

BAB V

KESIMPULAN DAN SARAN

Pada bab ini akan dibahas mengenai kesimpulan berdasarkan hasil analisis data yang telah dilakukan. Pada bab ini juga akan dibahas mengenai saran yang bisa diberikan untuk penelitian serupa selanjutnya. Berikut ini merupakan pemaparan kesimpulan dan saran pada penelitian ini.

V.1 Kesimpulan

Berdasarkan hasil analisis, berikut ini merupakan kesimpulan yang dapat ditarik dari hasil penelitian ini:

1. Hasil penelitian membuktikan durasi tidur tidak memengaruhi indikator *eye tracking* yang digunakan pada penelitian ini, yaitu durasi fiksasi, diameter pupil, jumlah sakadik, dan kecepatan sakadik. Namun terdapat pengaruh pembatasan waktu pemeriksaan terhadap durasi fiksasi dan jumlah sakadik. Maka dari itu dapat disimpulkan bahwa tidak terdapat indikator *eye tracking* yang digunakan pada penelitian ini yang sensitif terhadap pembatasan durasi tidur, namun indikator jumlah sakadik dan durasi fiksasi sensitive terhadap waktu pemeriksaan.
2. Hasil penelitian membuktikan jika korelasi antara diameter pupil dengan *mean RT* dan *mean 1/RT* berkorelasi lemah. Maka dari itu dapat disimpulkan bahwa tidak terdapat indikator *eye tracking* yang digunakan pada penelitian ini yang mampu untuk menggantikan indikator PVT dalam mengukur kewaspadaan yang dipengaruhi oleh pembatasan durasi tidur dan waktu pemeriksaan.

V.2 Saran

Berdasarkan hasil penelitian, terdapat beberapa saran yang dapat diberikan. Saran diharapkan dapat membantu penelitian selanjutnya dengan topik serupa. Berikut ini merupakan beberapa saran yang dapat diberikan:

1. Melakukan pengambilan data pada kondisi dan lingkungan asli kegiatan, sehingga hasil penelitian dapat langsung diterapkan pada kondisi asli kegiatan inspeksi senter.
2. Menetapkan waktu pemeriksaan saat melakukan inspeksi senter agar waktu pengerjaan setiap partisipan seragam.
3. Menggunakan produk selain senter, yang memungkinkan kegiatan inspeksi didominasi oleh pergerakan mata dan meminimasi pergerakan tangan. Penggunaan produk yang meminimasi pergerakan tangan juga akan membantu pada proses pembuatan AOI yang lebih mudah.

DAFTAR PUSTAKA

- Abe, T., Nonomura, T., Komada, Y. Asaoka, S., Sasai, T., Ueno, A., & Inoue, Y. (2011). Detecting deteriorated vigilance using percentage of eyelid closure time during behavioral maintenance of wakefulness tests. *International Journal of Psychophysiology*, 82(3), 269-274. doi: <http://dx.doi.org/10.1016/j.ijpsycho.2011.09.012>
- Al-Shargie, F., Tariq, U., Mir, H., Alawar, H., Babiloni, F., & Al-Nashash. (2019). Vigilance Decrement and Enhancement Techniques: A Review. *Brain Sciences*, 9(8), 1-36. doi: <https://dx.doi.org/10.3390%2Fbrainsci9080178>.
- Anderson, C., Wales, A.W.J., & Horne, J.A. (2010). PVT Lapses Differ According To Eyes Open, Closed, or Looking Away. *Sleep Research Society*, 33(2): 197-204. doi: <https://doi.org/10.1093%2Fsleep%2F33.2.197>.
- Arenasolutions. (2022). *What is Quality Inspection: Quality Inspection Definition*. Diunduh dari: <https://www.arenasolutions.com/resources/glossary/quality-inspection/> [Diakses 3 Februari 2022].
- Assauri, S. (1998). *Manajemen Operasi dan Produksi*. Jakarta LPFE UI
- Baiasu, A.M., & Dumirescu, C. (2021). Contributions to Driver Fatigue Detection Based on Eye-tracking. *International Journal of Circuits, Systems, and Signal Processing*, 15, 1-7. doi: <http://dx.doi.org/10.46300/9106.2021.15.1>.
- Basner, M., & Dinges, D.F. (2011). Maximizing sensitivity of the Psychomotor Vigilance Test (PVT) to sleep loss. *Sleep*, 34(5), 581-591. doi: <https://doi.org/10.1093/sleep/34.5.581>.
- Basner, M., Mollicone, D., & Dinges, D.F. (2011). Validity and sensitivity of a brief psychomotor vigilance test (PVT-B) to total and partial sleep deprivation. *Acta Astronaut*, 69(11-12), 949-959. doi: <https://doi.org/10.1016/j.actaastro.2011.07.015>.
- Blanca, M.J., Alarcon, R., Arnau, J., Bono, R., & Bendayan R. (2017). Non-normal data: Is ANOVA still a valid option?. 29(4): 552-557. doi: <https://doi.org/10.7334/psicothema2016.383>

