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# Integrated Speed and Driver Fatigue Detected with Method Image Processing

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**Abstract.** Integrated Speed and fatigue drivers detected with the image processing method are devices that can give a warning of fatigue when the driver operates a truck or bus, so that potential accidents can be minimized caused by driver fatigue. This device uses the image processing method by image processing with camera right on the driver's face to determine facial changes that include formulated driver yawning intervals in the form of Mount Aspec Ratio (MAR), Eye Aspect Ratio (ER), Eye State (ES), Mouth State (MS ), and the Slifa Sleepiness Scale (SSS) is a scale used to describe the driver's sleep level. The results of this research are a device that can detect driver fatigue levels by connecting to speed limiting devices, from the data obtained when range float EAR value < 0.2 eye close and then value 0.2-0.3 eye condition half open and then >0.3 eye condition open, range float MAR value <0.5 mouth close condition, 0,5-0,8 mouth half open and >0.8 mouth open condition, SSS value scale 1-9, if driver condition scale 1-5 fatigue not detected, if the driver scale 6-9 driver fatigue detected.

**Keywords:** fatigue; image processing; sleepiness scale

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## 1. Introduction

Indonesia is one of the countries with the largest number of traffic accidents in the world. Percentage of factors causing traffic accidents resulting from human error or HR reached 69.7% compared to factors caused by facilities and infrastructure. This data is based on the NTSC database (National Transportation Safety Commission) and the results of investigations on Road Traffic and Transportation in 2010-2016 [1].

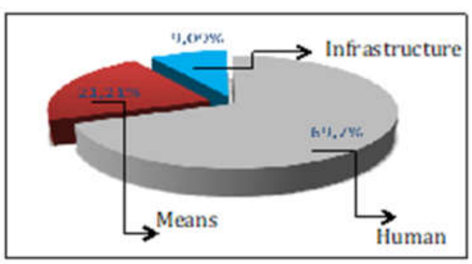


**Figure 1.** Causes of accidents in Indonesia 2010-2016

The biggest cause of distracted driver concentration besides drowsiness and fatigue is the result of using a mobile telephone when driving. The United States Department of Transportation's 2010

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study showed that 13 percent of fatalities in traffic accidents were caused by carelessness of drivers using mobile phones while driving [2].

Related parties such as the government, motor vehicle manufacturers, and the community have made efforts to reduce the number of traffic accidents [3]. Efforts made include adding and repairing traffic facilities, installing signs to notify road and traffic conditions, establishing standards of transportation feasibility, promoting socialization of driving safety, periodic testing of motorized vehicles, adding resting places for motorists , and effort other efforts to reduce the number of traffic accidents.[4]

Efforts made are more concentrated on improving traffic facilities and infrastructure, while efforts to reduce the number of traffic accidents resulting from human error have not been carried out immediately [5]. This can be seen from the still high percentage of causes of traffic accidents due to human error.

Device is expected to increase motorist awareness of the importance of maintaining body condition and always be vigilant in driving. The big hope of this research activity is the creation of tools that are able to overcome the causes of traffic accidents caused by human error [6].

## 2. Material and Methodology

The test method is used to prepare equipment and carry out the process of testing the sleep detector [7]. This method is carried out with the aim of ensuring the testing process can run according to planning and expectations. Expectation of the elaboration of this testing method to minimize errors that might occur during the testing process.

### *2.1 Material*

The main components used in this study were single board computer raspberry pi 3 model B, Logitech C922 web cam, 3.5 "LCD touch screen, and SLIFA (Speed Limiter Integrated Fatigue Analyzer) [8].

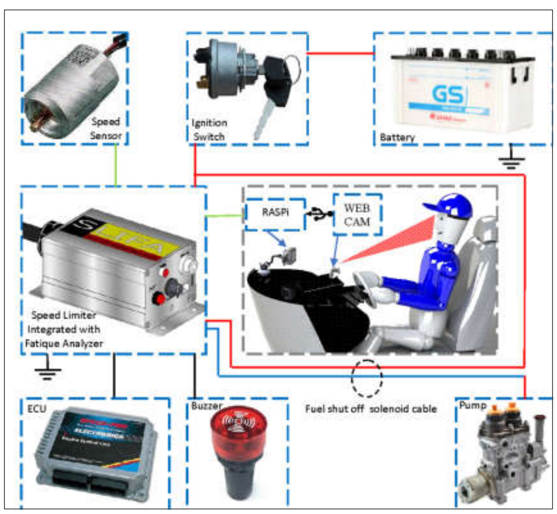


**Figure 2.** SLIFA Installation Diagram + Sleep Detector

### *2.2 Methodology*

Observation is an activity of collecting data to carry out further analysis and interpretation. Data collection of this research uses purposive sampling method. Purposive Sampling is the process of retrieving data by specifying data characteristics before conducting testing. The purpose of this data collection method is to ensure data retrieval can be in accordance with the hypothesis and research objectives.

