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Traffic Light Control System using Raspberry Pi and OpenCV

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A B S T R A C T

In order to ensure safe driving at road intersections, traffic signals are necessary. Due to the queue delays at each traffic flow, they disrupt and decrease traffic fluency. We present the Intelligent Traffic Light Controlling (ITLC) algorithm in this paper. For arranging the time phases of each traffic signal, this algorithm takes into account the real-time traffic characteristics of each traffic flow that plans to cross the relevant road intersection. The newly implemented algorithm attempts to improve traffic flow by cutting down on the amount of time moving cars have to wait at signalised road intersections. Also, it tries to increase the number of cars that cross the road intersection per second.

Keywords: Intelligent Traffic Light controlling

1. Introduction

One of the many issues we deal with in modern life is traffic congestion, which gets worse every day. Determining traffic flow might be a key factor in learning more about them. A true record of traffic volume patterns is provided by this data, which is utilised to build censorious flow time periods such as the impact of large vehicles and specific parts on vehicular traffic flow. This data is useful for processing traffic more effectively in terms of the cycle times of traffic lights. There are various ways to gauge the amount of traffic flow by counting the number of cars that pass through an area at a given moment. Today, camera-based systems are superior options for tracking the data of the cars. This study focuses on a unique firmware-based vehicle detecting method. Using an existing identifier for each vehicle, this method locates the automobiles in the given image. Later, it groups each vehicle according to its category and counts each one separately. More precision, greater dependability, and fewer errors are produced as a result of the developed approach's implementation in a firmware platform. On a daily basis, traffic lights are crucial for regulating and controlling traffic. The density of the roads is calculated using Python, and the microcontroller modifies the length of the green light for each road in accordance with the results of image processing.

2. Literature Survey

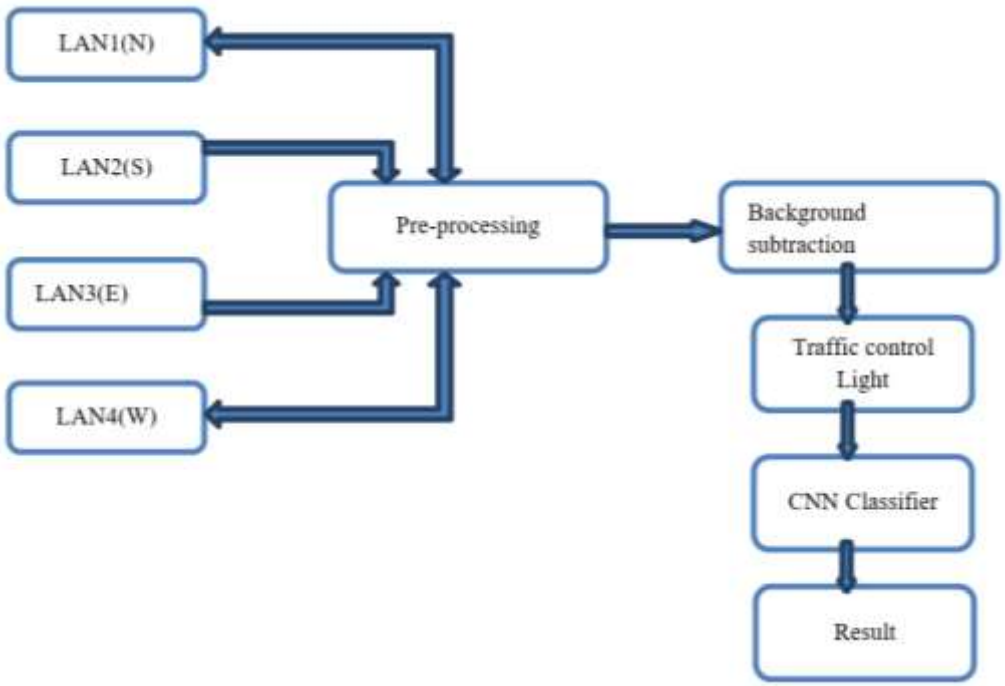
S.no	Title	Author name	Year	Technology
1	Image Processing Based Intelligent Traffic Controller	Vikramaditya Dangi, Amol Parab	2012	• Image enhancement • Edge detection • Preprocessing • RGB to gray
2	Traffic light recognition using Image processing Compared to Learning Processes	Raoul de Charette and Fawzi Nashashibi	2009	• cascade classifiers • image processing algorithm • object recognition
3	Smart Traffic Control Using Image Processing	Mriganka Panjwani, Nikhil Tyagi, Ms. D. Shalini	2012	• Intelligent Transportation • System (ITS), • Traffic light, • Image Processing, • edge detection.
4	ubiquitous smart home system using android application	Shiu Kumar	2014	• Arduino Ethernet • light switches, power plugs, • temperature sensors,

				• humidity sensors, current sensors, • intrusion detection • sensors, smoke/gas sensors
5	An image detection technique based on morphological edge detection and background differencing for real time traffic analysis	M. Fathy, M. Y. Siyal	1995	• edge detector • dynamic threshold • background differencing

The most crucial stage of the software development process is the literature review. Determine the time factor, economics, and company strength prior to building the tool. The next stage is to choose the operating system and language that can be utilised to construct the tool when these requirements have been met. As soon as they begin creating the tool, programmers require a lot of outside assistance. You can find this support online, in books, or from senior programmers. The aforementioned factors are taken into account when creating the suggested system before it is built.