- Berka, C., Davis, G., Levendowski, D.J., & Zivkovic, T., (2007). EEG correlates of task engagement and mental workload in vigilance, learning, and memory tasks. *Aviation Space and Environmental Medicine*, 78(5), 231-244. Diunduh dari: <https://pubmed.ncbi.nlm.nih.gov/17547324/>.
- Bodala, I.P., Abbasi, N.I., Sun, Y., Bezerianos, A., Al-Nashash, H., & Thakor, N.V. (2017). Measuring Vigilance Decrement using Computer Vision Assisted Eye Tracking in Dynamic Naturalistic Environments. *Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2017, 2478-2481. doi: <https://doi.org/10.1109/EMBC.2017.8037359>.
- Bodala, I.P., Li, J., Thakor, N.V., & Al-Nashash, H. (2016). EEG and Eye Tracking Demonstrate Vigilance Enhancement with Challenge Integration. *Frontiers in Human Neuroscience*, 10 (273), 1-12. doi: <http://dx.doi.org/10.3389/fnhum.2016.00273>.
- Bollu, P.C. (2019, 05 November). What are the effects of sleep deprivation?. *Medscape*. Diunduh dari: <https://www.medscape.com/medicalstudents>
- Budiono,C.K. (2018). Penentuan jenis aromaterapi bagi pengemudi kekurangan tidur pada kondisi jalan monoton. Skripsi Program Studi Sarjana Teknik Industri. Bandung: Universitas Katolik Parahyangan.
- Chin, W. W. (1998). The Partial Least Squares Approach to Structural Equation Modeling. *Modern Methods for Business Research*, 295-336.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*, Second Edition. New York: Lawrence Erlbaum Associates.
- Corriero, E.F. (2017). Counterbalancing. *The SAGE Encyclopedia of Communication Research Methods*. Diakses dari: <https://methods.sagepub.com/reference/the-sage-encyclopedia-of-communication-research-methods/i3526.xml>
- Creswell, J.W., (2012). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*, Fourth Edition. Boston: Pearson Education, Inc.
- Crescenzi, A., Kelly, D., & Azzopardi, L. (2016). Impacts of Time Constraints and System Delays on User Experience. *Conference on Human Information Interaction and Retrieval*, 2016, 141-150. doi: <http://dx.doi.org/10.1145/2854946.2854976>.

