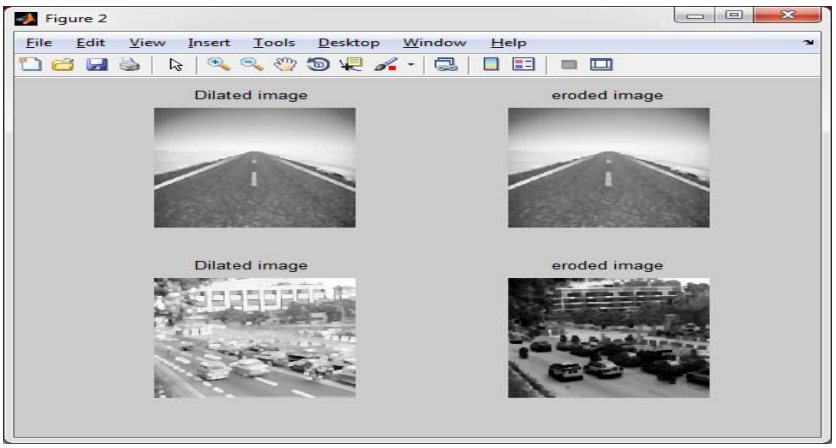

Fig 5.4 Morphological processed images

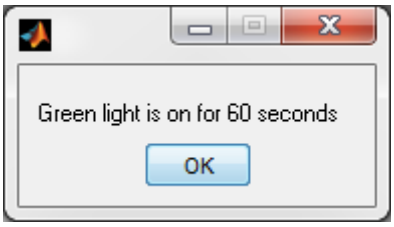

Fig 5.5 message box to display number of seconds

CONCLUSION-

In order to manage and control traffic more effectively and avoid wasting time waiting for a green light to turn without any vehicles, the traffic automation system is created utilizing image morphological operations. To confidently and more efficiently detect the presence of a vehicle, it is preferable to use picture data to identify if cars are in the road lane. Algorithms for computer vision and image processing outperformed the shortcomings of several conventional traffic control systems. The price of sensors and other hardware components is also eliminated. A load of traffic along a particular lane of the road is analyzed by multiple cameras.

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