ISSN: 2366-1313

Image Processing Based Smart and Secured Intelligent Traffic Safety and Efficiency System

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ABSTRACT- The increased number of cars has significantly worsened the traffic situation. Driver negligence was mostly responsible for the majority of accidents. For many years, nations and businesses have studied intelligent transport systems to find ways to decrease traffic accidents and intelligent traffic safety and efficiency (ITS). By sensing and interpreting its surroundings, an intelligent vehicle (IV) can help drivers prevent accidents by alerting them to potential dangers ahead of time. When it comes to transportation systems, Driver Assistance Systems are among the most innovative and useful developments. Lane detection aids drivers in making more prudent decisions, which in turn reduces the likelihood of collisions. This research suggests a vision-based method for Vehicle Detection in misty environments. This method relies heavily on the field of image processing in its execution. Algorithms using the MATLAB image processing package are put into action. For the purpose of feature extraction, the Gabor wavelets method has been applied to images. The primary focus here is on developing a reliable automatic vehicle identification system that relies on vehicle licence plates. As soon as a car approaches the security checkpoint, the system would take a picture of it. Next, the segmentation procedure is used to extract the images from the captures. The text is read by an optical character recognition system. For ITS to be really intelligent and secure, these qualities are essential. The information is checked against their database for any discrepancies. All of the system's implementation and simulation takes place in MATLAB, and its performance is evaluated using real-world photographs. This type of device is commonly utilised in places like toll booths, parking lots, and traffic control centres. The security functions of this system are the primary focus of its design.

Key Words: Intelligent Traffic Safety and efficient System, intelligent vehicle, feature extraction, Driver Assistance Systems.

I. INTRODUCTION

Contextualizing the need of creating a driver aid system, the state of the roads is essential. Road signs are sometimes obscured or absent, making it difficult for drivers to navigate obstacles such as potholes, bumps, and sharp curves. Assuming a vehicle is equipped with both a motion camera and a computer, the two could work together to create a rudimentary driver guidance system based on frame-by-frame analysis of the motion frames, which in turn would generate the alarm signals to alert the driver to potential danger.

An intelligent vehicle's system is a part of the system that gathers information about its surroundings and uses that knowledge to help drivers avoid potential risk [1] [2]. Numerous investigations concerning recognition have been conducted thus far. The authors begin with a reverse-perspective image of a plane and a bird flying along a road. Perspective effect mapping, restriction-based lane markers, and lane marker retrieval.

Automobile crashes have risen to prominence as a major issue. The vast majority of traffic incidents occur because a driver was careless. Careless and erratic driving puts everyone on the road at risk. If such hazardous driving conditions can be discovered early and warned to other drivers, it will help reduce the number of accidents. Cameras and speed sensors are installed along most highways and roads in order to track and identify speeding motorists. These are very basic rules, and there are no limits. To avoid being caught going too fast, vehicles can slow down the speed detectors. One could argue that there are drawbacks to using conventional approaches [3]. For instance, while an algorithm may be optimal for the treatment of roads in rural areas, it may not be optimal for processing urban roads, and vice versa. In particular, edge- or intensity-based approaches will be deployed on flat roadways, where neither edges nor markings are particularly clear or bright. However, road surfaces defy backdrop colour or texture-based approaches due to the lack of visual distinction between adjacent lanes.

Many vision-based techniques have found use in the transportation sector, for tasks as varied as traffic monitoring, speed estimation, detecting traffic light states, and accident detection[1-3]. The rising number of city dwellers and their disposable incomes have contributed to a rise in the number of automobiles on the road. Congestion, greater travel time, higher fuel consumption, and delays in transportation are only some of the negative effects of this trend. Fixed light traffic control systems,

ISSN: 2366-1313

vehicle actuated systems, inductive loops, magnetic loops, etc. employ real-time data and have been suggested and tested for traffic management, but they have limitations, including poor coverage and expensive setup and maintenance costs [5].
Cost-effectively addressing these issues while also overcoming the constraints of conventional systems may be possible with vision-based traffic control technology (such as image sensors). The article proposes a method for defogging video footage from a crossroads, which might be used as a cheap substitute for detecting vehicles there in order to regulate traffic flow. Difficult environmental conditions, such as fog, might hinder picture feature detection, segmentation, object tracking, and recognition. It is impossible to operate the vehicles if there are any environmental disruptions caused by the weather.