- Dawson, D., Searle, A.K., & Peterson, J.L. (2014). Look before you (s)leep: Evaluating the use of fatigue detection technologies within a fatigue risk management system for the road transport industry. *Sleep Medicine Reviews*, 18(2), 141-152. doi: <https://doi.org/10.1016/j.smrv.2013.03.003>
- De Gennaro, L., Ferrara, M., Urbani, L., & Bertini, M. (2000). Oculomotor Impairment After 1 Night of Total Sleep Deprivation: A Dissociation Between Measures of Speed and Accuracy. *Clinical Neurophysiol*, 111(2000), 1771-1778. doi: [https://doi.org/10.1016/s1388-2457\(00\)00393-x](https://doi.org/10.1016/s1388-2457(00)00393-x).
- Dinges, D.F. (1995). An Overview of Sleepiness and Accidents. *Journal of Sleep Research*, 4(S2), 4-14. doi: <https://doi.org/10.1111/j.1365-2869.1995.tb00220.x>.
- Doran, S.M., Dongen, H.P.V., & Dinges D.F. (2001). Sustained attention performance during sleep deprivation: evidence of state instability. *Archives Italiennes de Biologie*, 139 (3), 253-267. Diunduh dari: <https://pubmed.ncbi.nlm.nih.gov/11330205/>.
- Dunn, N., & Williamson, A. (2012). Driving monotonous routes in a train simulator: The effect of task demand on driving performance and subjective experience. *Ergonomics*, 55(9), 997-1008. doi: <http://dx.doi.org/10.1080/00140139.2012.691994>.
- Farnsworth, B. (2020). *10 Most Used Eye Tracking Metrics and Terms*. Diunduh dari: <https://imotions.com/blog/10-terms-metrics-eye-tracking/> [Diakses 7 Februari 2022]
- Fitbit. 2022. *Working to fit a sleep lab in a sesnsor*. Diunduh dari: <https://www.fitbit.com/global/us/technology/sleep> [Diakses 28 Februari 2022].
- Franzen, P.L., Buysse, D.J. Dahl, R.E. Thompson, W., Siegle G.J. (2009). Sleep deprivation alters pupillary reactivity to emotional stimuli in healthy young adults. *Biol Psychol*, 80(3): 300-305. doi: <https://doi.org/10.1016%2Fj.biopsycho.2008.10.010>.
- Frost, J. (2018). *Interpreting Correlation Coefficients*. Diunduh dari: <https://statisticsbyjim.com/basics/correlations/> [Diakses 22 Juli 2022].
- Gartenberg, D., Gunzelmann, G., Hassanzadeh-Behbaha, S., & Trafton, J.G. (2018). Examining the Role of Task Requirements in the Magnitude of the

- Vigilance Decrement. *Frontiers in Psychology*, 9 (1504), 1-13. doi: <https://doi.org/10.3389/fpsyg.2018.01504>.
- Giedke, H., Klingberg, S., Schwarzler, F., & Schweinsberg, M. (2002). Direct comparison of total sleep deprivation and late partial sleep deprivation in the treatment of major depression. *Journals of Affective Disorders*, 76(2003), 85-93. doi: [http://dx.doi.org/10.1016/S0165-0327\(02\)00071-X](http://dx.doi.org/10.1016/S0165-0327(02)00071-X).
- Glen, S. (2014). Counterbalancing in Research. Diunduh dari: <https://www.statisticshowto.com/counterbalancing-2/> [diakses 19 Juli 2022].
- Glen, S. (2014). Bartlett's Test: Definition and Examples. Diunduh dari: <https://www.statisticshowto.com/bartletts-test/> [diakses 20 Juli 2022].
- Granholm, E., Asarnow, R.F., Sarkin, A.J., & Dykes K.L. (1996). Pupillary responses index cognitive resource limitations. *Society for Psychophysiological Research*, 33(4), 457-461. doi: <https://doi.org/10.1111/j.1469-8986.1996.tb01071.x>
- Hart, S.G. and Staveland, L.E., 1988. Development of NASA-TLX (task load index): results of empirical and theoretical research. *Human Mental Workload*, 52, 139-183. doi: [https://doi.org/10.1016/S0166-4115\(08\)62386-9](https://doi.org/10.1016/S0166-4115(08)62386-9)
- Heinze, C., Hutterer, C., Schnupp, T., Lenis, G., & Golz, M. (2017). Drowsiness discrimination in an overnight driving simulation on the basis of RR and QT intervals. *Current Directions in Biomedical Engineering*, 3(2), 563-567. doi: <https://doi.org/10.1515/cdbme-2017-0117>.
- Hidayat, A. (2017). Uji Normalitas dan Metode Perhitungan (Penjelasan Lengkap). Diunduh dari: <https://www.statistikian.com/2013/01/uji-normalitas.html> [Diakses pada 19 Juli 2022].
- Hidayat, A. (2013). Penjelasan Rumus Kolmogorov Smirnov Uji Normalitas. Diunduh dari: <https://www.statistikian.com/2013/01/rumus-kolmogorov-smirnov.html> [Diakses pada 19 Juli 2022].
- Hidayat, A. (2012). Pengertian dan Rumus Uji Saphiro Wilk – Cara Hitung. Diunduh dari: <https://www.statistikian.com/2013/01/saphiro-wilk.html> [Diakses pada 19 Juli 2022].

