Bigint Computing Journal
Open Access
Publisher Ali Institute of Research and Publication

Development of Image Processing to Visualize Car Dimensions Using Matlab Software

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A B S T R A C T

In an era of increasingly advanced technology, the development of image processing techniques has become important in various fields, including the automotive industry. One important aspect in the automotive industry is understanding and visualizing car dimensions with high accuracy. In this research, we propose the development of image processing techniques using MATLAB software to visualize car dimensions. The proposed method involves a series of image processing steps, including car object segmentation, binary image, and image editing. First, the car image is imported into MATLAB software and converted into a grayscale image. Next, segmentation of the car object is carried out using an appropriate threshold technique. Next, the feature extraction results are used to visualize the dimensions of the car. This visualization can be in the form of a 2D diagram that displays the dimensions of the car proportionally, or a 3D model that shows a three-dimensional view of the car. Through this visualization, users can easily see and understand the dimensions of the car without the need for complicated manual measurements.

Keywords:
image processing, segmentation, binary images, grayscale, visualization.

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INTRODUCTION

Along with the rapid development of science and technology, we are currently faced with increasingly complex forms of problems that require creativity in developing image processing techniques which are currently developing rapidly, especially in image processing [1]. Land transportation is the most widely used means of transportation. In Indonesia, especially cheap cars are emerging, educational institutions such as high schools and similar institutions are already producing their own cars [2]. In general, image processing is a technology that applies a set of computer algorithms to process digital images. Digital imaging applications can be found in robotics, medical imaging, remote sensing, photography and forensics [3]. Matlab is a high-level computing language that combines computing, visualization, and programming into

one simple model. Problem solving is expressed in mathematical notation related to matrices and equations commonly used in certain fields of science [4].
Digital images are converted into discrete images from two-dimensional, continuous analog images. The analog image is divided into m rows and n columns by scanning. Identification means searching, finding, collecting, researching, registering and recording data and information from the field [5]. In digital images, pixels are the smallest image units that can be controlled and addressed by coordinates, and the intensity of each pixel varies [6]. Digital image processing is a scientific discipline that studies image processing techniques [7]. Images captured by a camera and quantized in the form of discrete values are called digital images. Photos printed by a printer cannot be called digital images, but photos stored in image files (BMP, JPG, PNG or other formats) on a computer can be called digital images.[8] The problem that affects the character segmentation step is the step before character segmentation, namely pre-processing character segmentation or what is called pre-processing. In this research we will solve the problem of measuring car dimensions with the Matlab application [9]. A fairly common approach to morphological segmentation involves three steps: image simplification, marker extraction, and contour definition [10]. An image is converted into digital form so that it can be stored in computer memory or other media. Converting images into digital form can be done using various devices, such as scanners, digital cameras and camcorders. When an image has been converted into digital form (hereinafter referred to as a digital image), various image processing processes can be carried out on the image [11]. The availability of good shooting technology today is not difficult to find. Digital cameras are getting better by increasing the pixel value that can be produced from camera shots [12]. Color characteristics are closely related to color spaces and their descriptors [13].
Technological research in the field of measurement systems is necessary and complex, keeping up with the times and the needs of an industry. So we need a measurement system that has an accuracy value and can approach the actual reading. The system created is intended to allow simpler measurements and can help achieve the desired product quality [14]. Image processing development can be used to visualize car dimensions using Matlab software. Image processing is the processing of images that are converted into other forms of images using certain techniques and certain purposes [15]. This process requires improvement of the processed image to achieve optimal results [16]. When working on this journal, image processing methods can be used to process or manipulate images in two dimensions. Image processing is a form of processing or signal processing that takes input in the form of an image and converts it into another image using several techniques as output [17]. The image processing pipeline starts by sampling the input image or using color reduction operations to reduce the amount of data (color) in the image [18]. Image processing is usually used to improve image quality, remove information or descriptions of objects contained in the image, and compress or reduce data [19]. There are still many activities to measure an object manually. In this regard, this research develops image processing to visualize ship dimensions using MATLAB software, namely creating a program in Matlab software that helps in measuring ship dimensions, using time and energy more efficiently [20]]. Artificial intelligence is a branch of science that deals with the use of machines to solve complex problems in a more humane way. Artificial intelligence has now opened up new phenomena in the fields of business and corporate governance[21]. Converting a color image to grayscale requires more knowledge about color images. The pixel color in an image is a combination of the three colors red, green and blue (RGB) [22]. Many image segmentation techniques have been proposed specifically for grayscale images. The reason is that while color information allows for a more complete image representation and more reliable segmentation, processing color images requires much longer computing time

