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# Vehicle Object Segmentation as a Pre-Processing of Motorcycle License Plate Number Detection

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**ABSTRACT**:Now, there are many methods used to identify vehicle number plates, in general, vehicle identification made by using images from Video Sensor (VS), which is CCTV which is then processed using Optical Character Recognition to recognize each character on the number plate then combined into a complete vehicle number plate information. The builder of Optical Character Recognition has many methods that can be used. The builder method itself divided into three stages, namely pre-processing, identification, and classification. The pre-processing stage is the initial stage, and the results significantly influence subsequent processes. In the pre-processing section, there are also many methods that can be used. Therefore, in this study analysis will be carried out regarding the methods used in identifying vehicle registration number plates in Indonesia for the type of vehicle motorcycle case study of vehicles passing through the portal the campus entrance to the UGM Science Cluster based on the pre-processing video data section. The test results obtained by the method using the Background Subtractor MoG with the addition of several methods such as Sobel x, Threshold, Closing, Erosion, Dilation, and Contours managed to segment better with a 100% success rate on the existing dataset.

**KEYWORDS**: identification of motorcycle license plate number, pre-processing methods

## I.INTRODUCTION

The portals on the entrance to the UGM environment were implemented and developed since 2009 with the socialization process in advance [1]. One of them is a portal that is in the entry point of the Science cluster which currently has two lanes for motorbikes and cars. In its development, many things have been done to improve the system on the portal, starting from the application of KIK (Vehicle Identity Card) to the testing of smart cards with single IDs. Currently, the realization of smart cards is a priority, because it considered as a strategic instrument in assisting campus traffic arrangement to replace the control system through the disincentive of vehicle identity cards (KIK), said UGM Executive Secretary, Sufi Kismono [2]. The portal system is important because, in addition to limiting the number of vehicles that cross the campus environment also in order to create a campus that has a conducive environment for the learning process, the portal also used as an identification tool for campus security needs.

There are many methods used to identify vehicle number plates, in general, vehicle identification is made using images from Video Sensor (VS), which is CCTV, which is then processed using Optical Character Recognition to recognize each character on the number plate then combined into a plate information vehicle number in full. The builder of Optical Character Recognition has many methods that can be used. The builder method itself divided into three stages, namely pre-processing, identification, and classification. The pre-processor part is the initial stage, and the results greatly influence the subsequent processes. In the pre-processing section, there are also many methods that can be used. Therefore in this study, an analysis will be carried out regarding the methods used in identifying vehicle registration number plates in Indonesia for two-wheeled vehicles, case studies of vehicles passing through the portal the campus entrance to the UGM Science Cluster based on the pre-processing video data section.
The research on identifying motorcycle vehicles is the smallest part of the research with the topic of Intelligent Traffic Monitoring and Control System (ITMCS). The concept of the ITMCS began in 2011 with initial research to recognize

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the presence or absence of vehicles in video input since 2015 research has been conducted on Smart Video Sensors (SVS) located on roads, which the system will analyze and identify plate information from each vehicle [3].

## II. SIGNIFICANCE OF THE SYSTEM

The paper focuses on how Detect objects of motorcycle vehicles that pass through the entrance portal of the science cluster. This detected object will be used as a data capture in the form of data capture which later will be processed further to detect the motorcycle license plate number. The study of literature survey is presented in section III, Methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and Conclusion.

## III. LITERATURE SURVEY

Al-Audah and colleagues created a vehicle number recognition system. This system is applied in Saudi Arabia using the NI-Camera Vision System. The success of this system reaches 94% in optimal conditions with an average processing time of 40ms / number plate [4]. Prabhakar et al. Also created an automated system to detect and recognize number plates by applying various segmentation algorithms in order to improve recognition capabilities [5]. At the end of the study, using the Hough transform and horizontal projection profile method. Sharma et al. Made a hybrid technique to detect vehicle number plates. Hybrid systems that are combined are feature selection from wavelet transforms and artificial requirements network [6]. Babu and Raghunadh detected and identified vehicle number plates using the bounding box method in 2016 [7]. Segmentation is done by using a bounding box to detect vehicle number plates more accurately and quickly. In the next study conducted by Khan and Shah, the vehicle number plate can be detected and identified by using multiple template matching [8].