- Himashree, G., Banerjee, P.K., & Selvamurthy, W. (2002). Sleep and performance-recent trends. *Indian Journal of Physiology and Pharmacology*, 46(1), 6-24. Diunduh dari: <https://pubmed.ncbi.nlm.nih.gov/12024958/>.
- Hussein, S. (2021). Uji Statistik: Jenis-jenis dan Bagaimana Memilihnya. Diunduh dari: <https://geospasialis.com/uji-statistik/> [Diakses pada 20 Juli 2022]
- Jin, L., Niu, Q., Jiang, Y., Xian, H., Qin, Y., & Xu M. (2013). Driver Sleepiness Detection System Based on Eye Movements Variables. *Advances in Mechanical Engineering*, 2013, 1-7. doi: <https://doi.org/10.1155%2F2013%2F648431>.
- Johansson, B., & Balkenius, C. (2018). A computational model of pupil dilation. *Connection Science*, 30(1):1-15. doi: <http://dx.doi.org/10.1080/09540091.2016.1271401>
- Korber, M., Cingel, A., Zimmermann, M., & Bengler, K., (2015). Vigilance Decrement and Passive Fatigue Caused by Monotony in Automated Driving. *Procedia Manufacturing*, 3(2015), 2403-2409. doi: <https://doi.org/10.1016/j.promfg.2015.07.499>.
- Lamond, N., Jay, S.M., Dorrian, J., Ferguson, S.A., Roach, G.D., & Dawson, D. (2008). The sensitivity of a palm-based psychomotor vigilance task to severe sleep loss. *Behavior Research Method*, 40(1), 347-352. doi: <http://dx.doi.org/10.3758/BRM.40.1.347>.
- Lavine, R.A., Silbert, J.L., Gokturk, M., & Dickens, B. (2002). Eye-tracking measures and human performance in vigilance task. *Aviation Space and Environmental Medicine*, 73(4), 367-372. Diunduh dari: <https://pubmed.ncbi.nlm.nih.gov/11952058/>.
- Laerd Statistics. (2018). *Correction for Violation of Sphericity in Repeated Measures Designs*. Diunduh dari: <https://statistics.laerd.com/statistical-guides/sphericity-statistical-guide-2.php> [Diakses 23 Juli 2022].
- Lerman, S.E., Eskin, E., Flower D.J., George, E.C., Gerson B., Hartenbaum, N., Hursh, S.R., & Moore-Ede, M. (2012). Fatigue risk management in the workplace. *Journal of Occupational and Environmental Medicine*, 54(2): 231-58. doi: <https://doi.org/10.1097/jom.0b013e318247a3b0>.
- Li, F., Ching-Hung, L., Chen, C.H., & Khoo, L.P. (2019). Hybrid Data-driven Vigilance Model in Traffic Control Center using Eye-tracking Data and

