IMPLEMENTATION LANE DETECTION USING HOUGH TRANSFORM MEHTOD FOR THE ASSESSMENT OF DRIVING BASED ON ROAD MARKINGS (CASE STUDY AT SUKSES MANDIRI)

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ABSTRAK

Road marking is a mark which is at street level or above street level which includesequipment or signs which form a line which serves to direct the flow of traffic and limiting the area of interest of the traffic. Sukses Mandiri is a service company engaged in driving courses that want to implement a system of automatic driving asessment to drivers can how to drive on line of the road.

Hough transform method is a method as a companion lane detection. Hough transform is the image transformation techniques that can be used to isolate or otherwise acquire the features of an image. Hough transform method works by finding an object with a straight line on an equation on the object. Research on the lane detection hough transform method for line detection have been done earlier researchers. This research will add a feature after detecting road markings, the system is able to estimate the position of the vehicle with a line, was able to recognize lane pass a vehicle, and calculates the percentage of the estimated value of the position so as to produce output in the form of a predicate for the assessment of driving.

Based on the results of the study concluded that all video sources are tested, the system can detect road markings and it is able to issue a driving title based on the valuation parameters Sukses Mandiri.

Keyword: Lane Detection, Hough transform Method, Driving Assesment, Line of The Road.

1. PENDAHULUAN

Road markings are a sign that was on the surface of the road or on the road surface which includes the equipment or signs that forms a line that serves to direct the flow of traffic and restrict traffic areas of interest. Driving on road markings are so important because one of the tests required in the manufacture of SIM (Surat Izin Mengemudi) in the Indonesian police are driving on road markings.

Sukses Mandiri is a service company engaged in the course of driving. In driving training, successful Independent assessment in the form of a written certificate apply. The assessment process conducted by the Successful Independent one is how driving in order to remain in the path of the appropriate road markings. Based on the results of the interviews of Mr. Dadang Budiman as the owner of a successful Independent assessment that driving in a successful Independent still done subjectively, that is relative to its assessment (results of guessing or based on feelings or tastes) with output in the form of predicate value driving that process his driving is unknown by the owners of the establishments, according to Mr. Dadang peniliaian dear reader that felt less well, because Successful Independent wished to give birth to a reliable driver-driver , such as with how good driving and true, especially driving a vehicle on road markings. Mr. Dadang Budiman wants to change the way Independent Success in driving assessment be objective, that is to be supported with facts/data the way the driver drove his car, to later made Sukses Mandiri reports. Driving assessment objectively requires an innovation for the assessment, the innovation that can be applied, namely in the form of a video with the help of a system, that later can automatically assess the mengendarakan driver in his car, in particular how to riding on road markings.

Lane detection is a method to find out the location of the road markings without prior known noise on the surrounding environment. Lane detection has been the research is often done by many people to be one of the support Driver Assistant and for Autonomous that include for Inteligent Transportation System.

Hough transform method is a method as an escort lane detection. Hough transform is a technique transformation of image that can be used to isolate or otherwise acquiring the features of an image. The workings of the Hough transform with the method how to find an object with a straight line on an equation on the object. In this case the object will be detected road markings.

n this study must not be separated from reference journals that support. Studies related to this research including by habana Habib and

Mahammad A Hanan [1] describes the level of detection accuracy on the condition of road lighting with test results of the night by lighting the lamp vehicles 60%, tunnels 80%, and during the day 85%. Further research conducted by Mohamed Aly [2] explains that it is able to detect all the markers located in urban areas with good roads with high rates of 50 Hz. Recent studies conducted by Charles Edison, Herland, and Sofyan [3] explains that this study compared the method with Multiresolution hough transform hough transform hough transform to the conclusion that faster detection time of 1.7 seconds compared with multiresolution method hough transform for 4.329 sec , but the accuracy is more multiresolution hough transform with an average error of 2.0520 position with an average error of 1,3555^{o} corner.