than grayscale images[23]. Grayscale images are a type of image. CT and MRI are gray scale images. In image segmentation, image pixels are divided into non-overlapping areas [24].
The main aim of this research is to determine the differences in the influence of variables that influence area measurement research [25]. The difference between this research and the previous quote lies in the object that in the previous research the dimensions of ships were studied, whereas in this research the dimensions of cars were studied.

METHODOLOGY

Determining the size of the car uses the main size comparison method with shape coefficients and main size comparisons as in table 1, and the research steps can be seen in Figure 1.

Table 1. Data Table

No.	Car name	Panjang	Wide	Tall
1.	Calya	4.070 mm	1.655 mm	1.600 mm
2.	Avanza	4.395 mm	1.730 mm	1.665-1.700 mm
3.	Kijang Inova	4.735 mm	1.830 mm	1.795 mm
4	Honda Jazz	3.955 mm	1.694 mm	1.524 mm
5.	Honda Brio	3.795-3.810 mm	1.680 mm	1.485 mm

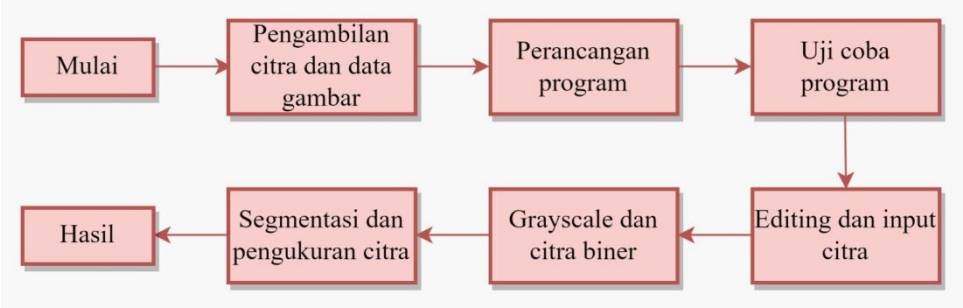

Figure 1. Research flow diagram

1. Retrieval of images and image data
   Image capture functions as data for further processing as well as for testing the program. The distance between the camera and the object is measured using a meter.
2. Programming design
   Programming design with a programming flow starting from inserting the image until the output of the program becomes the dimensions of the car.

3. Test the program
   Program testing is carried out to ensure whether the program that has been created can be used and the percentage of errors does not exceed the allowable limits. The testing step is to take a sample photo of the car at a predetermined distance, then carry out an editing process on the initial image, then input the edited image results into the program, then the program will visualize the dimensions of the car, with the target dimensions in the program matching the original dimensions in car or the error percentage difference does not exceed the permitted limits.