- Context Data. *Advances Engineering Informatics*, 42, 1-29. doi: <http://dx.doi.org/10.1016/j.aei.2019.100940>.
- Ma, F., Xiao, Y., Cai, G., Xu, F.G., & Chen, S.G. (2017). Effect of Mental Fatigue on Error Monitoring. *Advances in Biological Sciences Research (ABSR)*, 4, 276-284. doi: <https://dx.doi.org/10.2991/bbe-17.2017.46>.
- Mackworth, N.H. (1948). The breakdown of vigilance during prolonged visual search. *Quarterly Journal of Experimental Psychology*, 1:1, 6-21. doi: <http://dx.doi.org/10.1080/17470214808416738>.
- Maxwell, S.E., & Delaney, H.D. (2004). *Designing Experiments and Analyzing Data: A Model Comparison Perspective Second Edition*. London: Lawrence Erlbaum Associates.
- May, J. F., & Baldwin, C.L. (2009). Driver fatigue: The importance of identifying causal factors of fatigue when considering detection and countermeasure technologies. *Transportation Research Part F*, 12(2019), 218-224. doi: <https://doi.org/10.1016/j.trf.2008.11.005>
- McIntire, L., McIntire J., McKinley, J., & Goodyear, C. (2014). Detection of vigilance performance with pupillometry. *Proceedings of the Symposium on Eye Tracking Research and Applications*. doi: <http://dx.doi.org/10.1145/2578153.2578177>
- Michelle, R.H., (2019). *What Are the Differences Between Time Constraints & Resource Constraints in a Project?*. Diunduh dari: <https://smallbusiness.chron.com/differences-between-time-constraints-resource-constraints-project-35756.html> [22 Februari 2022]
- Miley, A.A., Kecklund, G., Akerstedt, T. (2016). Comparing two versions of the Karolinska Sleepiness Scale (KSS). *Sleep and Biological Rhythms*, 14(3), 357-260. doi: <https://doi.org/10.1007/s41105-016-0048-8>.
- Mishra, P., Pandey, C.M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive Statistics and Normality Tests for Statistical Data. *Annals of Cardiac Anaesthesia*, 22(1), 67-72. doi: https://dx.doi.org/10.4103%2Faca.ACA_157_18.
- Montgomery, D.C. (2013). *Design and Analysis of Experiments*. Danvers: John Wiley & Son, Inc.
- Montgomery, D.C., Runger, G.C. (2004). *Applied Statistics and Probability for Engineers*. Singapore: John Wiley & Son, Inc.

- Nayak, B.K. (2010). Understanding the Relevance of Sample Size Calculation. *Indian Journal of Ophthalmology*, 58(6): 469-470. doi: <https://doi.org/10.4103%2F0301-4738.71673>.
- Nickolas, S., (2021). What do Correlation Coefficients Positive, Negative, and Zero Mean?. Diunduh dari: <https://www.investopedia.com/ask/answers/032515/what-does-it-mean-if-correlation-coefficient-positive-negative-or-zero.asp> [diakses pada 20 Juli 2022].
- Pattyn, N., Neyt, X., Henderickx, D., & Soetens, E., (2008). Psychophysiological Investigation of Vigilance Decrement: Boredom or Cognitive Fatigue?. *Physiology & Behavior*, 93(1-2), 369-378. doi: <https://doi.org/10.1016/j.physbeh.2007.09.016>.
- Petterson, K., Muller, K., Tietavainen, A., Gould, K., & Haeggstrom. (2018). Saccadic eye movements estimate prolonged time awake. *Journal of Sleep Research*, 2018, 1-13. doi:<https://doi.org/10.1111/jsr.12755>.
- Razali, N. M., Yap, B. W. (2011). Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling Tests. *Journal of Statistical Modeling and Analytics*, 2, 21-33.
- Redaksi Halodoc. (2018). *Berapa Jam Waktu Tidur yang Ideal?*. Diunduh dari <https://www.halodoc.com/artikel/berapa-jam-waktu-tidur-yang-ideal-> [Diakses 21 Februari 2022]
- Reifman, J., Kumar, K., Khitrov, M.Y., Liu, J., & Ramakrishnan, S. (2018). PC-PVT 2.0: An updated platform for psychomotor vigilance task testing, analysis, prediction, and visualization. *Journal of Neuroscience Methods*, 304, 29-45. doi: <https://doi.org/10.1016/j.jneumeth.2018.04.007>.
- Roach, G.D., Dawson, D., & Lamond, N. (2006). Can a Shorter Psychomotor Vigilance Task Be Used as a Reasonable Substitute for the Ten-Minute Psychomotor Vigilance Task?. *Chronobiology International*, 23(6), 1379-1387. doi: <http://dx.doi.org/10.1080/07420520601067931>.
- Sagberg, F. (1999). Road Accidents Caused by Drivers Falling Asleep. *Accident Analysis and Prevention*, 31(1999), 639-649. doi: [https://doi.org/10.1016/S0001-4575\(99\)00023-8](https://doi.org/10.1016/S0001-4575(99)00023-8)