In general, previous studies that discuss the lane detection and methods hough transform only up to the stage to detect lane markings with the accuracy of detection, but also in this study added a feature after detection of lane markings, the system is able to determine the path you pass a vehicle, estimating the vehicle with markers per frame of video, calculate the calculation of estimated position of the vehicle with markings overall with parametenya ie when the vehicle in road markings, moving lane and past the side of the road. After that, the system is able to issue a predicate value for the output of driving assessment.

The purpose of this research is the application of the method Knowing hough transform to detect lane markings through the video and find out from the detection of road markings able to issue a citation for a driving assessment.

1.1 Hough Transform

Hough transform is to make the equation of a pixel and consider all couples who meet this equation. All couples are placed on an accumulator array, called array transformation. Hough transform has been developed to detect common forms in the image such as a circle, ellipse and parabola. The basic concept of the Hough transform is that there are lines and curves countless potential at an image through any point in the take berbagaiu and orientation. Transformation is done to find the lines and curves that pass through many of the points in the image, the lines and curves that closest and palingsesuai with the data in the image matrix.

In particular Hough transform used herein are for detecting the line on road markings are where at first line of the road in the form of Cartesian space coordinates (x-y) which is then converted into a sinusoidal curve in hough space (rho and theta.)

$$\rho = x \cos \theta + y \sin \theta \qquad \text{(Pers 1)}$$

1.2 Estimated Position

Estimates of the vehicle's position markers are approximate position of the vehicle to the left and right markers are traversed by the vehicle itself. The vehicle in question is a private car is used for driving.

The formula to find the estimated position of the vehicle to the markings on the equations 2 and 3 Moderate to determine the range in Equation 4:

R1 = (Central - B1) - P1 (2)
R2 = P2 - (Central + B2) (3)
R = R1 + R2 (4)

Information:
P = point x of y maximum
B1 & B2 = Limit car side
R1 & R2 = Range B to P
Middle = length of the curve x / 2

The formula to find markers which direction the vehicle is moving left or right, use the equation 5:

(R1-R2)/R x100 (5)

In Equation 5, the value is multiplied by 100 to find the value in pentuk percentage.

Here is a rule to determine the vehicle moves toward the left and right markers:

If the direction of the car = R1> R2, (R1-R2) / R x100 marking the direction of the vehicle to the right side.

If the direction of the car = R1 <R2 (R2-R1) / R x100 marking the direction of the vehicle to the left.

If not, then the value is 0. Directions vehicle in the middle.

1.3 Driving Assessment

The driver with the title of "Good": If the percentage value in Marka in the range of 70-100%. The driver with the title "Pretty Good": If the percentage value in Marka in the range of 40-70%. The driver with the title "Something Good": If the percentage value in Marka in the range of 0-40%.

At the conclusion of the predicate driving if Move Lane is the percentage of 40-100%, it will produce output "Too Many Moving Strip". If Edge Boundary generate 50-100%, the percentage of the output to the conclusion that "Too often Alongside Road", if the percentage of 5-50% Outskirts Limiting the output to the conclusion, "Reduce Being in Roadside".

To find out how to calculate In Marka, Moving Strip, and Edge guides using the following formula:

$$\sum \frac{\text{Inside marka}}{\text{total } \textit{frame}} \times 100\% \quad (6)$$

That is just as if you want to calculate the Moving Boundary Lane and baseboards using a formula such as the markers.

In Marka has several conditions, namely when the vehicle when it is in the left lane and right. In each lane has three conditions, namely the so-called In Marka Marka Left Inside, Inside the Middle Marka, and Inside Right Marka. To calculate In Marka on each lane using the following formula.

$$\sum \frac{\text{Marka Left Inside}}{\text{Inside Marka}} \times 100\% \quad (7)$$

That is just as if you want to calculate the Middle Marka Inside and Inside Right Marka using a formula like in Left Marka.

