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Automatic Density Based Traffic Congestion Control System Using Arduino Nano

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ABSTRACT

Problem of traffic overcrowding needs to be conveyed in a systematic way, notably in the country like India where this is a very grave problem due to enormous population. The attending traffic control systems that are used are either Physical controlled or instinctive controlling system with static time allocation. One requires huge man potential to operate and is less efficient and Destruction of time.In this project, image processing technique is used to control traffic overcrowding by instinctive allocating time to let out vehicles depending upon on the density of vehicles on roads. The proposed work uses Canny Edge detection, Gaussian Blur, Density calculation, Arduino UNO.

Keywords: Canny Edge detection, Gaussian Blur, Density calculation algorithms.

INTRODUCTION

The existing traffic control system in developing countries like India are operated physically which leads to time consuming and fuel which bring about heavy traffic Overcrowding in topmost countries. The happening traffic signal system has colored signals to control the motion of vehicles by allocating certain amount of flow to stop motion of vehicles, due to which there is wastage of time. Even though the road is free the vehicles are made to wait to match againstthe allocated time. Image Processing is the technique used in this work to control the traffic overcrowding. And the technique has numerous steps such as converting an image to gray scale image, segmentation of an image using thresholding algorithm, edge detection and image enhancement. The system calculates the total number of vehicles across the road using image processing technique. Algorithm used in this system is Gaussian blur, canny edge detection algorithm and time allocation algorithm. The noises from images are withdrawal by using Gaussian filter. The withdrawal of noises is important as it results in false edge detection. Canny edge detection is less sensitive to the noise but is more expensive. However canny edge detection performs better than all these operators in any way. Time allocation algorithm is used to allocate time for green and red signals accordingly. Time is allocated dynamically to green signal by calculating density of vehicles. Traffic lights are signals that are used to sway the motion of vehicles on the road. This traffic signal is observed and controls the traffic on the road and avoid over crowed. The traffic light on the road comprises of 3 signals- red, yellow and green. People are made to grip back for the green signal to further proceed. Lag in the red signal cause longer waiting time because of over crowed. CCTV cameras are put at almost all junctions on the cities and accident-prone and traffic-prone areas. This would enhance traffic maintenance and help police book violators. With the help of these CCTV cameras, we can calculate the density of vehicles on the road. Image processing is the use of computer algorithms to perform image processing on digital images. This technique controls the traffic light signals onthe road in order to avoid unnecessary traffic congestion.

LITERATURE SURVEY

[1] "Design and Development of an Image processing based adaptive traffic control system with GSM interface", Umar Farooq, Hafiz Muhammad Atif, Muhammad Usman Assad, Asim Iqbal, Zeeshan Azmat. In big cities,

it is very hard to control the traffic over crowed because of rise in number of vehicles every day. The proposed system contains the camera mounted on stepper motor and using this it calculates the density of vehicles on each road and then grant extra time to the lane with lofty density. It does not hang on instinctive time allocation. In case of emergency, the signals are controlled with help of mobile. The methods used are, Region of interest (ROI) filters the undesirable things present in the image. SOBEL edge detection method is used to detect the edges found in resulting image. Round robin method is used to count the total number of vehicles.

[2] "Smart Traffic Optimization Using Image Processing", Pranav Maheshwari, Deepanshu Soneji, Praneet Singh Yogeshwar Mutneja, IEEE 2015.Ever enlarge vehicles on road tends on the way to traffic congestion, due to which it is required to develop the traffic control system. The system proposed in this paper uses cameras to monitor the traffic. Then image processing technique is used to calculate density and allocate time. The work is focused on using machine learning techniques to adjust With different problems of traffic.

[3] "Development of Closed Loop Traffic Control System using Image processing", Shahe gouda Halladamani and Radha R C, 2017. In this paper, image processing technique is used to control the traffic congestion, and following are the algorithms used to process an image out.

[4] "Density based smart traffic control system using Canny Edge detection algorithm for congregating traffic information", Taqi Tahmid and Eklas Hossain © 2017. In this paper, canny edge detection algorithm is used to keep a count on total number of vehicles which in turn is Required to control traffic congestion automatically.

[5] "Traffic Surveillance and anomaly discovery using image processing", Siddharth Shashikar, Vikas Upadhyaya, IEEE 2017. This work focuses on identifying the asymmetry in direction of vehicle movements observed from the videos of traffic and using Image processing techniques and algorithms. Point tracking, Silhouette tracking.

[6] "Time to Cross – Traffic Light Control System using Image Processing", Anju Jaison, Evict Varghese, Go pika K, Krishna as, IRJET 2018. This work focuses on using two cameras to compute the density of vehicles and density of pedestrian respectively.

