DROWTECT – VIBRATING CHAIR AND SPRAY NOZZLE TO PREVENT SLEEPINESS IN CAR DRIVERS BASED ON IMAGE PROCESSING WITH DROWSINESS DETECTION ALGORITHM

Eko Nevriansyah, Afdal Luthfi[a], Auliya Einsrizkianne Edray[b], Goani Marind[c], Kurnia Illahi[d], Mukhlidi Muskhir[e], Silvi Handri[f]

Magister Programme of Biochemistry, Postgradute, Universitas De La Salle, Philippines
[a,c,d,e]Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesian
[b]Department of Biology, Faculty of Mathematics and Natural Science, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesian
[f]Magister Programme of Educational Chemistry, Postgraduate, Faculty of Mathematics and Natural Science, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesian

*Coresponding email: afdalluthfi02@gmail.com

ABSTRACT

Based on data from the police of the Republic of Indonesia from 2014 to 2018 there was a significant increase in the number of motorized vehicles, namely 6.49% per year (Indonesian Central Statistics Agency, 2018: 22). This increase in the number of vehicles occurs in all types of vehicles every year according to police data, in Indonesia an average of 3 people die every hour due to traffic accidents. The data also states that the large number of accidents is caused by several factors, including 61% caused by humans related to the driver's character, 9% due to vehicle technical requirements, and 30% caused by infrastructure and the environment (Kominfo, 2017). Based on these data, many traffic accidents occur because of the character of the driver, such as not focusing and traveling. According to Rau et al (2005) in the United States about 100,000 accidents per year (1.6% of 6.3 million) are identified in the Police Crash Report (PCR) due to problematic drivers. accidents experienced by drivers in circumstances have general characteristics that are usually observed by traffic safety officers including, during the late hours of the night (2:00 to 6:00) or after the day (3:00 to 17:00)) , driving on highways or toll roads, only young drivers, not using brakes, one person in the car, lack of security at the accident site, the level of drivers exceeding the limit for safe driving (Kamran, et al. 2019). Driver's drowsiness is a major factor in road accidents (Kumar, et al. 2018). Drowsiness while driving is very dangerous because it can cause an accident that can be found in death. Death due to traffic accidents caused by drivers is an event that can be avoided and minimized. To reduce the number of traffic accidents and their impacts, it is necessary to have a role from all parties. Based on this, the purpose of our research is to create a detection device system using image processing that is used to detect the eyes of the car driver, if the driver detects the data from the image processing will communicate and to a tool called a nozzle, then the nozzle will issue The air sprays into the driver's face slowly and in the driver's seat is also installed a dc motor that can cause a low level of shock to the driver, so that the driver can regain consciousness and focus on the traffic.

Keywords: Image Processing, Nozzle, Accident, Driver, Image Processing, Nozzle

1.   INTRODUCTION

Transportation is needed for humans to meet the needs of daily life. Transportation is used as a means to transport people, goods, animals, from one area to another. Generally, in modern times, they already use machine transportation tools, such as motorcycles, cars, planes, trains, and so on. Based on data from the police of the Republic of Indonesia from 2014 to 2018 there was a significant increase in the number of motorized vehicles, namely 6.49% per year [1][2][3][4]. This increase in the number of vehicles occurs in all types of vehicles every year.

One of the purposes of making a means of transportation is to create a life that is practical, energy efficient, safe, and orderly. However, when viewed from the existing problems, there have been many cases of traffic accidents that have occurred in Indonesia. A traffic accident is an event that occurs on the road that is unexpected or unintentional between a driver and other road users which can cause fatalities, serious injuries, minor injuries, or property loss [5][6][7][8][9].

According to police data, in Indonesia an average of 3 people die every hour due to traffic accidents. The data also states that the large number of accidents is caused by several factors, including 61% caused by humans related to the driver's character, 9% due to the fulfillment of vehicle technical requirements, and 30% due to infrastructure and the environment [10][11][12]. Based on these data, many traffic accidents occur due to the character of the driver, such as being unfocused and sleepy. Meanwhile, according to Rau et al (2005) in the United States about 100,000 accidents per year (1.6% of 6.3 million) were identified in the Police Crash Report (PCR) due to sleepy drivers [13][14].

Accidents caused by drowsy drivers have common characteristics that are usually observed by traffic safety officers including, during the late hours of the night (2:00 to 6:00) or after the afternoon (3:00 to 17:00).), driving on highways or expressways, young driver, brakes not being used, only one person in the car, lack of security at the accident site, driver's alcohol level exceeding the limit for safe driving [15][16].