The majority of traffic lights in India are pre-timed, meaning that it is predetermined when each lane will receive a green signal. One lane at a time receives a green signal at a four-lane traffic signal. As a result, the traffic light permits all lanes of vehicles to pass one after the other. Hence, traffic can move forward either straight ahead or by making a 90-degree bend, as seen in Fig. 1. Hence, even when a particular lane has the lowest traffic density, it must wait unnecessarily for a long period before getting the green light, which unnecessarily causes other lanes to wait even longer.

3. Proposed System



Using CNN, we will create a crowd-based traffic control system in this system, opening lanes based on the crowd's density at the desired lane. It can be found by photographing the lane's vehicle throng and counting the number of red-colored automobiles in the chosen lane. We provide a method for traffic control that makes advantage of image processing. Our model will intelligently distribute the time period of the green light for each road in accordance with the traffic concentrations on all roads. As cameras are far less expensive than other equipment like sensors, image processing was the method we chose to determine the traffic density. The suggested model is built as follows: A Raspberry Pi is attached to four sets of LEDs that stand in for traffic lights. It is the procedure of keeping track of the volume of traffic on each side and adjusting the signal in accordance with the volume in each direction.

Module 1:

PREPROCESSING

Image Pre-processing is a term used to describe actions taken on photographs at their most basic level. Images of intensity are the input and output of it. Pre-processing aims to improve the image data by reducing undesirable distortions or enhancing certain elements that are crucial for subsequent processing. Image restoration is the process of estimating the original, clear image from a corrupted or noisy image. Motion blur, noise, and camera focus

issues are just a few examples of corruption. Picture enhancement differs from image restoration in that it emphasises aspects of the image that make it more aesthetically acceptable to the viewer rather than necessarily producing data that is realistic from a scientific perspective. There is no a priori model of the process that formed the image when using image enhancing techniques offered by "Imaging packages," such as contrast stretching or nearest neighbour deblurring.

By surrendering some resolution, noise can be effectively removed from images using image enhancement, but this is not acceptable in many applications. The z-direction resolution in a fluorescence microscope is already poor. To recover the item, more sophisticated image processing techniques must be used. A technique for restoring images is de-convolution. It can increase resolution, particularly in the axial direction, reduce noise, and boost contrast. Here, the traffic signals from every lane are taken into consideration as an input. This is the very first block and process in image processing where the inputs are handled. Here, the image is taken as input and some operations are known as scaling. Also, some general filters are applied, and rgb to grey scale conversion is performed.

Module 2:

BACKGROUND SUBSTRACTION

The foreground of an image is retrieved for further processing using a technique in the fields of image processing and computer vision known as background subtraction, sometimes known as foreground detection (object recognition etc.). A common technique for spotting moving objects in films taken by stationary cameras is background removal. The idea of the technique is that of recognising the moving objects from the difference between the current frame and a reference frame, sometimes called "background picture", or "background model". If the image in question is a part of a video feed, background removal is typically performed. For many computer vision applications, such as surveillance tracking or pose estimation, background subtraction offers crucial cues.

Module 3:

CNN

Predictive models known as neural networks are loosely based on how biological neurons function.

One of the greatest PR triumphs of the 20th century was the choice of the word "neural network". A technical statement like "A network of weighted, additive values with nonlinear transfer functions" seems far less intriguing. Neural networks are not "thinking machines" or "artificial Brains," despite their moniker. One hundred neurons is a standard number for an artificial neural network. In contrast, it's estimated that the human nervous system contains roughly 3 x 1010 neurons. From "Data," we are still light years away.

Frank Rosenblatt created the first "Perceptron" model in 1958. Rosenblatt's model had three layers: a "retina" that dispersed inputs to the second layer, "association units" that combined inputs with weights and triggered a threshold step function that fed into the output layer, and a layer that combined values at the third layer. Unfortunately, the neurons' usage of a step function made it difficult or impossible to train the perceptions. After Marvin Minsky and Seymore Papert released a critical review of perceptrons in 1969 that identified a number of serious flaws, interest in perceptrons temporarily decreased.

When David Rumelhart, Geoffrey Hinton, and Ronald Williams released "Learning Internal Representations via Error Propagation" in 1986, interest in neural networks was rekindled. In order to eliminate the drawbacks of the step functions of the original perceptron, they proposed a multilayer neural network with nonlinear yet differentiable transfer functions. They also offered a neural network training technique that was reasonably efficient.

4. CONCLUSION AND FUTURE SCOPE

In this modern era, since the population has grown quickly, vehicle usage has also grown significantly. Heavy traffic is the cause of it. It is better to flow new communication methods such as image processing based intelligent traffic controlling and monitoring system using opencv in order to avoid this problem. We can obtain information about vehicles in specific junctions via access to the internet by using this method. This is more suitable for traveling in an emergency. Further improvements to this process' performance will allow for more accuracy.

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