1.4 OpenCV

OpenCV (Open Source Computer Vision Library) is a software library that is intended for dynamic image processing in real-time, created by Intel, and is now supported by Willow Garage and Itseez. This program is free and is in the shade of the open source BSD license.

OpenCV is used in the system to be built is OpenCVSharp namely that contains the image processing method, which also has a lot of method. But that will be used and invoked in the system include: grayscale, threshold, smooth filter, morphological operations and hough transform, can be seen in Table 1 to 4.

Table 1. Parameters cvtColor OpenCV

Nama Parameter	Deskripsi
Src	Source original image shows the result of input pixel values RGB 8 bit, 16 bit or single-precision values
Dst	Destinations images output by the same provisions of the src parameter.
Code	Color space conversion code
dstCn	The number of channels in the image of interest, the number of channels is derived automatically from src and code.

Table 2 Parameters *Cv.Smooth* OpenCV

Nama Parameter	Deskripsi
Src	Source original image input results.
Dst	Destinations image output.
Smoothtype	Choosing a median filter
Size1	The value of the parameter matrix smoothing operation. Must be a number of positive odd numbers such as (1,3,5,7 ...)

(2.14)

Table 3. Parameter Threshold OpenCV

Nama Parameter	Deskripsi
Src	Input array (single-channel, 8-bit or 32-bit)
dst	Output array that has the same size as the src parameter.
thresh	Threshold values.
maxval	The maximum value for the use on the type of threshold
Type	Choosing the type of binary

Table 3. Parameter *morphologiEx* OpenCV

Nama Parameter	Deskripsi
Src	Input array (single-channel, 8-bit or 32-bit)
Dst	Output array that has the same size as the src parameter.
op	Type of morphological operation. The following types are possible: MORPH_OPEN opening MORPH_CLOSE closing MORPH_GRADIENT morphological gradient MORPH_TOPHAT “top hat” MORPH_BLACKHAT “black hat”
kernel	Structuring element.
anchor	Position of an anchor within the element. The default value Point(-1, -1) means that the anchor is at the element center.
iterations	Number of times erosion and dilation to be applied
steam	Stream for the asynchronous version

Table 4. Parameter *HoughLine2* OpenCV

Nama Parameter	Deskripsi
dst	Output image to be detected by the line
lines	A vector that will store the parameters (ρ, θ) of the detection line
rho	Resolution of the ρ parameter in pixels.
theta	Resolution of the θ parameter in radians.
threshold	The minimum number of intersections to detect a line
srn and stn	Value supporting parameters of the line

2. ISI PENELITIAN

2.1 Alur Proses Sistem

The main process flow system can be seen in Figure 1:

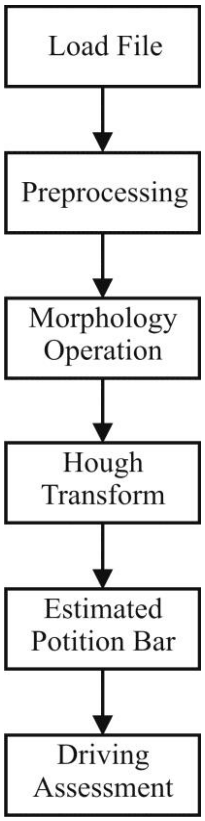


Figure 1 Main Process Flow System

A. Load File

In this stage, taking the driving video data that has been stored in the computer system. Videos recorded facing forward, in the direction of the car's speed and put in the middle of the vehicle.