The vehicle number plate identification system divided into three main parts, namely the global search process that aims to recognize the number plate area in the entire video frame, character segmentation to separate between characters in the found plate area, and character recognition that serves to recognize each character on segmented image. Of the three stages, the global search method which is currently still a challenge for researchers is due to the variety of environments in a frame and the variation in the number plate itself [9]. Also, Setumin and Sheikh, using global search to detect rectangular areas, this study adds the value of compactness and the size of the angle between candidate areas as a distinguishing feature between the plate area and the non-plate area [10]. The two studies between Cika et al. and Setumin and Sheikh have not considered the condition if the number plate is not straight with the camera so that the area is not in the form of a rectangle (as in the case of the portal lane of motorcycle vehicles at the UGM Science cluster).

In the research of Automatic License Plate Recognition (ALPR), Kosala et al. divided into two stages in detecting plate numbers in a complex environment, namely candidate plate extraction and plate area selection. In extracting candidate, plates use the Sobel operator, Closing Morphological operation, and Connected Component Analysis (CCA). Whereas for the process of selecting the plate area using the Convolutional Neural Network - Support Vector Machine (CNN - SVM) method. Compared to several other machine learning architectures, the methods applied in some cases of four-wheeled vehicle number plates achieve the highest accuracy of up to 93% [11].

## IV. METHODOLOGY

Segmentation is useful for separating the background of an object into the foreground object. Segmentation is also useful for separating objects from other objects. Data input from segmentation is a normalized data frame. The output of segmentation is a segment. A segment is a group of pixel objects [3]. In the case of vehicle number plate detection for the purposes of the entrance portal UGM Science Cluster is based on video data, especially motorcycle vehicles have a rule scheme that is a vehicle that passes through the entrance portal reads the number from its vehicle license plate. Therefore, to obtain number data from number plates, there are stages which divided into several stages.

The first step is segmenting vehicles with other objects. Second is the segmentation of candidate vehicle license plates in vehicle images. Third, identification of vehicle number plates with vehicle images. The first stage is to separate the objects of motorcycle vehicles that will pass through the entrance portal with other objects. This is done because it

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based on an analysis of the conditions in the environment and the possibilities that exist. So that the process is chosen by taking and segmenting the vehicle photo data of motorbike vehicles that will pass through the portal. This paper focuses on how to segment the object of the vehicle by comparing several methods to obtain photos of the segmented vehicle as shown in Figure 1. Sequentially the processes in testing methods in this study are shown in Figure 2.

