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Original Article

Video Analytics Based Online Traffic Regulation System

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Abstract - *Video Analytics extracts relevant and required information from a digital video. It has many applications in many sectors like Retail, Airports, Railways, Transportation, Healthcare, Education, and the Military. Traffic monitoring is a challenging task in real-time. Traditional traffic monitoring procedures are manual, expensive, time-consuming, and involve human operators. It is now possible to implement object detection and tracking, behavioral analysis of traffic patterns, number plate recognition, and automate security and surveillance on video streams produced by traffic monitoring and surveillance cameras.*

This project works to develop a system where the footage from a traffic camera is analyzed, and reports are generated. Here our project concentrates on the vehicle number plate detection and vehicle count from the live video streaming. Our Framework uses different image processing and video processing techniques in MATLAB.

Keywords - *City Popularity, tweets, sentiment analysis, re-tweet count*

I. INTRODUCTION

The increasing rate of crime calls for effective security measures. Security Personnel, IP Cameras, and CCTV are usually employed for these reasons. But Human vigilance is required in each case which is bound to induce errors. Manually monitoring CCTV cameras is tedious and monotonous, which effectively reduces productivity. Humans are inefficient when it comes to doing repetitive and mundane jobs.

The natural transition made the whole process computerized to make it faster and more efficient. Video Analytics is a new technology. New applications are frequently found. However, the track record of different types of Video Analytics differs widely. Functionalities such as motion detection and people counting are believed to be available as commercial off-the-shelf products with a decent track record. The main aim of this application is to automate the entire process of analyzing and reporting spatial events in different areas of requirement.

This automated process must be improved in several surveillance and security monitoring fields. Video Processing is a particular case of signal processing, in particular image processing, which often employs video filters and where the input and output signals are video files or video streams. Video applications present common but difficult challenges that require flexible analysis and processing functionality.

Video processing covers most image processing methods and includes methods where the temporal nature of video data is exploited. Image. Analysis Here, the goal is to analyze the image to find objects of interest and then extract some parameters of these objects. For example, finding an object's position and size.

Video analytics or video content analytics can automatically analyze video to detect and determine temporal and spatial events. It uses mathematical algorithms to monitor, analyze and manage large volumes of video. It digitally analyses video inputs, transforming them into intelligent data, which helps make decisions. Video Analytics can be real-time, configured to track and provide alerts to specific incidents as they happen, or post-event, retrospectively searching for incidents that have already occurred. Video analytics software for security cameras is available in several forms: installed on your camera, on your NVR, or as 3rd party software you buy. However, each version will do the same thing - monitor your videos to search for and alert you to activity.

Each video analytics solution will work differently depending on the manufacturer and application. They all work in the same basic way, however. When setting up the software, you set up parameters for the activity the software is looking for and set up the alert notification system. When the software detects something that meets its search criteria, it alerts you. For example, many businesses use surveillance systems to detect motion in their store after hours. You can set your system to motion detection during the hours your business is closed, so if it detects motion, it will send you an email - a quick response that may help you react quickly to a break-in or accident.

Security and surveillance are important issues in today's world. The recent acts of terrorism have highlighted the urgent need for efficient surveillance. Contemporary surveillance systems use Digital Video Recording (DVR) cameras which play host to multiple channels. The major drawback of this model is that it requires continuous manual monitoring, which is infeasible because of factors like human fatigue and the cost of manual labor.

Moreover, it is virtually impossible to search through recordings for important events in the past since that would require the playback of the entire duration of video footage. Hence, there is indeed a need for an automated system for video surveillance that can detect unusual activities on its own. With Video Analytics, you can

• **Detect** if any suspicious activity is going on.
• **React** to that activity if you deem it a crime.
• **Intervene** and act against the unusual activity.
• **Prevent** any crimes before they happen.

A. Aspects of image processing

Image enhancement: This refers to processing an image to make the result more suitable for a particular application. Examples include:

i. sharpening or de-blurring an out of focus image,
ii. highlighting edges,
iii. Improving image contrast or brightening an image, removing noise.