B. Preprocessing

Preprocessing include Frame RGB conversion to grayscale with a function call through opencvsharp library are as follows:

```
Cv.CvtColor(src,gray,ColorConversion.BgrTo
Gray);
```

The next process is cropping frame with a function call through the library opencvsharp as follows:

```
src.SetROI(new CvRect(0,
(src.Height/2)+100, src.Width-1,
src.Height-1));
```

The next process is the median filter with a function call through the library opencvsharp as follows:

```
Cv.Smooth(gray, gray, SmoothType.Median,
7);
```

The next process is the threshold by calling the library functions through opencvsharp as follows:

```
gray.Threshold(gray, 85, 255,
ThresholdType.Binary);
```

C. Operasi Morphologi

Morphological operation via function calls opencvsharp library as follows:

```
Cv.MorphologyEx(gray,gray,gray,new
IplConvKernel(3,3,1,1,ElementShape.Rect),M
orphologyOperation.Close,3);
```

D. Hough Transform

In hough transform process is the process of formation markers were found in the binary image that has a structure equation of the line. In the initialization function calls the establishment of the library opencvsharp line is as follows:

```
line = gray.HoughLines2(memo,
       HoughLinesMethod.Probabilistic,
       5,Math.PI / 180, 200, 75, 150);
```

In function (HoughLines2) is a function that contains equation with the formula ρ = x cos θ + y sin θ. Where (HoughLines2) implementation will provide output with the output in the form of line detection (X_0 , Y_0 , X_1 , Y_2).

The next process is a probabilistic point initialization. Here is a point initialization process

and limit detection angle, and manufacture coordinates of the point markers: `for (int i = 0; i < line.Total; i++); double angle = Math.Atan2(dy, dx) * 180 / Math.PI;`

After the initialization process is further probabilistic point line drawing by connecting the dots already known. With the implementation of the program to the following formula:

$$\frac{y2 - y1}{x2 - x1} = \frac{y2 - y}{x2 - x} \qquad \text{(Pers 8)}$$

Then the result will be a system to detect lane markings such as in Figure 2.

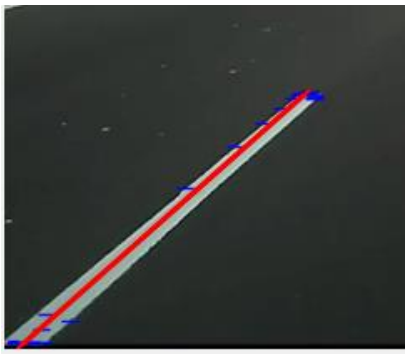


Figure 2 Formation Process Line

The blue color is a probabilistic dots and red is the union and pengaambaran line through the points that are detected.

E. Estimated Posisiton Bar

In this process the system will estimate the position of the vehicle with the left and side markers perframe. Bar estimated position of the vehicle with markings involves the midpoint of the vehicle and the limits of the vehicle. The midpoint of the vehicle's systems diinisalisasikan using program code `(src.Width / 2)` and applying the equations 1 to 5 which has been described in the basic theory.

Here is a scanner bar estimation of the vehicle position if the car closer to the marker to the right, seen in figure 3.

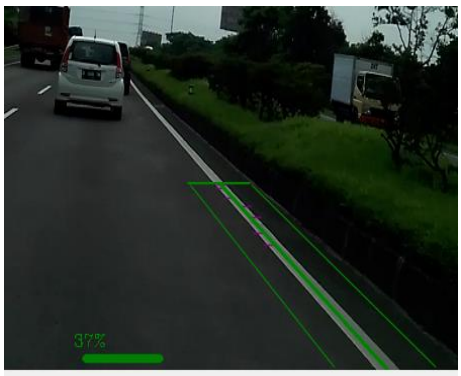


Figure 3 Bar Estimated Position

F. Driving Assesment

The next process in completing this system that analyzes driving assessment. At this stage, the system calculates the percentage of detail driving the vehicle with markings. The process that will count them when the vehicle is in "In Marka", "Move Strip" and "Edge Delimiter".

Before calculating how to calculate the vehicle when in markers, will be explained in detail about the first terlibih "the markings". The left lane and the right to have "In Marka" consisting of Inside Left Marka, Central Marka Inside and Inside Right Marka.