EXISTING SYSTEM

There are numerous procedures proposed already for traffic monitoring to avoid the traffic jam on the road. The previously practiced traffic control system in most of the cities is based on fixed time control or manual control. However, the new implementations in a few cities focus on the implementation of the 'Adaptive Traffic Control System' (ATCS). In this system, with the help of traffic detectors, the traffic density is obtained from all approaches of 1 intersection of the road. The traffic light control time-dependent system has a fixed period to switch traffic between different directions. The traffic lights turn ON and OFF by itself based on the timer value. Consequently, the vehicles are made to wait for a longer period even on the empty road, or if the traffic density is very less. Using sensors is another way to control traffic by detecting the number of vehicles. Another most common strategy to control traffic is manual controlling. Manual controlling involves the need for traffic police. The traffic signals can be changed by the police manually based on the vehicles and traffic flow on the road by himself.

DISADVANTAGES IN EXISTING METHODS

A time-based traffic control system is one of the common methodologies or techniques to control traffic. But this methodology is contingent on time rather than on density. On account of this, the vehicles have to encounter an erratic delay in waiting time. The vehicles are made to wait even on the empty road in a time-based traffic control system which can again contribute congestion or traffic jam. Sensors can be used to detect vehicles and control traffic accordingly. But even in this method, the time is wasted by the green light on an empty road. Manual controlling engages the need for traffic police to change the traffic signals accordingly. This method also requires manpower. Although abundant methods are present already to control traffic, these methods can still bring on congestion due to disparate reasons. A traffic light control system based on the image processing technique can handle the problem of traffic congestion more effectively.

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PROPOSED SYSTEM

The Traffic congestions especially at read intersection is becoming an issue for which road traffic users contend with daily. The consequences of this problem often harm the wider community both material and non-material forms such as fuel and wastage of time. Several alternatives are being sought to affect the matter. These include expanding road networks, regulating the number of vehicles on the roads, and deployment of Intelligent Transportation Systems. In the system the vehicles are detected and extracted from the video that is captured by a CCTV camera and Density is estimated. The traffic density is then obtained because of the number of vehicles per unit area of theroad section. This approach was implemented inOPENCV2 and program which is used is python.

This will give the maximum accuracy even at some weather conditions like rain and fog.

STEPS IN PROPOSED SYSTEM

Input of Frames from Camera

The initial step is to obtain the frames of the road from the live streaming of the camera. Then images of the road with vehicles are taken periodically as the current frames

Cropping of the Image to Obtain Required Details

The next step is to focus only on the region of interest. his is done by cropping and all the unwanted regions are eliminated. The lanes of the road are our region of interest. All other trees, persons in the backgrounds are unwanted details.

Detecting vehicles

The next step is to detect the number of vehicles on the road. To obtain this the current frame and the Background frame are converted to gray scale.

RGB to Gray conversion

It takes reference and captured image as input which are initially RGB images (24 bits/pixel). The outcome of this process is either in the form of red, green and blue channels with 8 bits/pixel. As a next step, the RGB images are converted to gray scale images to discard the unwanted information from image. The process of calculating average of R, G, B values into a single value is the easiest way to covert RGB image into gray scale image. This operation would be done for each pixel.

Gaussian blur

The noises from digital image are discarded by using Gaussian filter. The equation for a Gaussian filter kernel of size (2k+1) *(2k+1) Gaussian Kernel size plays an important role in the performance of the detector. As the size of Kernel increases the detector's sensitivity towards noise decreases. With the larger size, the error localization to detect the edge is high. The kernel size of 5×5 and sigma value with 1.4 is used in this work. After selecting the Kernel size, convolution methods are used to perform the Gaussian smoothing.

Edge detection

The process to identify different shapes from digital images is called edge detection. In this paper it is used to differentiate vehicle shapes from other objects from image. With a literature survey, it has been decided to adopt canny edge detector for this experiment. Canny edge detection algorithm is used for the detection of edges.

Image difference using SSIM (structured similarity index)

The Structural Similarity Index (SSIM) is a metric that involves a procedure to improvise the quality of image which might have degraded due to data compression or data transmission loss. The procedure requires two images from same image namely captured and reference images.

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Density comparison and Time allocation

The proposed system calculates the traffic density by doing comparison between captured image and reference image. Different time periods of green signal are allocated for each lane and this time period of green signal can be dynamically calculated depending upon matching percentage between reference and captured image. Canny edge detector is used to localize the vehicle density.

IMPLEMENTATION

The algorithms used in this system are Gaussian blur and canny edge detection algorithm.

Gaussian blur: The process of enhancing quality of a digital image by applying a Gaussian function is known as Gaussian Blur or Gaussian smoothing. The function neither adds any energy nor removes any energy from an image. Kernel Function is a square matrix of image pixel values and Gaussian curve values (in 2D). Gaussian Kernel is appeal on each pixel of an image. The mid pixel value from kernel is multiplied with values from original image pixel that overlaps with Kernel pixels. The resulting values are added up and this summation result is used at the goal pixel. Gaussian filters are the easy methods to Experiment with filtering the process of filtering an image directly affects the sigma value. The lesser value of sigma is Due to a greater number of frequencies and vice-versa is also true. 2D Gaussian function is required while working with images.