Driver's drowsiness is a major factor in road accidents. Drowsiness while driving is very dangerous because it can cause an accident that can lead to death. Death due to traffic accidents caused by drowsy drivers is an event that can be avoided and minimized. To reduce the number of traffic accidents and their impacts, it is necessary to have a role from all parties [17] [18].

Based on this, the purpose of our research is to create a system of detection equipment using image processing which is used to detect sleepy eyes in car drivers, if the driver is detected as sleepy then the data from the image processing will communicate and be forwarded to a device called a nozzle, then The nozzle will spray water slowly towards the driver's face and in the driver's seat is also installed a servo device that can cause a low level of shock to the driver, so that the driver can regain consciousness and focus on the traffic [19][20].

2. LITERATURE REVIEW

2.1 Sleepy Eyes

Drowsiness is a condition where the body needs rest or sleep so that it is interpreted as a tendency to sleep. There are several kinds of sleepy conditions so that a person can be categorized as sleepy or not. A person's sleepy condition can be seen, one of which is the condition of the eyelids

starting to get heavy, blurry vision and the head starting to be unbalanced to withstand the load so that it requires lying down and resting. When sleepy, someone will lose focus so they want to close their eyes immediately. Drowsiness can be caused by fatigue from doing repetitive work such as driving a vehicle when on a long trip. Drowsiness and fatigue have much of the same effect. In this case, at the moment when the eyelids start to feel heavy and close immediately, the vision begins to blur and suddenly the eyelids close, so the eyes can't be compromised anymore. Though in the mind, feel still awake. This is a sign that someone is sleepy. Therefore, the research that we will do is detecting sleepy eyes, using the object of the eye in a sleepy state based on Image Processing [21].

Figure 1. Sleepy Eyes

(Source : Courtesy of Afdal Luthfi, *et al)*

2.2   Sleepy Parameters

According to Tecce's research. The blinking frequency of a person can be affected by several different factors, including conditions and commands. Under normal circumstances or stress free the average eye blink is 15 to 20 times per minute [22]. This frequency decreases to 3 times per minute when reading. The frequency increases in times of stress, pressure or when you close your eyes when needed. The indicator used to determine a person's condition when drowsy can be described when the normal condition (not sleepy) is the position of the eyelids being wide open before closing. When closing it has a fast time interval (less than one second). When a person gets tired and sleepy, the distance between the eyelids narrows and the blinking frequency decreases until they fall asleep [23][24][25].

To model a sleepy driver, it can be indicated that there are the following parameters:

a. Decreased interest in the environment.

b. Increased drowsiness or a tendency to sleep, which is characterized by increased duration of blinking to close.

According to a study conducted by Phillip .P. Caffier (in Maslikah, Etc. 2019: 124), classifies the level of sleepiness based on the duration of the blink of an eye. Generally the average blink

duration is less than 400 Ms and 75 Ms for the minimum. For this reason, 400 Ms is used as sleep time (T_sleep) and 800 Ms as sleep time (T_sleep) [26][27][28].

Table 1 Sleepy Parameters

Sleepy Level	Description
Normal	Blinking Duration T<_ *Sleepy*
Sleepy	Blink Duration >D_Drowsiness and duration
Sleep	wink<T_sleep

(Source : Courtesy of Afdal Luthfi, *et al)*

2.3 Image Processing Techniques Based on Raspberry Pi 4

Image processing is a process with image input and produces an output in the form of an image as desired. Image processing (image processing) is a form of processing or signal processing with image input (image). In doing this, we use a raspberry pi4-based webcam camera that will process eye objects when we are sleepy. Using the eye features, different measures can be performed calculated by the percentage of eyelid closure, maximum duration of closure, blink frequency, average eye opening rate, eye opening rate, and eye closing rate. The eye is then transformed into digital data in the form of coordinate points as the output to move the servo as a vibrating device to vibrate the seat of the car driver [29].
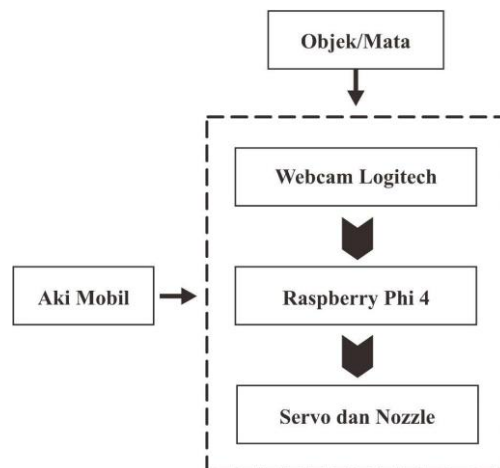

