Distortion Inspection System Development of Rearview Mirror using Radial Line Method Based on Image Processing

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Abstract - Quality control is one of the important steps in production process of rearview mirror industry. This activity can be in the form of product inspection. As an essential component of vehicle, rearview mirror must be observed especially in distortion assessment. During this time, the assessment of rearview mirror product is finished by experts. Thus, faults of inspection can be occurred. These faults could be caused by a decrease of accuracy which is an effect of eyes tiredness. The technique of image processing method is observed to solve this inspection problem. This study is proposed to construct the distortion inspection system on rearview mirror by using radial line method based on image processing.

Index Terms – Radial line method, image processing, distortion and rearview mirror.

INTRODUCTION

Assessment of rearview mirror through this study is prepared in open space. Web camera is used to capture the mirror image in conditioned lighting environment. This captured image will be sent to the personal computer to be processed by using radial line method and other image processing. Through the process, the distortion factor value can be acquired. Then, this distortion factor value will be compared to Indonesian Standard of Distortion value of rearview mirror to determine if the product appropriate to the standard or conversely. According to Indonesian Standard, the distortion factor value is 7 thus the separation of rearview mirror can be done. The following process in this study is generating an automatic detection system by online using open source software to simplify the algorithm.

METHOD OF RESEARCH

As the hardware, this study use controller and mechatronics system which consist of mechanical and electronic system. The components of mechanical system are rearview clamp, torsion gear, mounts hole, moving arm, static cam and connecting rod. The electrical systems consist of servo, SPS, Wiring and PCB. Servo is a rotary actuator that can be control angle position, velocity and acceleration correctly. Servo consist several component which are high torsion motor DC and gearbox which is compiled to sensor for position response feedback. Therefore, it needs accomplished module to control the servo. SPS is a power supply which is equipped by regulation switch and called power supply switching. The power supply switching has excellence with high efficiency up to 85%. Wiring is utilizing to connect the controller to other components. Controller must be connected to the other controller, servo and personal computer. To assemble the PCB, it needs Computer Aided Design (CAD) software and PCB manufacture. For capturing the rearview mirror image, this study use Camera Logitech C920.

The experimental hardware set up can be shown in Figure 1. Radial line pattern in as shown in Figure 1 are the lines which are separated angel of 15^0. This pattern can be shown in Figure 2.

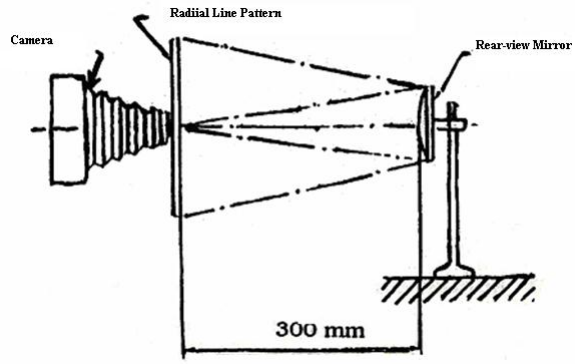

Figure 1. Experimental of Rear-view Inspection Set Up.

Software which applies to this study is GNU Octave which can be used to process high level numerical computation such as image processing. GNU Octave contain feature which can solve the linear and non linear problem including numerical experiment. Moreover, Octave is also accomplished by graphical sophisticated capability to process data visualization and manipulation. Besides, script of Octave program is similar to the Matlab software, thus it can be used both of them.

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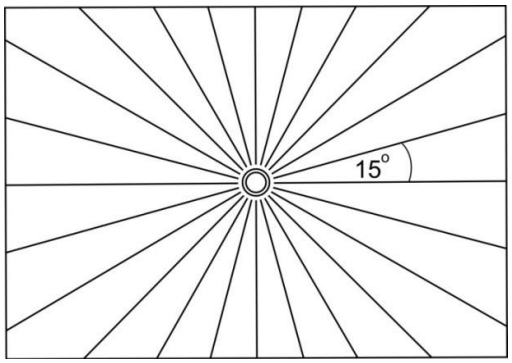

Figure 2. Radial line pattern.

RESULT AND ANALISYS

The result of this study shows that estimation of distortion factor value can be evaluate automatically, easier, cheaper, quick and accurately. There are 15 samples which had been investigated through this study. The distortion factor results can be shown on Table 1.

TABLE 1. DISTORTION FACTOR OF INVESTIGATED SAMPLES.

No	Types	Distortion
1	AR1	2,82438
2	AR2	2,73756
3	AR3	1,95244
4	AR4	2,52062
5	AR5	2,44262
6	BL1	2,486
7	BL2	2,01714
8	BL3	2,31116
9	BL4	2,7586
10	BL5	2,26026
11	BR1	2,51006
12	BR2	4,07896
13	BR3	2,55146
14	BR4	2,45096
15	BR5	1,99014

From this experiment, it can be evaluated the distortion value in range of 1.95244 to 4.07896 with precision of 10^{-5}. It can be verified that all of the rear-view samples had been fulfilled the Indonesian Standards, which mentioned that maximum distortion factor of rearview mirror is 7. Thus, this innovation can facilitate rearview mirror industry to enhance the quality product assessment if compared to conventional method.

CONCLUSION

1. Radial line method can be used to determine distortion factor of rear-view mirror
2. Rear-view from Honda Spare Part have been fullfiled SNI 2770.2:2009

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