Canny edge detection algorithm: The Canny edge detector uses various stage algorithm to detect a greater number of edges from an Image. It converts an image into a useful pattern, containing more detailed information about image in form of edges of different objects which help to Process it further. Edges from image should be identified only once. Without the interference of false edges (noises).

Canny edge detection algorithm works as follows:

1. Noise reduction
2. Gradient Calculation
3. Non-maximum suppression
4. double threshold

Double thresholding: Strong, Weak and non-relevant pixels are Identified by double threshold. Edge tracking: The process of converting weak to strong pixel. Used to find the boundaries of image.

Density matching: Empty Road images as reference images, if a greater number of vehicles are present in sample images, then there is less similarity Between reference image and sample image.

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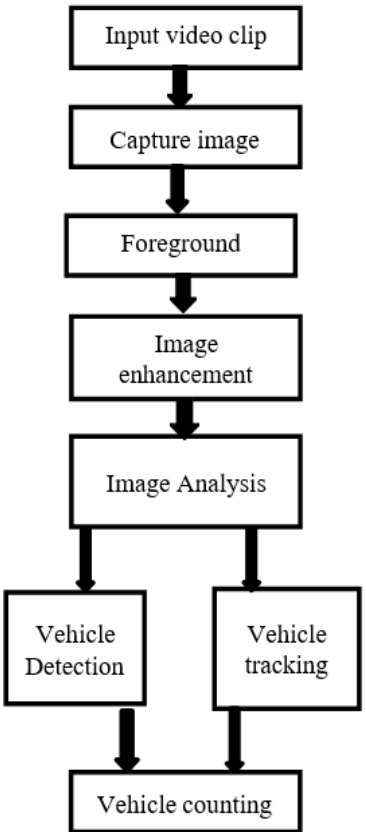
ARCHITECTUURE DIAGRAM



ALGORITHM FOR CANNY EDGE DETECTIONUSING OPENCV

import NumPy as npimport cv2 as cv

from matplotlib import pyplot as pltimg = cv. imread('messi5.jpg',0) edges = cv. Canny(img,100,200)

plt. Subplot (121), plt. imshow (image, cmap = 'gray') plt. Title ('Original Image'), plt. stick's ([]), plt. ticks ([]) plt. Subplot (122), plt. imshow (edges, map = 'gray')

plt. Title ('Edge Image'), plt. stick's ([]), plt. ticks ([])plt. Show ()

1. REFERENCE IMAGE

1. RGB IMAGE

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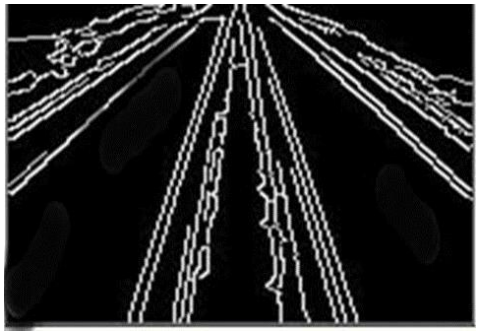
2. GRACYSCALE IMAGE

3. IMAGE RESIZING

4. CANNY EDGE IMAGE



B. ACTUAL IMAGE

1. RGB IMAGE

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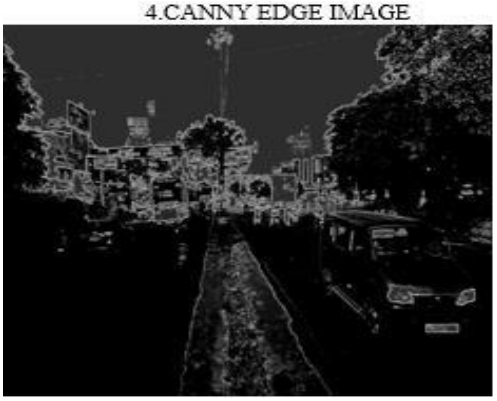
2. GRAYSCALE IMAGE

3. IMAGE RESIZING

4.CANNY EDGE IMAGE



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CONCLUSION

In these modern systems, video surveillance cameras are installed along the roads and road intersections where they're want to collect traffic data. The info is then analyzed to get traffic parameters like road traffic density. The system presents a comfortable and stylish approach for estimating the road traffic density during daytime using image processing and computer vision algorithms. The video data collected is first weakened into frames, which are then preprocessed during a series of steps. Captured images are the images of road with vehicles and reference images are the empty road images. The system converts RGB images into gray scale images. After conversion, Gaussian blur and edge detection operation is done for all the images and then it compares captured image of one road with reference image of same road. The vehicles are detected and extracted from the image. Image matching is done and traffic density is calculated after comparison. After calculation of traffic density, time is allocated. Among the four-side road the road with highest density is allocated green signal with more time and allowed to move vehicles and rest of roads will be made to wait for some time. The system will give the maximum accuracy even at some weather conditions like rain and fog.

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