Figure 2. Tool Work System Block Diagram

((Source : Courtesy of Afdal Luthfi, *et al)*

Raspberry Pi was first released in February 2012 and was developed by the non-profit Raspberry Pi Foundation and computer experts from the University of Cambridge, England. Raspberry Pi 4 is a type of single board for computers. Basically the Raspberry Pi 4 will function like a brain on a device that will receive and process data detected by a camera that will read the eye condition of the car driver [30]. Webcam is a peripheral in the form of a camera as an

image/image taker controlled by a computer or by a computer network. In image processing, the camera is the sensor needed to capture images. The camera used in this system is a Logitech C930e webcam. The C930e's webcam intelligently adapts itself to improve visual quality in low light at various distances and incorporates a 2.4 GHz Intel Core 2 Duo processor [20].

A sprayer is a device that functions to break up a liquid, solution, or suspension into liquid droplets. The Sprayer is used as a second prevention after the chair vibrates, this tool works automatically by spraying water on to the rider's face when the camera detects the eyes during a state of severe sleepiness. Some things to understand about spray equipment include the type of sprayer and the type of nozzle. The sprayer used in this tool is a nozzle type, the process uses a small pipe that is fed by water from a small tank that is connected to the nozzle [19].

Figure 3. Nozzle
(Source : Courtesy of Afdal Luthfi, *et al*)

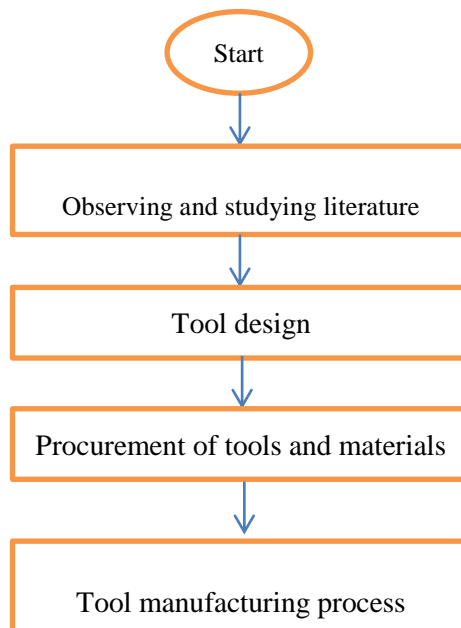## 3. EXPERIMENTAL

3.1 Implementation Stage

Figure 4. Flowchart Drowtect
(Source : Courtesy of Afdal Luthfi, *et al*)

Make observations on the body or interior of the car that can support the manufacture of anti-drowsiness seats and find out the problems that often occur so that they can be overcome with anti-drowsiness seats. The next step is to do a literature study, look for references from books, local and international journals related to the materials and basis for making anti-drowsiness chairs. The design of the tool using the Blender application takes into account the precision of the layout and the comfort of car users so that they do not feel disturbed when driving. The selection of electronic components and the procurement of supporting equipment are steps that must be carried out before the process of assembling the anti-drowsiness chair and spraying from the nozzle. The tool making process will be divided into 2 parts, namely tool manufacturing and programming where each team member is given responsibility for each of these parts.

4. RESULTS AND DISCUSSION

After the assembly of the tool is complete, it is continued by testing the tool which aims to find out whether the tool can run well or not. The tool revision stage is carried out if there is an error in the tool that has been made which we can find out in the previous trial stage. If the trial is successful, the tool will be introduced to the community by practicing the use of the tool by the writing team. During socialization, the writing team also monitored regularly to see the level of effectiveness of the tool's work and the level of public interest in the tool. The evaluation stage is carried out to see the level of success of the tool and see the shortcomings of the tool that has been made. The final report is made after all stages are completed so that the results obtained from the manufacture of the tool can be explained in detail.

