

# A real-time Computer Vision System for Vehicle Tracking and Collision Detection

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**Abstract**—Recent developments in automotive technology are focused on economy, comfort and safety. Vehicle tracking and collision detection systems are attracting attention of many investigators focused on safety of driving in the field of automotive mechatronics. In this paper, a vision-based vehicle detection system is presented. Developed system is intended to be used in collision detection and driver alert. The system uses RGB images captured by a camera in a car driven in the highway. Images captured by the moving camera are used to detect the moving vehicles in the image. A vehicle ahead of the camera is detected in daylight conditions. The proposed method detects moving vehicles by subtracting successive images. Plate height of the vehicle is determined by using a plate recognition algorithm. Distance of the moving object is calculated by using the plate height. After determination of the distance of the moving vehicle relative speed of the vehicle and Time-to-Collision are calculated by using distances measured in successive images. Results obtained in road tests are discussed in order to validate the use of the proposed method.

**Keywords**—Image possessing, vehicle tracking, license plate detection, computer vision

## I. INTRODUCTION

THE number of vehicles are growing rapidly in the world, and with this rapid growing brings some problems such as infrastructure, safety, traffic accidents, parking problems etc. Reducing traffic accidents provide both economic and social benefits. Today in car mechatronics important studies has started to prevent the traffic accidents arising from driver mistakes such as sleeping, and or technical problems. And future's vehicles are designing with intelligent systems to make vehicles safer. With the system that improved in this project, moving objects and moving objects speed difference and distance can be detecting and in this way important contributions may provide to preventing traffic accidents.

## II. MATERIAL AND METHOD

### A. Material

This study performed with two test cars(Volkswagen and Opel) those include testing settlements. In this application one camera (Sanyo), one laser meter (Bosch DLE 150), one navigation device (Goldmaster), one laptop computer and software that developed by authors has used.

### B. Method

With the improved software, the distance and speed difference between two cars intended to measure based on the real size of the license plate of the capturing car. Speed differences between two cars measured by dividing changing distance between two cars to unit of time.

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With detecting speed difference and distance, it will be using in the software for safe driving distance, early warning system for driver mistakes and vehicle mechatronics.

## III. APPLICATION

On the camera car, a camera and a laptop computer with the software, a laser meter and navigation device have settled. Camera arranged to focus straight angle directly to the license plate of the car that will capture. It is because of the angle difference affects the measurement of real h height of the license plate. But there are some algorithms to measure angle.

Firstly camera recordings made while test cars are stopping and camera focusing straight angle to the license plate of the capturing test car, and real distance of cars measured with Bosch DLE 150 laser meter. After the measurement of real distance, measurements sizing with the software to obtain more sensitive results. In particular distances camera recordings are repeated and recordings entered to the software. And finally real distance between two test cars measured.

Secondly, camera recordings made while camera and capturing cars are moving. Camera recordings mate while capturing car is moving 50 kilometers per hour and camera car was moving on different speeds. While camera car is accelerating and slowing, distance and speed differences between two cars controlled regularly with laser meter and navigation device.

In the study, firstly detection of the capturing car which will be measured the distance mate. With the improved software, the distance and speed difference between two cars intended to measure based on the real size of the license plate of the capturing car. Speed differences between two cars measured by dividing changing distance between two cars to unit of time. With detecting speed difference and distance, it will be using in the software for safe driving distance, early warning system for driver mistakes and vehicle mechatronics.

Firstly, image that captured by software that improved, transformed into grayscale in RGB color space. Secondly noise pollution raised from environment cropped to narrow the vision. By this means images such as signboard, animate and inanimate objects ensured to remove from the vision. Remained vision after the vision cropping flittered with the Gaussian Filter [6].

Objects are detected by using Canny edge detection filter. Study used which transform images that detected in to vertical and horizontal lines. Vertical and horizontal lines are found with angle method. Rectangles which formed by intersected vertical and horizontal lines detected. Beside the rectangles which formed by intersected lines approximately 90 and 180 degree are excluded. Whit these rectangles matched with license plate size and if it's each other this rectangle detected as license plate and took into a frame [1, 2].

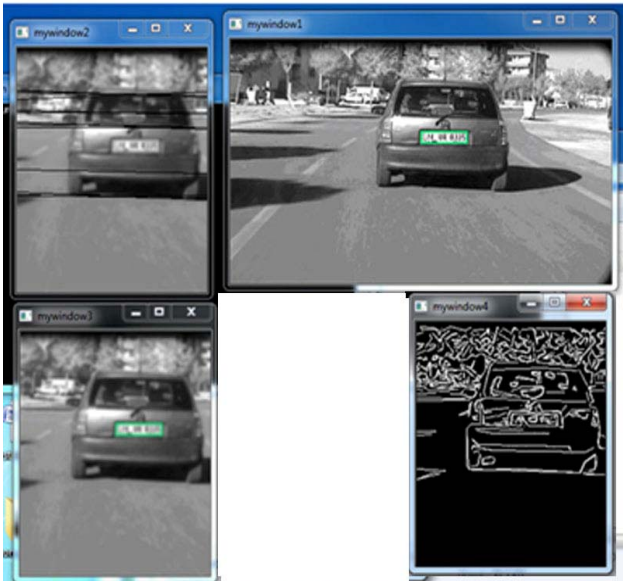


Fig. 1 Application of filter

License plates height measured in cm and then this sizes equivalent in pixels measured. After the comparison of the real pixel value with the values in the data's, distance between the camera and license plate has calculated. While measuring speed differences, same procedures in the measuring distance have applied. Captured frames values subtracted with the former values. This value divided to the capturing times between frames and speed differences have calculated [3, 7].



Fig. 2 First Application of increasing speed



Fig. 3 Second Application of increasing speed



Fig. 4 Second application of slow down speed

Equivalent words in images:

Anlık Hiz= Speed difference.

Plaka Pixel Degeri= License plate pixel value.

Yaklaşık Uzaklık= Distance between test cars.

Km/s= km/hour



Fig. 4 First application of slow down speed



#### IV. RESULT

After application of the software, all values that obtained from both measuring devices and program are compared each other. Results shown that, values that obtained are accurate at the range of %97-98 while capturing car's speed is 50 km per hour and distance between camera car and capturing car up until 40 meters. Value accuracy seemed to fall over long distances. For long distance, it is advised to use high speed and definition cameras and high speed CPU computers.

#### REFERENCES

- [1] J. R. Parker , Pavol Federl "An Approach To Licence Plate Recognition (1996) (Laboratory for Computer Vision Computer Graphics Laboratory; University of Calgary.
- [2] S. Ozbay, E. Ercelebi, Automatic Vehicle Identification by Plate Recognition World Academy of Science, Engineering and Technology 9 2005
- [3] H. Kwaśnicka, B. Wawrzyniak, License plate localization and recognition in camera pictures. *AI-METH 2002. November 13-15, 2002, Gliwice, Poland*
- [4] V.S. Petrovic, T. F. Cootes, "Analysis of Features for Rigid Structure Vehicle Type Recognition In British Machine Vision Conference, 2004 pp.587--596.
- [5] P. Bao, L. Zhang, X. Wu "Canny Edge Detection Enhancement by Scale Multiplication" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 27, NO. 9, SEPTEMBER 2005
- [6] Gaussian filter, [http://en.wikipedia.org/wiki/Gaussian\\_filter](http://en.wikipedia.org/wiki/Gaussian_filter)
- [7] O. Bingöl, Ö. Kuscü, Computer Based Vehicle Plate Recognition System. *Bilişim Teknolojileri Dergisi Cilt: 1, SAYI: 3, EYLÜL 2008*