Design a Prototype of The Application System of Classification and Calculating Motor Vehicles on Highway

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Abstract. The growth rate of the number of motor vehicles has a tendency that is always increasing. The increase in the number of motorised vehicles which is not followed by the addition of roads is a cause of traffic jams on the highway. This study aims to design an application system that is used to determine the level of traffic density on certain road sections by using the background subtraction method to classify and count the number of vehicles passing on that road section. From the results of software testing, three types of vehicles can be classified, namely motorcycles, cars, and trucks/buses with an accuracy of 96%, 83%, and 87.15%, respectively.

1. Introduction
Traffic density data is an indispensable component for planning a traffic condition. Until now to get traffic density data done manually, namely by assigning several people to be in the field, counting each vehicle that passes and then divided by a certain period. The background subtraction method is widely used for object detection applications, for example, traffic monitoring, human motion, and video surveillance. The object image is separated from the background image. The separated object image is then converted to a grayscale image to increase object segmentation [1]. The real condition of the traffic is recorded to determine the image processing techniques and simulation analysis data. The simulation method is then used to find out traffic problems. Then the traffic conditions are initiated and the actual conditions are modelled. Some changes are needed to make the model. Comparison of analysis between the conditions that are initiated and changes in the model will be performed [2]. Background registration and segmentation techniques use morphological operators. The system will detect and count objects on the highway. Computational complexity is proportional to the video size and the number of vehicles detected [3]. The first thing in making a video surveillance application is to detect and track the movement of objects. Detection and tracking of moving objects based on vision systems using a different image algorithm. With this method distance, frame per time and velocity can be determined [4]. Visual surveillance is widely used for security systems, law enforcement and military applications. Video surveillance applications can be made using background subtraction methods. A morphological method is used for further processing to eliminate noise [5]. Detection and segmentation of moving objects from two consecutive stereo frames by utilizing uncertainties in estimating camera movements and in calculating disparities. The relative camera movement and uncertainty are calculated by tracking and matching rare features in four images. The probability of motion at each pixel is estimated by calculating the uncertainty and ego-motion gap in the calculation procedure [6]. Many methods can be used for moving object detection. For example, temporal differences, background subtraction, optical flow. Each has advantages and disadvantages. The essence of this algorithm is a simple background subtraction method, it is easy and is used in real-time applications and does not need special hardware [7].
2. **Materials and Methods**

2.1 **Material**

Video camera recorder, Microsoft visual studio 2015 software, visual basic software, OpenCV software.

2.2 **Methods**

Placement of the video camera recorder for video shooting of traffic conditions on the highway on the flyover, then by analysing the work characteristics and suitability of each component supporting the design idea obtained a steady and optimal initial design. Overall the system built is a system used to classifications and calculate the number of motorised vehicles.

![Flow chart system](image.png)

**Figure 1. Flow chart system**

The system built is software that is able to insert videos, then detect motorised vehicles, classify them and then count the number of each motorized vehicle. The process of inserting video as an image to be processed is an image preprocessing. Next will be the Background Subtraction process so that the object (foreground) will be separated from the background image (background). When an object in the form of a foreground begins to be separated from its background, it is then converted from an RGB image to a Grayscale image and filtered using the Gaussian Blur method, after which an absolute image difference is carried out, namely the process of reducing the background with the current frame. Absolute different functions are used to calculate the absolute value of the difference between two arrays or images. Absolute is used to avoid negative values. After that, the threshold stage is carried out for segmentation or separation of an object with others. The classification used is the blob detection method. This method is said to be successful if every passing vehicle is detected by the program as an object. After one or more objects have been detected, a vehicle classification mark such as a motorcycle, car and truck/bus is placed. After each object is classified, each object is then made into a Blob for object movement (tracking). When the previously made Blob meets the value of a y coordinate, the counting process will increase by one.

3. **Results and Discussions**

This system is a form of applications of classifying and calculating motor vehicle on the highway. This system consists of a video camera recorder that will capture traffic conditions on a highway section. Next will be the Background Subtraction process so that the object (foreground) will be separated from the background image (background). The separated objects are then converted from an RGB image to a...
Grayscale image and filtered using the Gaussian Blur method. The classification process uses the blob detection method. Objects that have been classified are then made into Blob for object movement (tracking).

**Figure 2.** Condition of Pemuda street Purwokerto

Figure 2 shows the condition of Pemuda street Purwokerto during the day taken with a 1-minute video with a size of 1280 x 740 pixels.

**Figure 3.** The output system of Pemuda street Purwokerto condition

Figure 3 shows the system output for detecting traffic conditions on Pemuda street Purwokerto during the day, as shown in Figure 2.

**Figure 4.** Condition of Veteran street Purwokerto
Figure 4 shows the condition of Veterans Street Purwokerto in the afternoon taken with a 1-minute video with a size of 1280 x 740 pixels.

![Figure 4. Output system condition of Veterans street Purwokerto](image)

Figure 4. Output system condition of Veterans street Purwokerto

Figure 5 shows the system output for detecting traffic conditions on Veteran street Purwokerto in the afternoon, as shown in Figure 4.

![Figure 5. System output for detecting traffic conditions on Veteran street Purwokerto](image)

**Table 1. System accuracy test results**

| Location       | Motorcycle | Car | Truck/bus |
|----------------|------------|-----|-----------|
| Pemuda street  | 92%        | 88% | 96%       |
| Veteran street | 100%       | 78% | 78.3%     |
| Average        | 96%        | 83% | 87.15%    |

Table 1 shows the results of testing the accuracy of the system in classifying and counting motorised vehicles. The level of accuracy to classify and count the number of motorbikes is 96%, cars are 83% and trucks/buses are 87.15%.

**4. Summary**

The application system created in this study has been able to work following the plan, which can classify and count the number of motorised vehicles on the highway. From the test results, it can be concluded that the level of accuracy to classify and count the number of motorbikes is 96%, cars 83% and trucks/buses 87.15%.

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