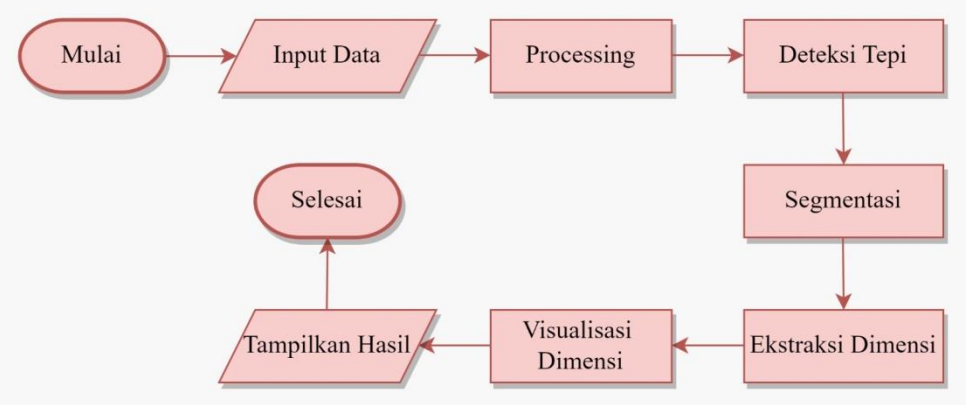

Figure 2. Program Testing Flowchart

4. Image editing and input
   The image editing process is carried out because when the image is taken the background data is not solid or 1 (one) color, because if the editing process is not carried out on the image, then when the program runs the resulting image will be blank. . The image editing process uses Photoshop software by utilizing the pen tool, by selecting the edges of the object in the image. The purpose of this selection is to make the image background a solid color.
   The images that have been collected during data collection are then input into the program that has been created and will then be processed further by clicking the Insert Image button. Thus the program will automatically open a new window to find where the image has been saved on the computer.

5. Grayscale and binary images
   The next process is a process where the program will change the previously colored or RGB image to gray, this is used to simplify the image model. And the purpose of this binary image is so that the program can detect objects and background images, because the binary image will change the image to black and white only.

6. Image segmentation and measurement
   Image segmentation is carried out with the aim of separating objects and backgrounds in the image. This process is carried out so that the program can detect the maximum dimensions of image objects. Meanwhile, image measurements are carried out to produce a comparison of the size of the original object with the size of the object in the photo.

RESULTS AND DISCUSSION

To get maximum photo results so that the error percentage does not exceed the permitted limits, steps are taken when taking photos, starting with paying attention to the direction of the light, taking photos should be taken in the direction of the light, this is done so that when the editing process is carried out you can know object part. Next, start measuring the distance of the object to the camera, this is done to analyze the percentage of program errors. The first distance is taken where the cellphone screen resolution can fully capture the photo object with the photo taking position referring to the car body as the center point of the object. If the distance between the shooting camera and the object is known, the photo is taken by activating

manual mode but the camera settings use automatic mode. So that when taking photos it doesn't tilt, the manual mode that has been activated has a balance feature that functions so that the photo doesn't tilt. Because the photo is taken using a landscape position, the horizontal lines in the balance feature are used to adjust the tilt of the camera, so that the photo results are even. Then the camera switches to the right and left where the cellphone screen resolution can take a complete picture without turning the angle of the camera taking the picture. Below is one of the photos of the car used to test the program at photo taking position number 1 and the camera is 5 meters away from the car. With a picture of the car taken from the front of the UINSU Tuntungan campus, measuring LxWxH = 3,955 mm x1,694 mm x 1,524 mm. Which can be seen as in Figure 3 below.

Figure 3. Honda Jazz Car Object

1. Image Editing
   After taking a photo of the object, an editing process is carried out to make the background solid. The results of the photo editing process of the Honda Jazz car are as in Figure 4 below.

Figure 4. Image editing object image.

2. Image and Grayscale Input
   The purpose of this process is to process the image further using the program that has been created. And the grayscale process is an image conversion process where the initial image contains RGB colors into a gray image. This is used to simplify the image model. The resulting grayscale image is as in Figure 5.

Figure 5. Car object using the grayscale method.

3. Binary Image
   The binary image process will make the pixels in the image only have two colors, namely black and white, where the object will be white and the background will be black. This process aims to enable the program to detect objects and image backgrounds. The resulting binary image is as in Figure 6.