Image restoration: This may be considered as reversing the damage done to an image by a known cause, for example:

- removing blur caused by linear motion,
- removal of optical distortions,
- removing periodic interfere

Image segmentation. This involves subdividing an image into constituent parts or isolating certain aspects of an image:

i) finding lines, circles, or particular shapes in an image in an aerial photograph, identifying cars, trees, buildings, or roads.

Video processing is a particular case of signal processing, in particular image processing, which often employs video filters. The input and output signals are video files or video streams. Video applications present common but difficult challenges that require flexible analysis and processing functionality.

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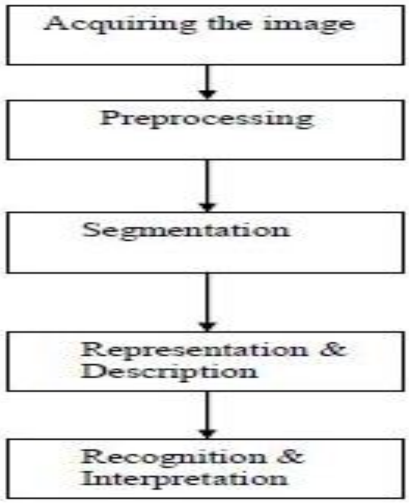


Fig. 1 Image processing tasks

B. Introduction to Python Language

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, made it very attractive for Rapid Application Development and used as a scripting or glue language to connect existing components. Python's simple, easy-to-learn syntax emphasizes readability and, therefore, reduces program maintenance costs. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms and can be freely distributed.

II. METHODOLOGY

Video Analytics Implementation:
Video Analytics can be implemented in two ways. They are
1. Server Based VA Implementation
2. Edge or Camera-Based VA Implementation

A. Server Based VA Implementation

Server-based video analytics allows the business to implement different analytics software for different business segments. Using a server-based solution allows for a faster search of archived data than edge-based systems.

Each camera has to be wired to the server that receives the feed and analyses them. This means that there is a huge network overload depending on the number of cameras used to record surveillance videos at any given point in time. Performance of video analytics is hampered due to the lower quality of the compressed 2. Edge or

B. Camera-Based VA Implementation

The cameras shoot the video and then, based on the onboard software, analyze them and only send a gist of the surveillance feed to the central server. There is no compression and subsequent decompression in edge-based implementations, resulting in no loss of video quality. Not all cameras can be used for an edge-based implementation. This means systems with a mix of IP Cameras and analog cameras will have only limited use. At the current state of technology, high-end IP Cameras cost very high, and for any degree of computing abilities, one has to dole out sufficient cash.

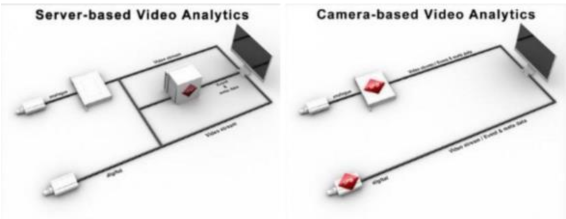


Fig. 2 Video Analytics implementation

C. Module 1: Traffic Regulation System

Traffic monitoring is one of the key parts of Intelligent Traffic Systems. As a result of the increase in vehicle traffic, many problems have appeared. For example, traffic accidents, traffic congestion, traffic-induced air pollution, etc. Traffic congestion has been a significantly challenging problem. It has widely been realized that increases in preliminary transportation infrastructure, more pavements, and widened roads have not been able to relieve city congestion. As a result, many investigators have paid attention to intelligent transportation systems (ITS), such as predicting the traffic flow based on monitoring the activities at traffic intersections to detect congestions.

Traffic monitoring offers solutions to the majority of the problems faced by the people. It also makes policing and controlling traffic easier. An increasing reliance on traffic surveillance needs better vehicle detection in a wide area to better understand traffic flow. Video surveillance is one of the technologies used for traffic monitoring. Automatic detecting vehicles in video surveillance data is a challenging problem in computer vision with important practical applications, such as traffic analysis and security. Video surveillance also is the most economical option, which doesn't involve major costs or infrastructural changes.