5. CONCLUSION

Detection device system are useful for the driver can regain consciousness and focus on the traffic. detection device system using image processing that is used to detect the eyes of the car driver, if the driver detects the data from the image processing will communicate and to a tool called a nozzle, then the nozzle will issue The air sprays into the driver's face slowly and in the driver's seat is also installed a dc motor that can cause a low level of shock to the driver, so that the driver can regain consciousness and focus on the traffic.

ACKNOWLEDGEMENTS

REFERENCES

[1] Washington, S, Karlaftis, M, Mannering, F, & ... (2020). Statistical and econometric methods for transportation data analysis., taylorfrancis.com, <https://www.taylorfrancis.com/books/mono/10.1201/9780429244018/statistical-econometric-methods-

transportation-data-analysis-simon-washington-matthew-karlaftis-fred-mannering-panagiotis-anastasopoulos>

[2] Bruton, MJ (2021). Introduction to transportation planning., books.google.com, <https://books.google.com/books?hl=en&lr=&id=VfUlEAAAQBAJ&oi=fnd&pg=PT9&dq=transportation&ots=54DxshPQsC&sig=ksxnABZ1RpYTwsbB6GsiglmvAF4>

[3] Villani, C (2021). Topics in optimal transportation., books.google.com, <https://books.google.com/books?hl=en&lr=&id=NElDEAAAQBAJ&oi=fnd&pg=PP1&dq=transportation&ots=G8ffB1E_Pm&sig=jZTICjHXB11ynqUEQfXM57gNG_k>

[4] Gray, RS (2020). Agriculture, transportation, and the COVID-19 crisis. Canadian Journal of Agricultural Economics/Revue …, Wiley Online Library, <https://doi.org/10.1111/cjag.12235>

[5] Wachs, M (2020). Transportation for the Elderly., degruyter.com, <https://doi.org/10.1525/9780520337749>

[6] Du, Z, Wang, L, Cauchemez, S, Xu, X, & ... (2020). Risk for transportation of coronavirus disease from Wuhan to other cities in China. Emerging infectious …, ncbi.nlm.nih.gov, <https://www.ncbi.nlm.nih.gov/pmc/articles/pmc7181905/>

[7] Banerjee, A, Duflo, E, & Qian, N (2020). On the road: Access to transportation infrastructure and economic growth in China. Journal of Development Economics, Elsevier, <https://www.sciencedirect.com/science/article/pii/S0304387820300171>

[8] Haydari, A, & Yilmaz, Y (2020). Deep reinforcement learning for intelligent transportation systems: A survey. … Transactions on Intelligent Transportation …, ieeexplore.ieee.org, <https://ieeexplore.ieee.org/abstract/document/9146378/>

[9] Tirachini, A, & Cats, O (2020). COVID-19 and public transportation: Current assessment, prospects, and research needs. Journal of Public Transportation, digitalcommons.usf.edu, <https://digitalcommons.usf.edu/jpt/vol22/iss1/1/>

[10] Qureshi, AI, Huang, W, Khan, S, Lobanova, I, & ... (2020). Mandated societal lockdown and road traffic accidents. Accident Analysis & …, Elsevier, <https://www.sciencedirect.com/science/article/pii/S0001457520315670>

[11] Lin, Y, & Li, R (2020). Real-time traffic accidents post-impact prediction: Based on crowdsourcing data. Accident Analysis & Prevention, Elsevier, <https://www.sciencedirect.com/science/article/pii/S0001457520305807>

[12] Casado-Sanz, N, Guirao, B, & Attard, M (2020). Analysis of the risk factors affecting the severity of traffic accidents on Spanish crosstown roads: the driver's perspective. Sustainability, mdpi.com, <https://www.mdpi.com/663918>

[13] Naqvi, NK, Quddus, MA, & Enoch, MP (2020). Do higher fuel prices help reduce road traffic accidents?. Accident Analysis & Prevention, Elsevier, <https://www.sciencedirect.com/science/article/pii/S0001457519306499>

[14] Saladié, Ò, Bustamante, E, & Gutiérrez, A (2020). COVID-19 lockdown and reduction of traffic accidents in Tarragona province, Spain. Transportation research …, Elsevier, <https://www.sciencedirect.com/science/article/pii/S2590198220301299>

[15] Zhang, Y, Lu, H, & Qu, W (2020). Geographical detection of traffic accidents spatial stratified heterogeneity and influence factors. … journal of environmental research and public …, mdpi.com, <https://www.mdpi.com/618578>