The sheer volume of cars on the road today makes it impossible to keep track of them all by hand. A guy must be present 24 hours a day, seven days a week to take down the count. It's labour intensive and takes a lot of time. In addition, information that is written down becomes unintelligible after a while. Because of this, we attempted to create a system that could automatically recognise the licence plate and save the information to a database. The data can be retrieved and used at a later time. Compared to a manual procedure, this one increases the likelihood of obtaining the proper outcome. The technology works by automatically capturing photographs and storing them as soon as the vehicle enters the restricted region. The system uses the installed software to perform the picture processing. The gate will open for the vehicle if its data matches what has previously been recorded. However, if the vehicle is not recognised or is on a blacklist, it is not permitted to pass through the gate, and additional inspection procedures are carried out.

II. LITERATURE REVIEW

In his article, Bassel Shanwar [1] describes the development of an application programme for detecting automobile licence plates, which first extracts the plate's location using morphological operation before segmenting its individual characters. Neural networks are often used for reading licence plates.
Number plate identification algorithms have been implemented in a work by Ratnakar N [2]. The image region containing the vehicle identification number has been detected by the algorithm.
In his work, Narendra Singh Tomar[3] proposes a project in which he and his colleagues use MATLAB and image processing to create software that can read licence plates. Four-wheeler licence plate lookup will be the task at hand. In order for this software to work properly, the number plate's backdrop must be white, and the image must be clear.
Ms. Shilpi Chauhan [4] has published a paper outlining a system and algorithm for recognising licence plates, which includes the successful detection of the number plate region inside an image, by first segmenting the vehicle number and then recognising the characters that make up the number. For safety considerations, the project was planned with the possibility of replacing the existing manual entry system with an automated number plate detection system.

According to research by Dening Jiang[5], a licence plate recognition system can accurately identify a vehicle's registration number. The processed plate number is simply displayed as-is in the system output.
[6] outlines a strategy for developing an effective system to automatically identify the car by number plate. When a vehicle approaches the security checkpoint, the system takes a picture of it, and afterwards uses a segmentation algorithm to pull out the various characters.

III. METHODOLOGY

The operation of the entire NPR system can be broken down into two major categories. Both the physical and digital components are necessary. How everything fits together and operates is explained in great detail below.

Versions of Software: In this procedure, the software model is the first and most crucial step. Image processing is included into the software model. The MATLAB environment is used to run the programmes. These are the sub-components of the algorithm: Image capture, Pre-processing, Extraction of Plate Region, Segmentation of Characters in the Extracted Number Plate, Character Recognition Do a database check and show the results. The following diagram depicts the process of implementing a licence plate recognition system in this work. MATLAB is used for the various stages of this method's implementation.