Automatic traffic monitoring from traffic video cameras has been widely studied in the past decade. This technique is crucial for effective transportation management, such as traffic planning, safety, law enforcement, and parking management. It is also used in traffic flows and mass transit routes to design and manage to optimize time and energy consumption.

The proposed system will detect, count, classify and identify vehicles using various methods. Thus data that is obtained from it can be put to good use. License plate detection can be used for tracking criminal activities and can also help police to find the location of the criminal. Traffic density and count can be used for traffic signal control and also can be helpful to commuters in route selections. Wrong-way detection can be used for tracking the vehicles whenever it detects any vehicles moving in the wrong direction. Helmet detection helps prevent accidents by automatically identifying whether the drivers are wearing helmets or not.

D. Proposed System Work Flow

In this paperwork, the CCTV system collects and stores the data. The vehicle number plate can be recognized through Image processing techniques, and identification can be done. This method helps for the parking slots areas, Tollgates residence surveillance, etc. The vehicle count and lane detection can be monitored through live video streaming. This technique can be applied to different areas like Retail, Airports, Railways, etc. Fig 3 shows the Project Flow.

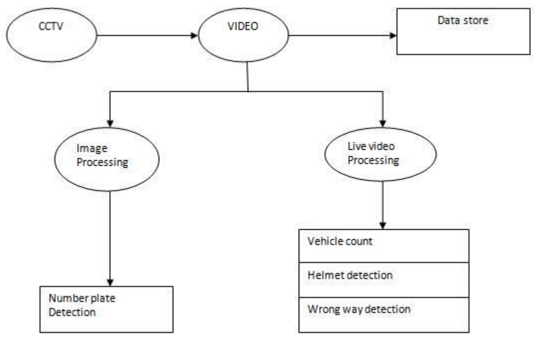


Fig. 3 Workflow of the Vehicle regulation System

D. Module 2: Automatic Number Plate Detection

The Automatic Number Plate Recognition System arose when the number of vehicles on roads drastically increased, and the recognition by the human eye became difficult. Later on, specialists started using video traffic footage to identify the vehicle they needed. But this also became difficult in cases when the clarity of the video is low and also required human supervision. These challenges welcomed an Automated workflow.

The Automatic Number Plate Recognition System work started in 1976 at the Police Scientific Development Branch in the United Kingdom[1]. This is used to identify a vehicle uniquely. It is a part of Image Processing Technology. Its applications vary but predominantly lie in the fields of Crime Enforcement & Traffic Surveillance. This system takes images as input and provides the text on the number plate of a vehicle as output. A few variants also give the person's image in the driver's seat as additional output if it identifies any suspicious activity on the vehicle.

Some license plate arrangements use variations in font sizes and positioning based on the place it was printed; ANPR systems must be able to cope with such differences to be truly effective. The best systems should be able to work internationally, but many were tailored specifically for individual countries to increase efficiency and optimality. The cameras used can be existing CCTV cameras and mobile units, which are usually attached to police patrol vehicles. Some systems use infrared cameras to take a clearer image of the plates. In most systems, the accuracy of the result is directly proportional to the resolution of the input image. In our system, we also use GUI, which is designed with the help of App Designer in MATLAB.

E. Working

The working of Automatic Number Plate Recognition consists of Image Processing techniques. It involves many steps such as image acquisition, image pre-processing, plate localization, text segmentation, and character recognition. There are many algorithms for achieving these modules. The following work was achieved using MATLAB.

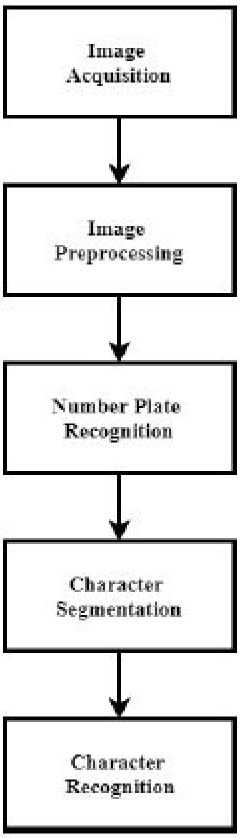


Fig. 4 Block Diagram of Automatic Number Plate Detection.

