

論文内容要旨

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学位論文題目	Develop Decision Support System Framework via Algorithm and Ergonomics Approach for Improving Driving Fatigue (運転疲労を改善するためのアルゴリズムとエルゴノミクスアプローチによる意思決定支援システムフレームワークの開発)		
内容要旨			
<p>Nowadays, driving activity has become more important as this medium being practical, faster and cheaper in connecting humans from one to another place. However, driving activity can cause disaster or death to a human in daily life as they get fatigued while driving. Driver fatigue is a top contributor to road crashes. The primary objective of this research was to develop a decision support system framework for improving the driving fatigue problem. The decision support system aims to provide systematic analysis and solutions to minimize the risk and the number of accidents associated with driving fatigue.</p> <p>Four major stages involved as the pillar in the development of decision support system; acquisition of knowledge, integration of knowledge, development of driving fatigue strain index using fuzzy logic membership function, and development of ergonomics vehicle model (EVM) and decision support system for driving fatigue (DSSfDF) model. The development of the strain index (DFSI) is based on the six risk factors associated with driving fatigue; muscle activity (MA), heart rate (HR), hand grip pressure force (HGF), seat pressure distribution (SPD), whole-body vibration (WBV), and driving duration (DD). The data is collected for all the risk factors and consequently, the three conditions or risk levels are defined as “safe”, “slightly unsafe”, and “unsafe”. The driving fatigue strain index was developed using a fuzzy inference system by MATLAB software before been converted into SciKit-Fuzzy by Python programming language through Django.</p>			

The linguistic variable which consist of six risk factors; MA, HR, WBV, HGF, SPD, DD, are divided into fuzzy sets defined by the membership function (MF). A membership function is defined for each fuzzy condition. The study uses the typical and simplest membership function that is triangular, trapezoidal and Gaussian membership function.

For fuzzy inference, IF-THEN rules were used to define the input and output variables that correspond to physical measures. The Mamdani-type, which is based on a simple structure of max and min operation, was used as the inference method. For this study, 20 rules set was created for rule statement. The knowledge available on the driving fatigue strain index (DFSI) produced by the interaction of six variables is described by 20 fuzzy rules.

In this study, the centroid average (CA) method is used for defuzzification process, which makes a quantifiable result in fuzzy logic. The driving fatigue strain index (DFSI) was tested with several data sets from the previous study. The use of fuzzy inference system in this study is due to its ability to model uncertainty derived from fuzziness and subjectivity. In addition, fuzzy have a capability to combine quantitative data with qualitative information in a systematic way by using fuzzy IF-THEN rules. This strain index is believed to be useful to quantify the driving condition level as a risk assessment method.

There are six main components for the development of EVM and DSSfDF model; ergonomics evaluation tools, graphical user interface (GUI), ergonomics database, working memory, inference engine, and knowledge base. Both models are essential systems and reliable advisory tools for providing analysis on risk factors that contribute significantly to driving fatigue and providing solutions and recommendations to the problem related to driving fatigue.

The graphical user interface was used to communicate the system with users. The Django framework based on Python programming language is used to develop the GUI for the web-based system of decision support system. There are five main GUIs; admin interface, superuser GUI, user profile and driving information GUI,

regression model GUI, and risk factor analysis GUI have been successfully developed through this study. The decision support system is an essential system to analyze the risk factors that would contribute significantly to driving fatigue associated with the driving activity. Besides, the decision support system provides solutions and recommendations to the users in order to minimize the number of road accidents in Malaysia.