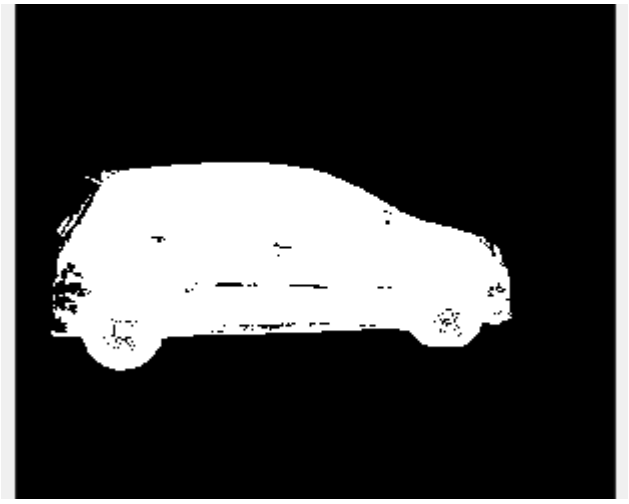

Figure 6. Car image using the binary image method.

4. Segmentasi Citra
   Image segmentation is carried out to separate objects and backgrounds contained in the image. This process is carried out so that the program can detect the maximum dimensions of the image object. This command will detect objects in the image and then the image will be segmented. The image segmentation results are as in Figure 7.

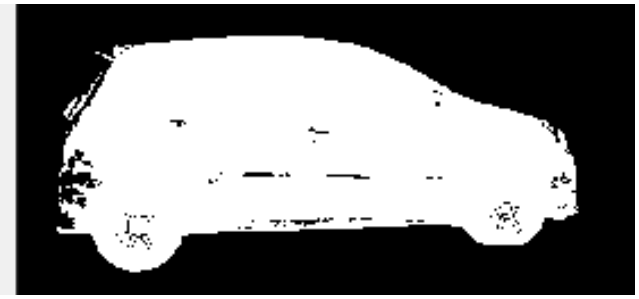

Figure 7. Object Image Using Image Segmentation.

5. Pengukuran Citra

This image measurement is carried out to obtain comparison results between the original object and the object after being photographed. The following Figure 7 is the size of the Honda Jazz car after entering it in the Matlab application from mm to cm.

```
>> pengukuran
Dimensi mobil:
Panjang: 55.30 cm
Lebar: 24.90 cm
Tinggi: 128.00 cm
fx >>
```

Figure 8. Car size in cm

Table 2. Comparison of original and outcome measures

No	Car Name	Long		Wide		Tall	
		Original	**Results**	**Original**	**Results**	**Original**	**Results**
1.	Calya	4.070 mm	63,90 cm	1.655 mm	24,40 cm	1.600 mm	48,00 cm
2.	Avanza	4.395 mm	0,20 cm	1.730 mm	4,40 cm	1.665-1.700 mm	96,00 cm
3.	Kijang Inova	4.735 mm	73,70 cm	1.830 mm	38,70 cm	1.795 mm	41,50 cm
4.	Honda Jazz	3.955 mm	55,30 cm	1.694 mm	24,90 cm	1.524 mm	128,00 cm
5.	Honda Brio	3.795-3.810 mm	0,40 cm	1.680 mm	0,20 cm	1.485 mm	96,00 cm

From the results of dimensional visualization using the Matlab application, two different sizes can be obtained with units of mm to cm. The original size was taken at a photo distance of 5 meters from the object. And the result is a value with dimensions that have been visualized in the Matlab application. The difference between our research and previous research is the object, where in the previous research it examined ships, and here the object studied is a car [26].

CONCLUSION

From the results of the program trials that have been carried out, namely regarding the development of image processing to visualize car dimensions using Matlab software, for taking photos at position number 1 and the distance between the camera and the object is 5 meters, a comparison of the size of the original object with the size obtained from measuring the object with The MATLAB application in terms of measuring car dimensions using the program in this research is possible because it can produce car dimensions in different units, from the original unit mm to cm.

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