[16] Petrović, Đ, Mijailović, R, & Pešić, D (2020). Traffic accidents with autonomous vehicles: type of collisions, manoeuvres and errors of conventional vehicles' drivers. Transportation research procedia, Elsevier, <https://www.sciencedirect.com/science/article/pii/S2352146520301654>

[17] Castillo-Manzano, JI, Castro-Nuño, M, & ... (2020). An assessment of road traffic accidents in Spain: the role of tourism. Current Issues in …, Taylor & Francis, <https://doi.org/10.1080/13683500.2018.1548581>

[18] Dunne, J, Quiñones-Ossa, GA, Still, EG, & ... (2020). The epidemiology of traumatic brain injury due to traffic accidents in Latin America: a narrative review. … of neurosciences in …, thieme-connect.com, <https://doi.org/10.1055/s-0040-1709363>

[19] Yoshida, H (2021). Substrate processing apparatus, nozzle base, and manufacturing method for semiconductor device. US Patent 11,001,924, Google Patents, <https://patents.google.com/patent/US11001924B2/en>

[20] Gong, C, Zhang, Z, Sun, J, Chen, Y, & Liu, F (2020). Computational study of nozzle spray-line distribution effects on stratified mixture formation, combustion and emissions of a high compression ratio DISI methanol …. Energy, Elsevier, <https://www.sciencedirect.com/science/article/pii/S0360544220311877>

[21] Zainul, R., Abd Azis, N., Md Isa, I., Hashim, N., Ahmad, M. S., Saidin, M. I., & Mukdasai, S. (2019). Zinc/aluminium–quinclorac layered nanocomposite modified multi-walled carbon nanotube paste electrode for electrochemical determination of bisphenol A. Sensors, 19(4), 941.

[22] Fatimah, S., Syafrini, D., & Zainul, R. (2021). Rendang lokan: history, symbol of cultural identity, and food adaptation of Minangkabau tribe in West Sumatra, Indonesia. Journal of Ethnic Foods, 8(1), 1-10.

[23] Jannah, W., Ellizar, E., Dewata, I., & Zainul, R. (2021). The Correlation Of A Scientific Approach Using The Probing Prompting Technique And A Problem-Based Learning Model On Learning Outcomes On Reaction Rate Material. International Journal of Progressive Sciences and Technologies, 27(2), 151-165.

[24] Putri, S. R., Zainul, R., Azhar, M., & Putra, A. Development Practices Content Learning System Based Discovery Learning on Atomic Structure and Periodic Systems of Class X Vocational School to Higher Order Thinking Skills. development, 4, 5.

[25] Delvi, I. P., & Zainul, R. (2019). Mercury (II) Nitrate (Hg (NO3) 2): Interaksi Molekul dan Adsorpsi Hg dengan Karbon Aktif.

[26] Sharif, S. N. M., Hashim, N., Isa, I. M., Bakar, S. A., Saidin, M. I., Ahmad, M. S., ... & Kamari, A. (2021). The effect of swellable carboxymethyl cellulose coating on the physicochemical stability and release profile of a zinc hydroxide nitrate–sodium dodecylsulphate–imidacloprid. Chemical Physics Impact, 2, 100017.

[27] Zainul, R., Abd Azis, N., Md Isa, I., Hashim, N., Ahmad, M. S., Saidin, M. I., & Mukdasai, S. (2019). Zinc/aluminium–quinclorac layered nanocomposite modified multi-walled carbon nanotube paste electrode for electrochemical determination of bisphenol A. Sensors, 19(4), 941.

[28] Putri, G. E., Arief, S., Jamarun, N., Gusti, F. R., & Zainul, R. (2019). Microstructural analysis and optical properties of nanocrystalline cerium oxides synthesized by precipitation method. Rasayan J. Chem, 12(1), 85-90.

[29] Zainul, R., Effendi, J., & Mashuri, M. (2019). Phototransformation of Linear Alkylbenzene Sulphonate (LAS) Surfactant Using ZnO-CuO Composite Photocatalyst. KnE Engineering, 235-247.

[30] Zainul, R., Adri, M., Wahyuningtyas, N., Wedi, A., Surahman, E., Aisyah, E. N., ... & Adnan, E. (2020, July). Development of e-Learning Courses for Subjects about 'Learn and Learning' with Moodle-based for Prospective Teacher in Indonesia. In Journal of Physics: Conference Series (Vol. 1594, No. 1, p. 012023). IOP Publishing.