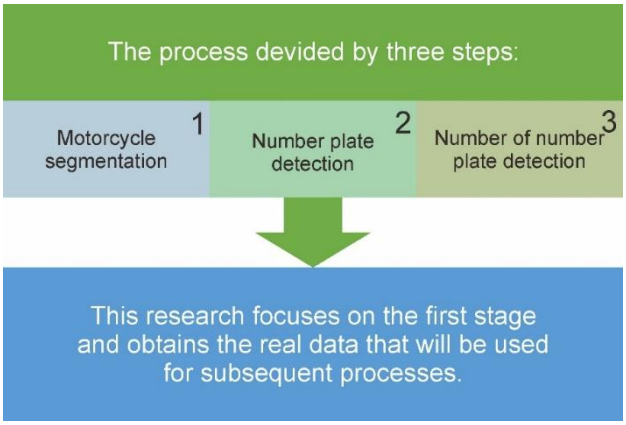


Figure 1. Chart of process steps

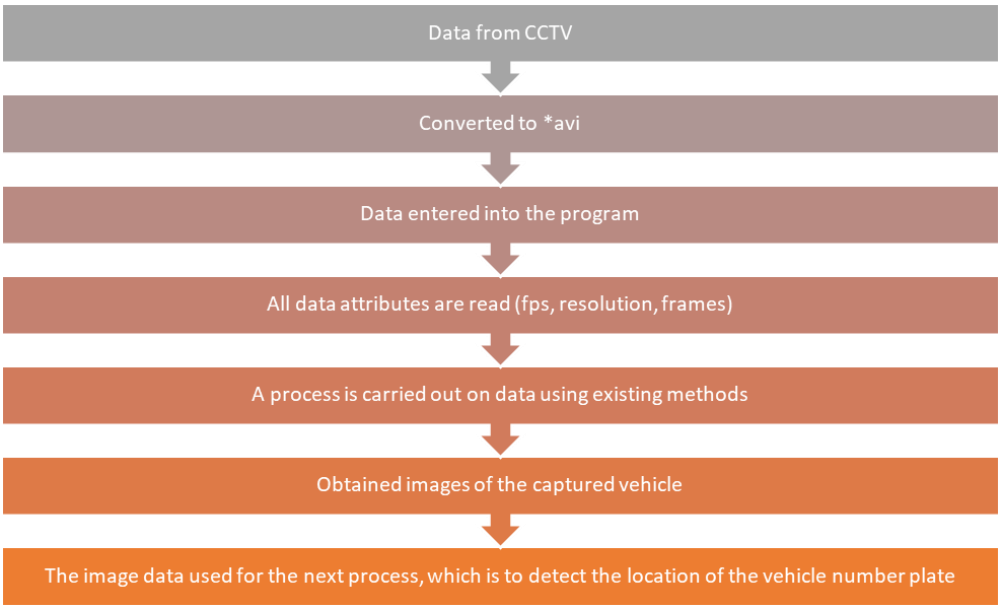


Figure 2. Steps of the method testing process

**Data Acquisition**

Video recording data were taken at the UGM science cluster portal using CCTV cameras. CCTV cameras are installed at portal guard posts to capture the front side of a motorcycle vehicle that will enter through the portal. The video resolution of a CCTV camera is 1920x1080 pixels. This is included so that the quality of the video to be processed is in good condition. A thumbnail capture of the video recording shown in Figure 3. The video recording used is 15 minutes long. Vehicle data that passes more than 50 vehicles and this data is a dataset.

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Figure 3. Thumbnail of video recording data

**Pre-processing**

CCTV cameras record video data with a resolution of 1920x1080 with * .mp4 format and then for this research process the video file data is changed to * .avi format which of course the color is RGB. Then, the image converted to grayscale images based on the RGB to grayscale conversion technique. This conversion implemented by eliminating hue and saturation data while maintaining luminance. Gray-scale video data is used to make the process faster. The following equation shows the optimal formula for RGB to grayscale conversion [12].Figure 4 is shown an illustration of the conversion process from RGB to grayscale.

$$Y = 0{,}299 * R + 0{,}587 * G + 0{,}114 * B \qquad (1)$$

Figure 4. Thumbnail of video recording data in grayscale

**Segmentation**

Segmentation is the process to detect objects or vehicles passing through the portal can be said object vehicle localization process. Several methods were tested in this process. The methods tested are using the GrabCut algorithm, the Background Subtractor MOG, and the Background Subtractor MOG2. Testing of this video data with the intention of applying an algorithm that is suitable for this case.

The GrabCut algorithm considers the color data model of an image as a map that connects pixels. Before the background segmentation and background of the candidate sample must be determined by interaction, and then look for

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pixels in the image, then calculate the distance between pixels and foreground, sample the background candidates respectively. Meanwhile, the GrabCut algorithm builds a color image data model with a Gaussian (GMM) mixed model. Each GMM (foreground or background) can be seen as a dimension-K covariation [13].Among kernel vision, the reduction of background considered as the primary kernel vision for separating foreground pixels (moving objects) from static background pixels. The Background Subtraction algorithm ranges from realization based on adaptive learning algorithms. Among them, Gaussian Mix (MoG). MoG is an efficient algorithm and often used for static camera positions. MoG is an adaptive algorithm where several Gaussian components track the background for each pixel [14]. The Background Subtractor MoG2 is also a Mixed Gaussian. This is based on two papers by Z. Zivkovic, "Improved adaptive Gaussian mixed models for background reduction" in 2004 and "Efficient Adaptive Density Estimates per Pixel Image for Background Reduction Tasks" in 2006. A critical feature of the algorithm this is that choosing the number of Gaussian distributions that are right for each pixel. It provides a better adaptation for various conditions due to changes in illumination and others. [15].

## V. EXPERIMENTAL RESULTS

The results and this discussion show the results data from algorithmic tests used in the case of this dataset.

**GrabCut Algorithm**

Experiment GrabCut algorithm on datasets that have been previously processed by adjusting the pixel size of video data converted to a size of 720 x 480-pixels. The test results using the GrabCut algorithm for segmentation produce image data as shown in Figure 5.