Conceptualization is the process of planning the variables to be tested. The variables to be tested include (EAR) Eye Aspect Ratio is the size of the eye expressed in ratio, (MAR) Mouth Aspect Ratio is the size of the mouth expressed in ratio, (ES) Eye State is the eye condition expressed in scale, (MS) Mouth State is the mouth condition stated in the scale, (SSS) Slifa The Sleepiness Scale is a scale used to describe the level of driver sleepiness adapted from the Karolinska Sleepiness Scale (KSS), (FD) Data fluctuation which is the rate of change of data in a certain time unit, and (DK) Sleep Detection which is a display of data strings that appear on the frame.

Operationalization is a planning process for the way observations or measurements of predetermined variables. Displaying real time graphs and float data on the frame then the data recording process is carried out does the method of observing and measuring variables.

## 3. Results and Discussions

The results of observations and measurements are processed and analyzed further. The results of data processing and analysis will strengthen the hypothesis and research objectives. Tests on YA respondents are carried out on January 24, 2017 at 20.00-21.00 WIB. In this test a scenario is carried out to monitor oral activity against sleepiness detection. Respondent activities during the testing process are displayed in the video frame below.

**Figure 3.** Testing Frame Videos of YA Respondents

The real time graph generated above will be observed and analyzed to obtain linguistic data. The graph is observed every 20 seconds and the data population is seen to be expressed in linguistic values. The collection of linguistic values generated in the table will be further processed for the final analysis. The linguistic data of testing on YA respondents is shown in the table below.

**Table 1.** Testing Linguistic Data of Respondents Y.A

| No | Variable | Time Frame | | | | |
|---|---|---|---|---|---|---|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 1 | EAR | open | open | open | Half-open | open |
| 2 | MAR | open | open | open | open | open |
| 3 | ES | low | open | low | medium | low |
| 4 | MS | high | open | high | high | high |
| 5 | SSS | low | open | low | low | low |
| 6 | FD | low | open | high | high | high |
| 7 | DK | Not yet | open | low | Not yet | Not yet |

Testing for HS respondents were carried out on May 24, 2019 at 21.00-23.00 WIB. In this test a scenario is conducted to monitor eye activity against sleepiness detection. Respondent activities during the testing process are displayed in the video frame below.

**Figure 4.** Testing Frame Videos of Respondents HS

The activity of HS respondents for one hundred seconds was recorded in the form of video streaming and real time graphics. The real time graph created will be used for further data analysis and evaluation. The test chart for HS respondents is described as follows.

**Figure 5.** Testing Graph of Respondents HS

The real time graph generated above will be observed and analysed to obtain linguistic data. The graph is observed every 20 seconds and the data population is seen to be expressed in linguistic values. The collection of linguistic values generated in the table will be further processed for the final analysis. The linguistic data of testing on HS respondents is shown in the table below.

**Table 2.** Data on Linguistic Testing of Respondent HS

| No | Variable | Time Frame | | | | |
|---|---|---|---|---|---|---|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 1 | EAR | open | close | open | close | open |
| 2 | MAR | close | close | close | close | close |
| 3 | ES | low | high | low | high | low |
| 4 | MS | low | low | low | low | low |
| 5 | SSS | low | high | low | high | low |
| 6 | FD | low | low | low | low | low |
| 7 | DK | not | yes | not | not | not |

Testing on respondents AS are conducted on May 25, 2019 at 08.00-09.00 WIB. In this test a scenario is conducted to monitor the disturbed eye activity against sleepiness detection. Respondent activities during the testing process are displayed in the video frame below.

**Figure 6.** Video Frame Testing of US Respondents

The activities of US respondents for one hundred seconds were recorded in the form of video streaming and real time graphics. The real time graph created will be used for further data analysis and evaluation. The test chart for US respondents is described as follows.

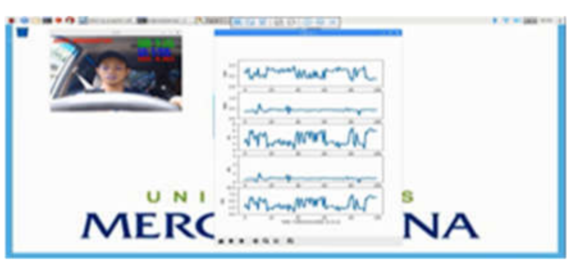

**Figure 7.** Testing Graph of US Respondents

The real time graph generated above will be observed and analysed to obtain linguistic data. The graph is observed every 20 seconds and the data population is seen to be expressed in linguistic values. The collection of linguistic values generated in the table will be further processed for the final analysis. The linguistic data of testing on AS respondents is shown in the table below.