If the vehicle is in a frame are the markers, then +1. The system will continue counting continues for a vehicle is in the markers (1,2,3,4,5,6,7 etc). To calculate Marka part in the left lane and the right lane, the formula is to use equation 7 that in Marka Left / Total In Marka, In The Middle Marka / Number In Marka, and In the Right Marka / Number In Marka. And to calculate In Marka, Moving Strip, and Edge guides using equation 6 is in Marka / Total Frame, Move Lane / Total Frame and Edge guides / Total Frame.

G. Output Predicate Values

The driver with the title of "Good": If the percentage value in Marka in the range of 70-100%. The driver with the title "Pretty Good": If the percentage value in Marka in the range of 40-70%. The driver with the title "Something Good": If the percentage value in Marka in the range of 0-40%.

At the conclusion of the predicate driving if Move Lane is the percentage of 40-100%, it will produce output "Too Many Moving Strip".

If Edge Boundary generate 50-100%, the percentage of the output to the conclusion that "Too often Alongside Road", if the percentage of 5-50% Outskirts Limiting the output to the conclusion, "Reduce Being in Roadside".

2.2 Results

Here are the results of research conducted prior testing of the final result.

2.2.1 Predicate Testing Scenarios Driving

Testing scenarios predicate driving assessment aims to determine the parameter values are implemented on a scoring system based on the driving lane markings. This scenario testing using three scenarios predicate assessment, ie when the vehicle is in the markers, moving lane, and the edge of the barrier. The predicate produced is good, quite good, and less good. Parameter values used in this test is the result of the interview to the case studies and the sukender is understood about how a good driving based on parameters that have been described.

Predicate driving scenarios to be tested is Good and Good. The range of values obtained from the predicate good percentage of the marker is at 70-100%. 40-69% fairly well. Predicate unfavorable 0-40%. At the conclusion predicate driving assessment no driving record obtained from the parameter value and move the edge of the lane divider. If the vehicle passes the edge of a road divider in the range of 5-29%, the driving of the record is "should reduce towards the edge of the road". If the vehicle passes the edge of the barrier of 30-100% then his driving record is: "too often on the side of the road". If the vehicle moving lane on the range of 50-100% then his driving record was "too often moving lane".

A. A Good Predicate Testing Scenarios

In testing the predicate good scenario aims to test the scenario run or not in the system, either parameter that is when the vehicle is in the range of 70-100% markup. Video used are the primary video or derived from case studies that tested with a sample video for one minute. Here's a predicate test well can be seen in Figure 4 and Figure 11

.