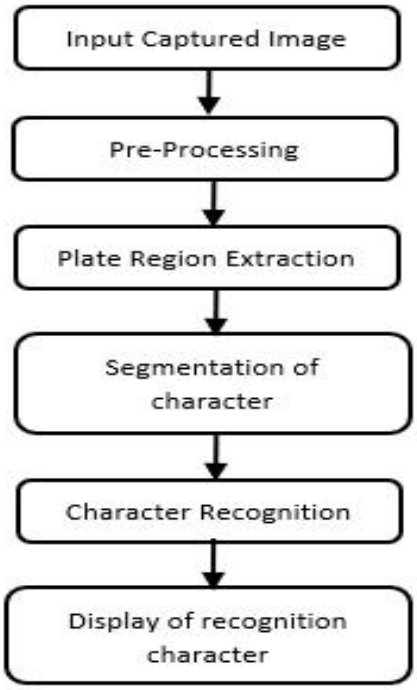

Figure 1: Flow Diagram of ANP

The ability of Gabor wavelets to accommodate several resolutions and orientations was a major factor in their selection. In addition, it saves neighbourhood relation- ships between pixels, can be easily updated, has quick recognition, and has a low computing cost, making it more efficient and accurate than conventional methods. In the first stage, called "Image acquisition," a stationary camera placed at a crossroads records live footage.After then, frames are continually taken from the input video while it is being

ISSN: 2366-1313

streamed in real time. In the next step, we crop the image to isolate the target area.

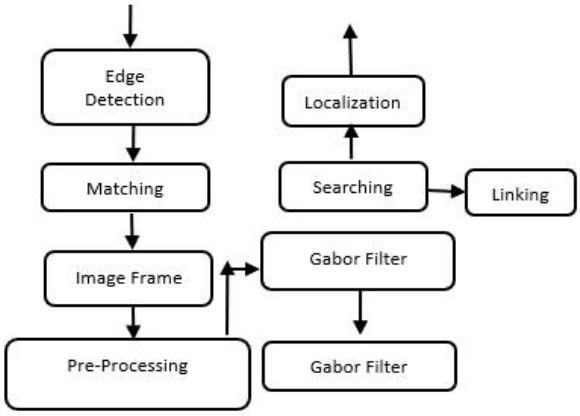

Fig 2. Block diagram of Lane and Fog detection

In this case, we keep the region where the vehicles are located while discarding data that isn't directly related to the vehicles. The next step is to employ binarization of picture differencing to further highlight the presence of objects.

A. Image Representation

For digital image processing to work, the images must first be sampled and quantized. Images can be represented either analogously or digitally. Digital images are employed to represent the images in this system; these digital images can be in either grayscale or full colour. There are 256 (0–255) shades of grey conceivable in the grayscale images represented by 8 bits.

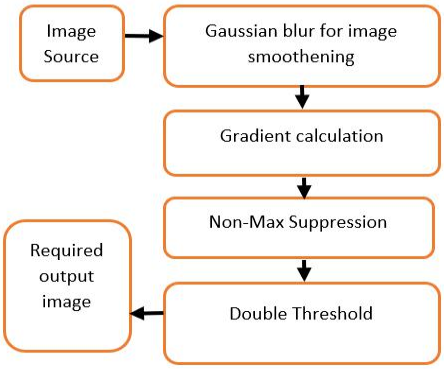

Fig 3. Canny Edge Detection

B. Image Analysis

Here are the several phases of image processing:

- Video capturing via camera
- Converting video input to frames of images
- RGB to gray-scale conversion on images
- Image enhancement
- ROI selection
- Feature extraction using Gabor Wavelet

C. Fog degraded Image Enhancement

Images taken in foggy conditions tend to be of lower quality. Therefore, in contrast to the distorted image frame, the mist is visible as a haze. The environment in which this kind of vision operates is what makes it less effective than standard surveillance systems. By applying a contrast enhancement and measuring the relative time difference, we are able to make an estimate of the depth of the images. The experimental data we give here provide convincing evidence that the algorithm we developed to improve the contrast of images that have been damaged by fog works.

D. Image filtering Approach

Images suffer from poor charge and mist extraction in foggy, hazy situations. Grayscale or colour images are made more air-visible with the help of the proposed method. There could be a disparity in the number of available spots if visibility were reduced by fog, mist, or haze. Particles inside the impression benefit from reduced visibility and wider beam spread. Since the sun started dispersing the particle beam and a witness at the scene streaked to relax the environment, the contrast between the entity and the background of the photograph had diminished significantly, making it easier to see the thing

.