F. Prerequisite

Before working on our system, we must have all the characters as bitmap images stored in a folder. Now we must load them into MATLAB and convert these images into matrix format and store them in the first row of a cell. In the second row, store the character corresponding to the matrix representation present in the first row. This cell must be stored using the Access database. Now we will save it as a Microsoft Access Table file. These files can be easily read into MATLAB files without additional software or tools.

Fig. 5 Bitmap images of Characters

G. Image Pre-processing

After loading the image, we need to pre-process the image. This includes converting the color image to a black and white image. Then we inverse the image so that the part of the image that might be text would be in white and the rest of the image is in black.

The code for pre-processing the image

Fig.6. Converting from color to Gray.

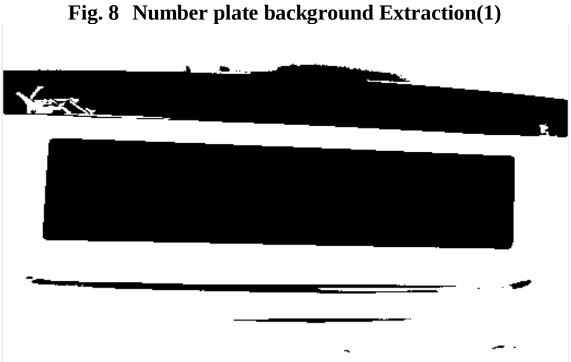
Fig. 6 Binarizing from Gray.

H. Number Plate Recognition

In this part, we identify the highly concentrated area with what might be text. First, we take the pre-processed image, then get the image without the text and subtract them. The result would be the image containing only the number plate area.

A

Fig. 8 Number plate background Extraction(1)



B

Fig. 9 Number plate Background Extraction(2)

C [where A - B = C]

Fig. 10 Number plate recognition

I. Character Segmentation

Here we consider each white-colored segment of the image under the assumption that it might be a character and normalize it to the size of 42x24 as our database contains the bitmap images with dimensions 42x24. This simplifies our next step of comparing the images for character recognition[2].

Fig. 11 Character Segmentation

J. Character Recognition

Finally, the segmented images are compared with the character images in our database, and the correlation coefficients are compared[3]. The image with the highest coefficient is matched and then checked if it crosses the threshold specified or not. If the coefficient is greater than the threshold value, it is recognized as a character. Otherwise, it is neglected and considered as not a character**.**

Module 3: Vehicle Counting

A. Vehicle Detection and Tracking

Transportation research involves vehicle detection, and counting the number of vehicles on the road and finding the density of traffic in an area is important in computing traffic congestion on highways. Detecting and counting cars can be used to analyze traffic patterns. Detection is also the first step before performing more sophisticated tasks such as tracking or categorizing vehicles by their type. The vehicle detection and counting in traffic video project aim to develop a methodology for automatic vehicle detection and counting on highways[6]. A system has been developed to detect and count dynamic vehicles efficiently. Intelligent visual surveillance for road vehicles is key for developing autonomous intelligent transportation systems. There are many methods of detecting vehicles on the road, such as motion detection, installing lasers on both sides of the road, etc., which is tedious and involves a large number of the hardware. This method uses image processing techniques to count the number of vehicles on the road and estimate the density. The number of vehicles found can be used for surveying or controlling the traffic signal. Moving vehicle detection recognizes the physical movement of a vehicle in each place or region. By acting segmentation among moving objects and stationary areas or regions, the motion of the moving objects could be tracked and thus could be analyzed later. To achieve this, consider a video is a structure built upon single frames; moving vehicle detection is finding the foreground moving target(s) in each video frame or only when the moving target shows the first appearance in the video.