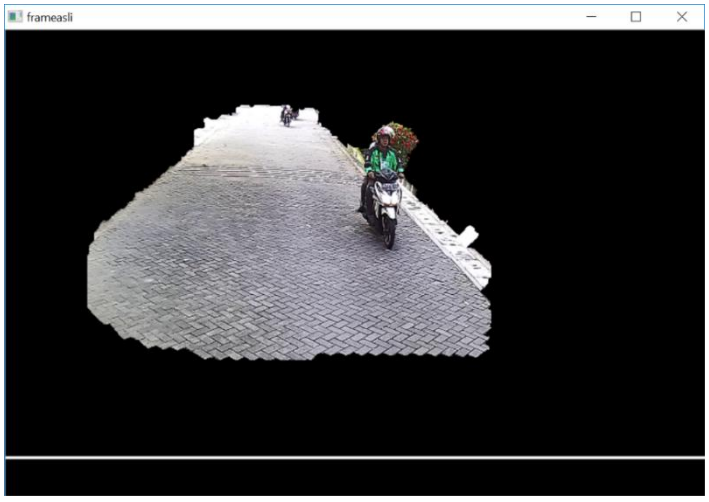


Figure 5. Test results using the GrabCut algorithm

The GrabCut algorithm generates data as shown in Figure 5. When viewed, this algorithm does not produce proper segmentation in this case. The processing time for frames gets results of more than 10 seconds, so regarding time too long. Therefore, the GrabCut algorithm can be said to be not suitable for segmentation in this case.

**MoG Background Subtraction Algorithm**

The Background Subtraction MoG algorithm implemented with results such as Figure 6.To get results from video frame segmentation, some other methods are used such as Sobel x, Threshold, Closing, Erosion, Dilation, and Contours. The results of segmentation shown in Figure 7.

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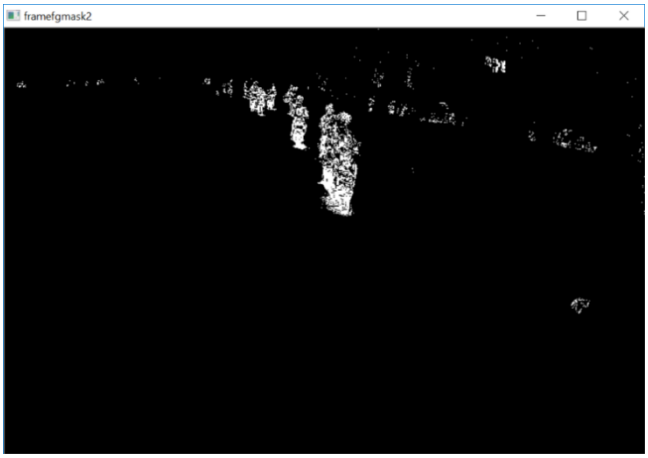


Figure 6. An image that is subject to the MoG Background Substruction algorithm


Figure 7. Results of segmentation using MoG Background Subtraction

**MoG2 Background Subtraction Algorithm**

The Background Subtraction MoG2 algorithm implemented with results like Figure 8. To get the results of video frame segmentation, several methods used.The results of segmentation shown in Figure 9 (using Sobel x-axis, and Contours) and Figure 10 (using Sobel x, Threshold, Closing, Erosion, Dilation, and Contours).


Figure 8. An image that is subject to the MoG2 Background Substruction algorithm

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Based on the processing time for each frame both the Background Subtractor MoG algorithm with MoG2 are less than 10 seconds, so concerning, this algorithm is more suitable to be applied compared to the GrabCut algorithm. If seen from the results both of these methods are Background Subtractor MoG with the addition of several methods such as Sobel x, Threshold, Closing, Erosion, Dilation, and Contours which are the best and ROI can be localized well. The process carried out using this method in the dataset has a 100% success rate.


Gambar 9. Background Substruction MoG2 with Sobel x and Contours

However, the note is that the capture of video frames is sometimes blurry. It is what becomes a challenge later in the process of storing photo data is carried out for security purposes. Then for vehicle number plate detection itself can still be done by comparing with the previous frames with the area inside the ROI.


Figure 10. MoG2 Background Substruction with Sobel x, Threshold, Closing, Erosion, Dilation, and Contours

## VI.CONCLUSION AND FUTURE WORK

The method uses the Background Subtractor MoG with the addition of several methods such as Sobel x, Threshold, Closing, Erosion, Dilation, and Contours successfully segmenting with a 100% success rate on existing datasets. The capture results from video frames are sometimes blurry. It is what becomes a challenge later in the process of storing photo data is carried out for security purposes. Then for vehicle number plate detection itself can still be done by comparing with the previous frames with the area in the Region of Interest.

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