**Table 3.** Testing of Linguistic Data of US Respondents

| No | Variable | Time Frame | | | | |
|---|---|---|---|---|---|---|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 1 | EAR | close | open | close | close | close |
| 2 | MAR | close | open | close | close | close |
| 3 | ES | high | low | high | low | high |
| 4 | MS | low | low | low | low | low |
| 5 | SSS | high | low | high | low | low |
| 6 | FD | high | high | high | low | low |
| 7 | DK | not | not | not | not | yes |

One hundred seconds of respondents AB activity was recorded in the form of video streaming and real time graphics. The real time graph created will be used for further data analysis and evaluation. The test chart for respondents AB is described as follows.

**Figure 8.** Testing Frame Video of AB Respondents


**Figure 9.** Test Graph of Respondents AB

The real time graph generated above will be observed and analyzed to obtain linguistic data. The graph is observed every 20 seconds and the data population is seen to be expressed in linguistic values. The collection of linguistic values generated in the table will be further processed for the final analysis. The linguistic data of testing on AB respondents is shown in the table below.

**Table 4.** Testing Linguistic Data of Respondents

| No | Variable | Time Frame | | | | |
|---|---|---|---|---|---|---|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 1 | EAR | Half-open | Half-open | close | Half-open | close |
| 2 | MAR | close | open | open | close | close |
| 3 | ES | medium | medium | high | medium | high |
| 4 | MS | low | high | high | low | low |
| 5 | SSS | low | low | high | low | high |
| 6 | FD | low | low | high | low | low |
| 7 | DK | not | not | not | not | yes |

Testing of IT respondents was conducted on May 05, 2019 at 11.00-12.00 WIB. In this test a scenario is carried out to monitor the driver's condition without indication of drowsiness. Respondent activities during the testing process are displayed in the video frame below.

**Figure 10.** Frame Video Testing of IT Respondents

IT respondents' activities for a hundred seconds were recorded in the form of video streaming and real time graphics. The real time graph created will be used for further data analysis and evaluation. The testing graph of TI respondents is described as follows.

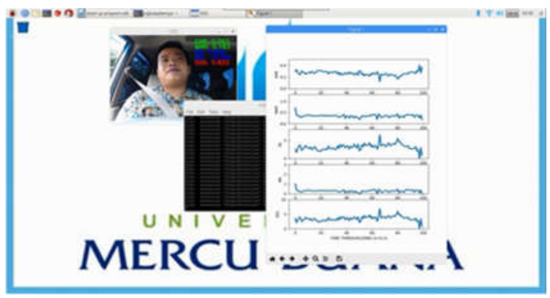

**Figure 11.** Testing Graph of IT Respondents

The real time graph generated above will be observed and analysed to obtain linguistic data. The graph is observed every 20 seconds and the data population is seen to be expressed in linguistic values. The collection of linguistic values generated in the table will be further processed for the final analysis. The linguistic data testing of IT respondents is shown in the table below.

**Table 5.** Testing of Linguistic Data for IT Respondents

| No | Varia | Time Frame | | | | |
|---|---|---|---|---|---|---|
| | ble | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 1 | EAR | Half-open | Half-open | close | Half-open | close |
| 2 | MAR | close | open | open | close | close |
| 3 | ES | medium | medium | high | medium | high |
| 4 | MS | low | high | high | low | low |
| 5 | SSS | low | low | high | low | high |
| 6 | FD | low | low | high | low | low |
| 7 | DK | not | not | not | not | yes |

**Table 6.** Possibility of sleepiness detection

| No | Variable | Value Ligusitic | |
|---|---|---|---|
| 1 | EAR | open | open |
| 2 | MAR | close | open |
| 3 | ES | low | high |
| 4 | MS | low | high |
| 5 | SSS | low | high |
| 6 | FD | high | low |
| 7 | DK | Not ditect | ditect |

The analysis obtained from the measurement and processing of the data above is a table of possibilities for sleepiness detection in Table 6.

## 4. Conclusions

The conclusion of this research activity was taken from the results of testing, analysis, and other findings during the research activities. This research concludes as follows:

1. This design activity produces a sleep detector that is based on digital image processing using analysis of eye and mouth activity.
2. Sleep detection devices are tested on night and day conditions, can detect sleepiness in various respondents, and are able to detect several variations in sleepiness conditions.
3. The test results are processed, and the data is analysed and the correlation data between variables, parameters, and test conditions is obtained.
4. This sleep detector cannot work in conditions of total darkness, does not function if the eye or mouth condition is out of range of the camera, and does not function perfectly if one eye or mouth is closed with a hand or other object.
5. The sleep detector cannot change the measurement parameters automatically when a driver or driver is replaced.

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