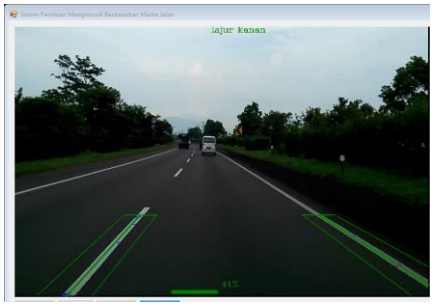


Figure 4. Video 1 Predicate Testing

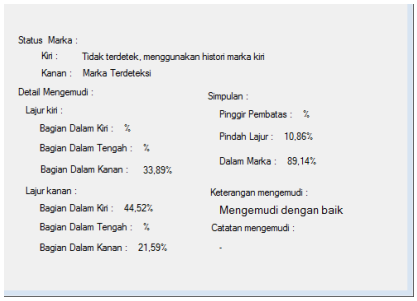


Figure 5. Conclusion The predicate Driving Good 1



Figure 6. Video 2 Predicate Testing Good

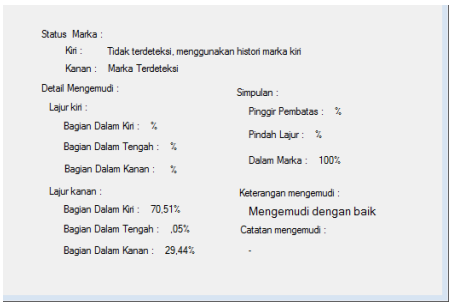


Figure 7. Conclusion Predicate Driving Good 2



Figure 8. Video 3 Testing Predicate Good

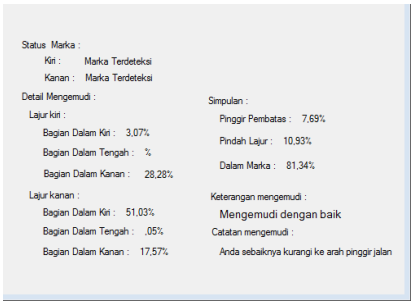


Figure 9. Conclusion Predicate Driving Good 3

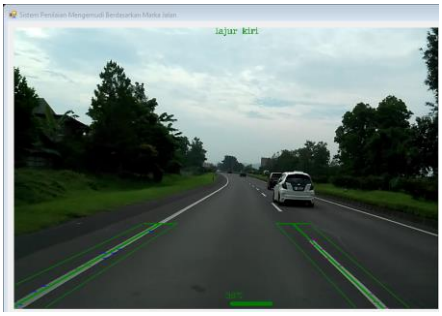


Figure 10. Video 4 Predicate Testing Good

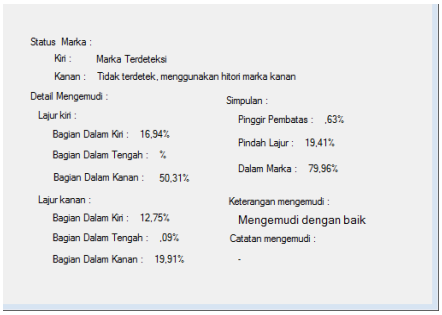


Figure 11. Conclusion Predicate Driving Good 4

B. Pretty Good Predicate Testing Scenarios

In the test scenario fairly well aims to test the scenario run or not in the system, the parameters good enough that when a vehicle inside the markers in the range of 40-70%. Video used are the primary video or derived from case studies that tested with a sample video for thirty seconds. Here's a predicate test well can be seen in Figure 11 and Figure 12.



Figure 10. Video Predicate Testing Pretty Good

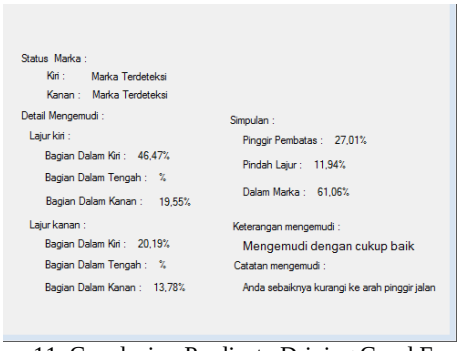


Figure 11. Conclusion Predicate Driving Good Enough

C. Conclusion Testing

Based on driving assessment test scenario, it can be concluded some conclusions as follows:

1. Testing scenarios predicate good driving assessment has been successfully tested.
2. Testing scenarios votes predicate good driving with your driving record has been successfully tested.
3. Testing scenario driving ratings up fairly well was successfully tested along with the predicate driving record.

3. CLOSING

Based on the results of research, analysis, system design, implementation and testing, it could be concluded that the implementation of the lane detection methods for assessing driving hough transform based lane markings with a case study on Success Mandri be concluded as follows:

1. Application of the method hough transform through the medium of video can detect lane markings.
2. The results of the testing of all video, daoat system detects lane markings and is able to issue a driving title based on the valuation parameters Sukses Mandiri.

Based on the research of the implementation of the hough transform method in detecting the road for driving assessment is still much to be developed or researched further. The authors propose some suggestions as follows:

1. The driving assessment system can be implemented in real-time and add another filter to eliminate objects that are considered structured as a marker system.
2. Analysis of the detection accuracy of the lane detection method with a variety of road conditions for driving assessment.
3. The system alerts issued when vehicles pass through the shoulder and when the vehicle is too close to another vehicle.

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