

ABSTRAK

Automated vehicle merupakan mobil atau truk yang dilengkapi fitur *software* dan sensor sehingga pengemudi tidak diwajibkan untuk mengambil kendali untuk mengoperasikan kendaraan dengan aman. Terdapat berbagai macam manfaat dari *automated vehicle*, seperti menurunkan resiko kecelakaan, meningkatkan keselamatan lalu lintas, dan meningkatkan penghematan konsumsi bahan bakar. Di masa depan, diprediksi jumlah kendaraan otonom di pasaran akan meningkat pesat dan sebagian besar kendaraan di jalanan adalah *automated vehicle*. Salah satu tantangan yang terkait dengan perkembangan kendaraan ini adalah peran pengemudi dalam *automated vehicle* dan permasalahan etika. Saat ini, permasalahan berkaitan dengan cara mengatasi kegagalan sistem otomasi belum banyak dibahas oleh pihak manufaktur dan para peneliti. Penerimaan sosial terhadap *automated vehicle* didasarkan pada tingkat kepercayaan antara manusia dan *automated vehicle*. Berdasarkan latar belakang tersebut, dilakukan penelitian tentang pengaruh *automated vehicle* terhadap kondisi emosi pengemudi dari respon fisiologis dan respon subjektif.

Subjek penelitian ini adalah 15 laki-laki dengan usia $21,6 \pm 0,74$ tahun. Seluruh responden dalam penelitian ini telah memiliki SIM A dan belum pernah menggunakan *automated vehicle* sebelumnya. Terdapat tiga skenario dengan level otomasi *automated vehicle* yang berbeda-beda untuk masing-masing skenario, yaitu *No Automation*, *Conditional Automation*, dan *Full Automation*. Dalam eksperimen, setiap responden diekspos ketiga level otomasi *automated vehicle* dengan tugas responden selama eksperimen adalah mengemudi mengikuti rute GPS. Metode pengambilan data aktivitas otak dengan menggunakan *electroencephalogram*. Pengukuran dalam penelitian ini meliputi *band power* gelombang otak, *performance metric*, dan kuisioner *Profile of Mood States*.

Hasil penelitian menunjukkan bahwa skenario *conditional automation* mampu menurunkan *band power* gelombang *theta* dan *gamma* pada otak bagian temporal kanan yang menandakan peningkatan kecemasan, stres, dan depresi. Setiap skenario yang diujicobakan mengakibatkan beberapa bagian otak menjadi aktif. Bagian otak yang aktif untuk masing-masing level otomasi *automated vehicle* memiliki persebaran yang berbeda-beda. Selain itu, skenario *no automation* berpengaruh pada peningkatan emosi berkaitan dengan *esteem* dan skenario *full automation* berpengaruh pada penurunan emosi berkaitan dengan *vigor*.

Kata kunci: *Automated Vehicle, Electroencephalogram, Kondisi Emosi, Aktivitas Otak, Driving Simulation*

ABSTRACT

Automated vehicles are cars or trucks equipped with software and sensors so that the driver is not required to control the operations of the vehicle. There are various benefits of automated vehicles, such as reducing the risk of accidents, increasing traffic safety, and increasing fuel consumption savings. In the future, it is predicted that the number of autonomous vehicles on the market will increase rapidly and most vehicles on the road are automated vehicles. Some challenges related to the development of these vehicles are such as the role of drivers in automated vehicles and ethical issues. Nowadays, one of many problems that is related to automated vehicle is how to overcome the failure of the automation system. This hasn't been much discussed by the manufacturers and researchers. Social acceptance of automated vehicles is based on the level of trust between humans and automated vehicles. Therefore a study was conducted to get knowledges about the effect of automated vehicles on the rider's emotional states that is measured by physiological and subjective responses.

Respondents in this study were 15 mens with an age of 21.6 ± 0.74 years. All respondents had got driving license and had never driven an automated vehicle. There were three scenarios with a different automation level of automated vehicles for each scenario. In this experiment, each respondent was tested to the all three automation levels of automated vehicle (No Automation, Conditional Automation, and Full Automation). The respondents had to drive the driving simulator and follow the routes which were generated by GPS during the experiment. In this research, electroencephalogram was used to collect the brainwave data. The data of band power of brainwaves, performance metrics, and the Profile of Mood States questionnaire were measured as the dependent variables.

The results showed that the conditonal automation scenario was able to reduce the band power of tetha and gamma in the right temporal lobe that indicating the levels of anxiety, stress, and depression were increasing. Each scenario were activated some areas of the brain. The areas of the brain that activated were different for each scenario. In addition, the no automation scenario had increased the emotion that related to esteem and the full automation scenario had decreased the emotion that related to vigor.

Keywords: *Automated Vehicle, Electroencephalogram, Emotional State, Brain Activity, Driving Simulation*