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Designing License Plate Identification through Digital Images with OpenCV

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Abstract

The aim of this research is to design and analyze the License Plate Identification program mediated through Digital Images or Automatic Number Plate Recognition (ANPR), especially by using desktop peripheral. In doing so, license plates attached, especially, on cars will be the test subject of this research. The ANPR is already implemented within the barrier gate parking system. It is able to record the data of the vehicles that come in yet it doesn't necessarily recognize or identify the license plates installed on the vehicles. The fundamental goal of the ANPR program itself is actually to utilize digital image identification system in order to identify every single vehicle that goes in and out through the barrier gate parking system. From the result of the experimentation, the ANPR is able to detect and translate the license plates into a form of text in less than one second with 100% accuracy for high quality image, 82.6% for medium quality and 44.5% for low quality image. Series of analysis that the ANPR program situates involves; analysis on the ratio of the license plate, experimentation on the distance of license plate detection process, comparison between binary calculation methods using Adaptive Threshold and Global Threshold, and overall system examination. The result retrieved from the conducted analysis can be considered as a part of the ANPR system

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Keywords: Digital images; ANPR; Adaptive Threshold; Global Threshold

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1. Introduction

Barrier gate parking system is a system that is able to record vehicles that come in and out inside a parking area or a building. In its development, the barrier gate parking system does suffer from problem in identifying the vehicles as it still requires human to actually identify the license plates of each vehicle when they are going out from the parking space. It slows down the identification process, and it creates a line consisting of cars which are trying to exit the parking space or the building. Thus the Automatic Number Plate Recognition (ANPR) is designed to identify vehicle's license plates [1]. The ANPR allows a program to identify a license plate attached to a vehicle [2,3]. One of the goals that this research carries is to study, apply and utilize the ANPR to enhance the vehicle identification process.

On this research we used infrared sensor to measure the distance. According to research by G. Benet, F. Blanes, J.E. Simo and P. Perez on 2002[2], infrared sensor was cheaper than ultrasonic sensor and has faster respond time but because of the infrared sensor has a non-linear behavior and it depends on the reflectance of surrounding objects so the result that we get from infrared sensor is not too accurate because there is many other factor that effecting the reading of infrared sensor. There are so many factors that affecting the infrared sensor so the result for mapping the environment that is built using this type of sensor has a low quality so most of the sensor is used only to determine a distance.

2. Design method

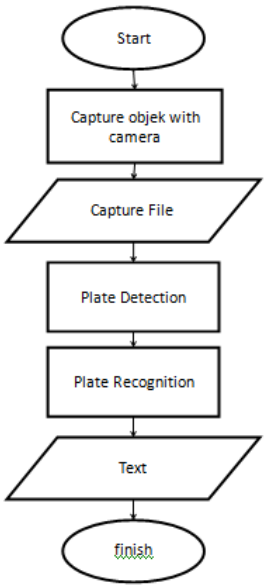

Fig. 1. Flowchart of the ANPR System

Detailed elaboration on the designing process of the system that is going to be analyzed will be provided, and it includes the flowchart and the working procedure of the system. The parameters which are going to be measured within the designing process of the Automatic Number Plate Recognition program will also be provided. There are three particular steps that include Capture, Plate Detection and Plate Recognition [4,6] which are prioritized in the designing process of the ANPR program. Capture is the first step of the whole process, and it will highly influence the ANPR system. The quality of the image will influence the Plate Detection process. It will process the image until the excesses are removed, and it will leave the image of the actual license plate. Thus it will make thing easier for the Plate Recognition process.

For the experimentation, the object of the analysis will be Indonesian vehicle license plate that uses the newest form. It has the physical dimension of 43.2 cm for the length times 13.5 cm for its width border with white colored

outline.

Fig. 2. Picture of the New License Plate

In Image Processing Module experimentation, there are four parts which are going to be examined. Each part will influence the algorithm and the detection threshold of the license plate identification. The first part which is going to be examined is the ratio of the image. This process is relevant compare detected blob with its actual size as the requirement for the license plate candidate. The second part is a test on the rotation or alignment of the image. This particular process is important in determining the threshold of the skew that the license plate does have in order for it to be identified by the program. It is also conducted in order to anticipate the probability in which the image will slant as a result from inappropriate position of the camera or a tilted license plate. The third part is distance measurement. This particular measurement is needed in order to evaluate the 2 megapixels camera in terms of determining the required distance for it to identify and detect a license plate accurately. The fourth part is determining the binary threshold value with the Global Threshold and Adaptive Threshold. The formula of the Adaptive Threshold is shown in (1).

$$\mathtt{dst}(x,y) = \begin{cases} \mathtt{maxValue} & \text{if } \mathtt{src}(x,y) > T(x,y) \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

3. Experimental Result

Table 1, 2 and 3 show the list for the software and hardware which are utilized for the research. We conducted several tests with different condition and form of license plates along with different specification of hardware. In ratio experimentation, we established several different situations and in each of the scenario we tried to use our program to determine the length and width of the object in order to calculate the ratio for the cars' license plate candidates. We found out that the observed ratio contains a range of value that spans from 15% to 35% [5].