IV. SIMULATION RESULTS

After Algorithms can be run in MATLAB with the help of the Image Processing Toolbox. The strategy's implementation command includes non-linear improvement as part of its internal support structure. With these image modifications, the beam pattern no longer looks the same. The variations for each image utilised to recover in this investigation are displayed in Figs. (4-5).

Fig. 4. Lane detection image

ISSN: 2366-1313

Fig.5. Lane Turn Left

Fig.6. Lane Turn Right

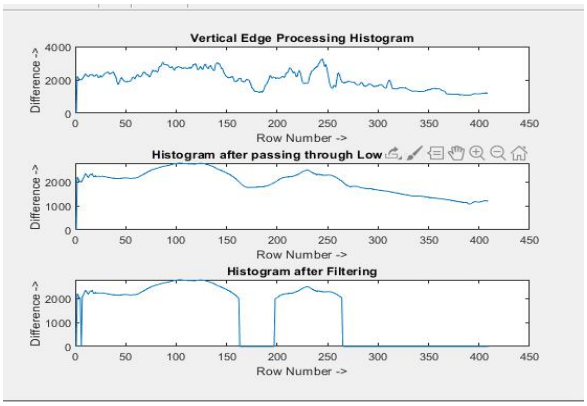

Fig.7. Vertical Edge Processing

Fig.8.Grey scaled image

Fig.9.Showing Canny Edge Detection Process

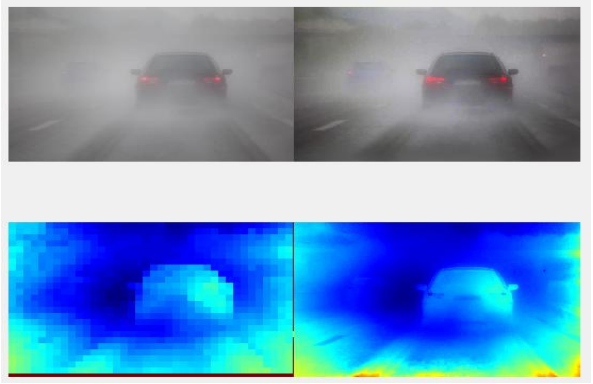

Fig. 10. Fog detection

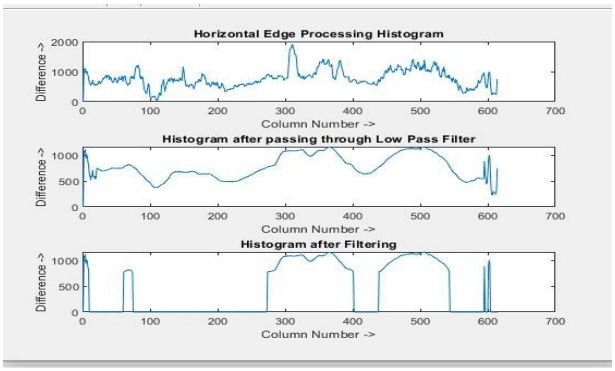

Fig.11. Horizontal Edge Processing

ISSN: 2366-1313

Fig.12. Total frame size and Means value graphs

Fig 13: final number plate detection image
The screenshot of the simulation and are displays above.

V. CONCLUSION

The latest innovative car was created using the Smart Vehicle System. One such device that aids drivers by identifying lanes of traffic has been crucial in eliminating traffic mishaps. Smarter security and better visibility are necessary additions to this system. This vehicle's licence plate and location can be determined even when there's thick fog around. In this study, we offer an artificial vision-based method that makes use of streaming video data to identify passing automobiles in a foggy environment. Future applications for the system's collected data include vehicle tracking, counting, and classification. Many photographs have been tested using our algorithm, and we have found that it performs well in terms of recognition. This project was conceived with the idea that an automated number plate detection system may eventually replace the existing system of manual entry, improving security. Even though the project has its own image processing and hardware needs limitations, it was successful in capturing a vehicle's licence plate.

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ISSN: 2366-1313