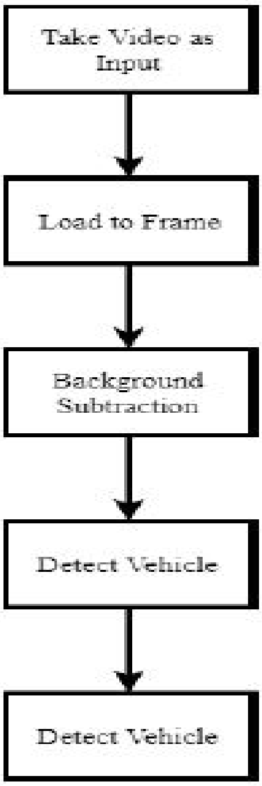


Fig. 12 Block diagram of vehicle counting

i) Read input video:

The VideoFileReader object reads video frames, images, and audio samples from a video file. Read a video from the file specified by the string filename. If the file is not in the current folder or a folder on the MATLAB path, specify the full pathname.

ii) Background Subtraction:

B. Gaussian Mixture Model

A Gaussian mixture model is a probabilistic model that assumes all the data points are generated from a mixture of a finite number of Gaussian distributions with unknown parameters. One can think of mixture models as generalizing k-means clustering to incorporate information about the covariance structure of the data and the centers of the latent Gaussians. The more advanced approach is to build a representation of the background to compare against new frames. Those approaches can be classified into two classes: parametric and nonparametric methods. For parametric methods, the Mixture of Gaussian (MoG) is the most common and significant one, and it employs statistics by using a Gaussian model for each pixel; every Gaussian model maintains the mean and the variance of each pixel; the assumption then is that the pixel value follows a Gaussian distribution. A mixture of Gaussian algorithms is used to model the background first. After the background is established, the algorithm detects foreground objects using the connected components algorithm and calculates its property, e.g., their position and motion.

Morphological Operations: direction, speed, area, contour, and color histogram. That information is used to track objects in later frames. According to the posterior information gained by tracking, the MoG background modeling algorithm can perfect the background to detect accurate and integrated foreground objects.

C. Working

The ForegroundDetector compares a color or grayscale video frame to a background model to determine whether individual pixels are part of the background or the foreground. It then computes a foreground mask. Using background subtraction can detect foreground objects in an image taken from a stationary camera. Rather than immediately processing the entire video, start by obtaining an initial video frame in which the moving objects are segmented from the background. This helps to introduce the steps used to process the video gradually. The foreground detector requires several video frames to initialize the Gaussian mixture model. First frames to initialize three Gaussian modes in the mixture model.

After the training, it shows two figures

1) video frame(fig)

2) foreground Image (fig), after the background subtraction.