Table 1. Hardware Specification of the Computer

Processor	**: AMD-C60 APU 1GHz**
Chipset	: Radeon(tm)
Memory	: 2GB
Graphic	: Gallium 0.4 on AMD PLM

Table 2. Hardware Specification of the Camera

Brand	Logitech C615
Resolution	Up To 1920x1080
Recommend OS	Windows 7, Windows 8, Windows Vista, Windows, XP(SP2+), Mac OS X10.5-10.6x,
RAM	2GB

Table 3. Software Specification

Sistem Operasi	Linux Ubuntu 13.10 kernel 3.11.0-26-generic 64 Bit
IDE	Qt Creator 2.7.1 , Qt Version 5.0.2 64 Bit
Library	OpenCV 2.4.3, Tesseract 3.0.3 dan Leptonica 1.81

Fig. 3. Looking for Blob (Region of Interest)

Fig. 4. Rotation in the License Plate

On the second experiment, we conducted a test for the tilting level of the license plate. This experiment is conducted in order to determine whether tilting or skewing on the license does affect the identification process. From the result of the test, we find out that the tilting of the license plate does influence the identification process of the object. We also find out that at 0 to 15 degree and at 0 to -15 degree, the application is unable to identify the object [5].

On the third experiment, we conducted another test on the distance between the camera, therefore mentioned hardware and the object that is the license plate. With the 2 megapixel camera, we find out that the minimum threshold for the detection spans from 40 cm to 310 cm. We also conducted a direct experimentation on the automatic parking gate that stands 155 cm from the object, and we find out that it is able to detect the license plate as well.

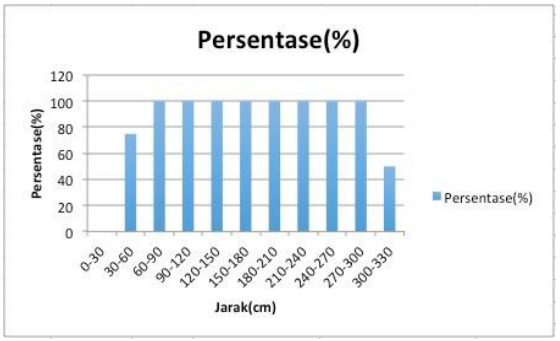

Fig. 5. Results from the Distance Experiment

In this fourth test, two types of thresholds are utilized and both of which are Global Threshold and Adaptive Threshold. Each types of threshold possesses different framework in determining the binary value of each image. We find out that the Adaptive Threshold is able to identify the object better compared to the Global Threshold. The following table will show the comparison:

Table 4. Comparison between Adaptive Threshold and Global Threshold

Image Classification	Global	Adaptive
High (15 Image)	93.4	100
Medium (23 Image)	56.5	82.6
Low (9 Image)	55.6	44.5
All Data (47 Image)	68.1	80.9

Within this fifth and the last examination, we established a thorough systemic evaluation by using all of the methods which have been conducted. We also conducted a comparison with similar system. The result can be seen in table 5.

Table 5. Results from the Total Evaluation and Comparison with Similar System

Image	ANPR			ANPR Patel	ANPR Sajjad
	HIGH (15 Image)	MED (23 Image)	LOW (9 Image)	135 Image	100 Image
SUCCESS RATE	100%	82.60%	44.50%	90%	92%

4. Conclusion

This particular writing elaborates series of experimentation that we have conducted with different condition and problems that occurred within the process of digital projection on the license plate as its object. Our system results show 100% accuracy for high quality image, 82.6% for medium quality and 44.5% for low quality image, this result still lower than previous work and need to be improved.

References

1. Chirag Patel, Dipti Shah, PhD and Atul Patel, PhD. Automatic Number Plate Recognition System. 69-9.(2013)
2. Chirag Patel, Atul Patel, PhD and Dharmendra Patel. Optical Character Recognition by Open Source OCR Tool Tesseract,pp. 55-10. (2012).
3. K.M Sajjad. Automatic License Plate Recognition using Python and OpenCV, pp 4-6. (2010).
4. Ronak P Patel, Narendra M Patel, Keyur Brhambhatt, Automatic License Plate Recognition. pp 285-294. (2013).
5. Reshma P dan Tushar Patnik, Noise Removal and Blob Identification Approach for Number Plate Recognition. pp 47-8. (2012).
6. S.Kranthi, K.Pranathi, A.Srisaila, Automatic Number Plate Recognition, pp 2-3. (2011).