- Schleicher, R., Galley, N., Briest, S., & Galley, L. (2008). Blinks and saccades as indicators of fatigue in sleepiness warnings: looking tired?. *Ergonomics*, 51(7), 982-1010. doi: <https://doi.org/10.1080/00140130701817062>.
- Selvanathan, M., Hussain, N., & Jayabalan, N. (2020). Employee Productivity in Malaysian Private Higher Educational Institutions. *PalArch's Journal of Archaeology of Egypt/ Egyptology*, 17(8): 66-79. doi: <http://dx.doi.org/10.48080/jae.v17i3.50>.
- Simkus, J. (2022). Between-Subjects Design: Examples, Pros & Cons. Diunduh dari: <https://www.simplypsychology.org/between-subjects-design.html> [Diakses pada 22 Juli 2022].
- Simkus, J. (2022). Within-Subjects Design: Examples, Pros & Cons. Diunduh dari: <https://www.simplypsychology.org/within-subjects-design.html> [Diakses pada 22 Juli 2022].
- Stojanoski, B., Benoit, A., Berg, N.V.D., Ray, L.B., Owen, A.M., Zandi, A.S., Quddus, A., Comeau, F.J.E., & Fogel, S.M. (2018). Sustained vigilance is negatively affected by mild and acute sleep loss reflected by reduced capacity for decision making, motor preparation, and execution. *Sleep Research Society*, 42(1), 1-9. doi: <http://dx.doi.org/10.1093/sleep/zsy200>.
- Sutalaksana, I.Z., Anggawisastra, R., & Tjakraatmadja, J.H., (2006). *Teknik Perancangan Sistem Kerja*. Bandung: ITB.
- Tobii Pro. (2021). *Pro Lab User Manual*. Tobii Pro AB.
- Tobii Pro. (2021). *What is Eye Tracking*. Diunduh dari: <https://tech.tobii.com/technology/what-is-eye-tracking/> [Diakses 4 Februari 2022].
- Verlag, S. (2008). Test of Homogeneity, Chi-Square. *Encyclopedia of Public Health*. doi: <https://doi.org/10.1007/978-1-4020-5614-7>.
- Warm, J.S. (1977). Psychological Processes in Sustained Attention. Di dalam Mackie, R.R. (eds.), *Vigilance: Theory, Operational Performance and Physiological Correlates*. New York: Plenum Publishing.
- Warm, J.S., Matthews, G., & Finomore, V. (2008). Vigilance, workload, and stress. Di dalam Hancock, P.A. & Szalma J.L. (eds.), *Performance Under Stress*. Burlington: Ashgate Publishing Company.
- Wesensten, N., Belenky, G., Thorne, D.R., Kautz, M.A., & Balkan, T.J. (2004). Modafinil vs. caffeine: Effects on fatigue during sleep deprivation. *Aviation*

Space and Environmental Medicine, 75(6), 520-525. Diunduh dari:
<https://pubmed.ncbi.nlm.nih.gov/15198278/>.

Wijayanto, T., Marcilia, S.R., & Lufityanto, G. (2018). Visual Attention, Driving Behavior and Driving Performance among Young Drivers in Sleep-deprived Condition. *KnE Life Sciences*, 4(5), 424-434. doi:
<http://dx.doi.org/10.18502/kls.v4i5.2573>.

Williamson, A., Lombardi, D.A., Folkard, S., Stutts, J., Courtney, T.K., & Connor, J.L. (2011). The link between fatigue and safety. *Accident Analysis and Prevention*, 43(2), 498-515. doi:
<https://doi.org/10.1016/j.aap.2009.11.011>.

Yan, Z., Wang, S., Ma, D., & Liu, B. (2019). Meteorological Factors Affecting Pan Evaporation in the Haihe River Basin and China. *MDPI*, 11(2): 317. doi:
<http://dx.doi.org/10.3390/w11020317>.