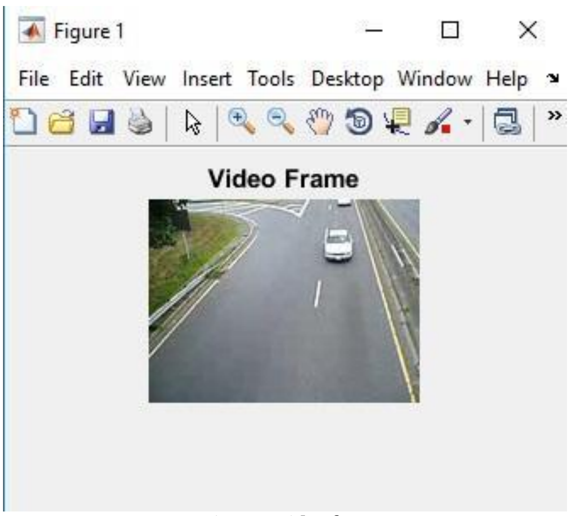


Fig. 13 Video frame

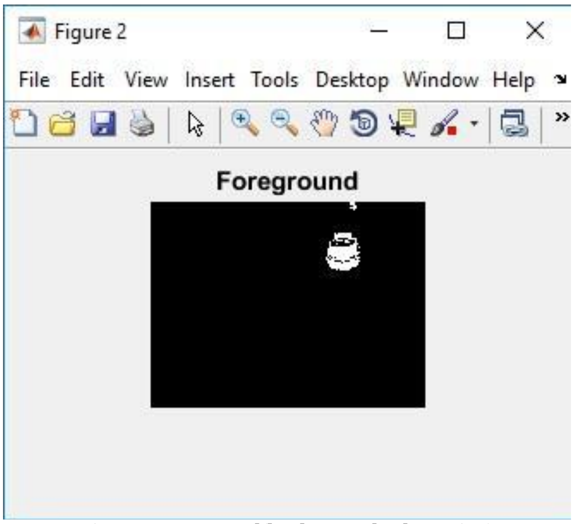


Fig. 14 Foreground(background subtraction)

D. Image Filtering and Enhancement

Morphology is a broad set of image processing operations that process images based on shapes. In a morphological operation, each pixel in the image is adjusted based on the value of other pixels in its neighborhood. By choosing the size and shape of the neighborhood, you can construct a morphological operation that is sensitive to specific shapes in the input image. The most basic morphological operations are dilation and erosion. Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. Dilation and erosion are often combined for specific image pre-processing applications, such as filling holes or removing small objects[8].

E. Structuring element

An essential part of the morphological dilation and erosion operations is the structuring element used to probe the input image. A structuring element is a matrix that identifies the pixel in the image being processed and defines the neighborhood used in the processing of each pixel. You typically choose a structuring element the same size and shape as the objects you want to process in the input image. For example, to find lines in an image, create a linear structuring element. The steel and offset steel functions might break structuring elements into smaller pieces; a technique is known as *structuring element decomposition*. The steel function creates a flat structuring element. You can use flat structuring elements with both binary and grayscale images. The foreground segmentation process is not perfect and often includes undesirable noise[9]. Image enhancement is adjusting images so that the results are more suitable for display or further image analysis. Noise removals, sharpen, or adjust the contrast of an image, making it easier to identify key features. Here, morphological operations remove the noise and fill gaps in the detected objects.

III. RESULTS

This phase has results for both tasks of
i) Number plate Detection
ii)Vehicle count

Task1 Results:

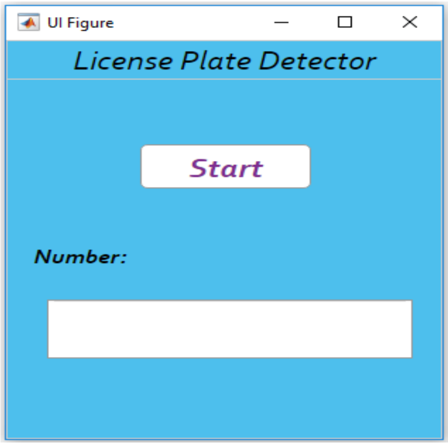


Fig. 15 Image of GUI

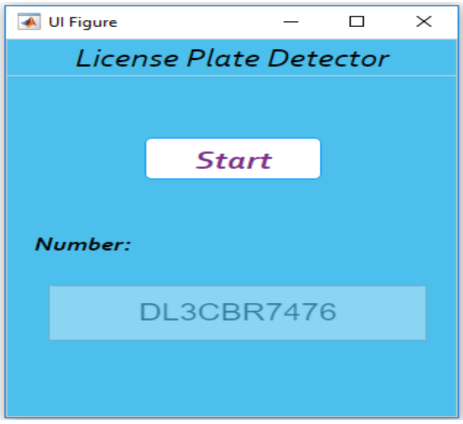


Fig. 16 GUI with Result

Task 2 Results:

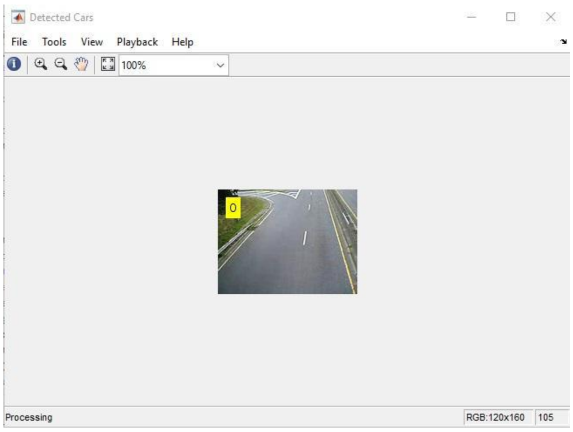


Fig. 18 Detected Cars Output(1)

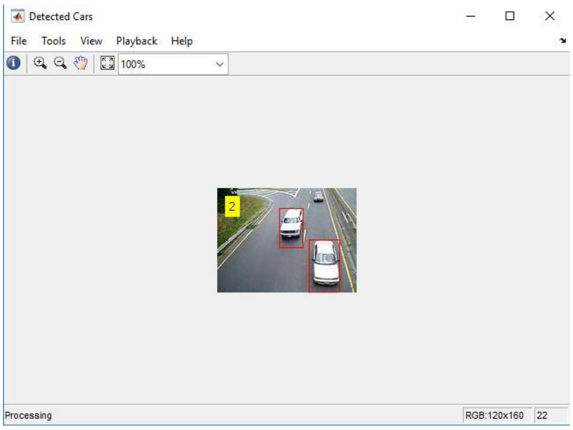


Fig. 17 Detected Cars Output(2)

FUTURE SCOPE

This further helps us in achieving more safer roads and less number of deaths due to accidents. The following future works will enhance the system to solve the sophisticated security problems extensively: The video files considered are from single stationary cameras only. Multiple stationary cameras will be utilized in the future, and a fusion algorithm to combine the results will be developed.

A night vision or infrared camera will help record the videos even at night or in a dark place. Collision and damage detections are important areas that can benefit from such an advanced system.

• IP camera should be used to notify any danger or suspect acts the user in a real-time alert system.

• High camera resolution should be selected where very clear images are necessary.

IV. CONCLUSION

Many algorithms implement ANPR. We have used the simple and fundamental one in our work, i.e., Optical Character Recognition. In India, where the size of number plates on vehicles is not fixed, some people using designs and unique font styles make ANPR a difficult problem. Additionally, CCTV cameras used for surveillance purposes are not of high resolution. Also, there may be problems with a lack of proper lighting and improper image capturing due to fog and rain. These challenges need to be overcome. There may come an algorithm with high accuracy that might detect any number plate irrespective of the country and overcome the abovementioned problems. Automatic Number Plate Detection and Recognition has already been widely tested and adopted by many countries like the UK, Canada, Australia, Sweden, Saudi Arabia, etc., for Surveillance and Law Enforcement purposes.

REFERENCES

[1] Kaur, Er Kavneet, and Vijay Kumar Banga. "Number plate recognition using OCR technique." International Journal of Research in Engineering and Technology 2.09(2013).

[2] Karwal, Hanit, and Akshay Girdhar. "Vehicle number plate detection system for indian vehicles." Computational Intelligence & Communication Technology (CICT), 2015 IEEE International Conference on. IEEE, 2015.

[3] Patel, Archita, and K. R. Patel. "An introduction to license plate detection system." International Journal of Engineering Research and Applications 4.1 (2014):216-22.

[4] http://www.anpr.net/anpr_09/anpr_applicationareas.html

[5] http://www.platerecognition.info/1106.html

[6] Dahiya, Kunal, Dinesh Singh, and C. Krishna Mohan. "Automatic detection of bikeriders without helmet using surveillance videos in real-time." Neural Networks (IJCNN), 2016 International Joint Conference on. IEEE, 2016.

[7] https://in.mathworks.com/help/vision/examples/object-detection-using-deeplearning.html

[8] Desai, Maharsh, et al. "Automatic Helmet Detection on Public Roads." International Journal of Engineering Trends and Technology (IJETT)-Volume 35.

[9] Waranusast, Rattapoom, et al. "A computer vision approach for detection and counting of motorcycle riders in university campus." Electrical Engineering Congress(iEECON), 2014 International. IEEE, 2014.