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# Energy Spectral Density Analysis of Muscle Fatigue

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**Abstract.** Driver's vigilance level is easily distracted when in a state of fatigue and drowsiness. Most drivers' shows sign of visual fatigue and loss of vigilance during long and monotonous driving. Their ability to maintain adequate driving performance is affected by various factors. Popular technique to estimate driver's vigilance level is physiological measure that use electromyogram (EMG) signal in estimating driver muscle fatigue while driving. In this project, the EMG signal will be obtained by attaching the electrodes to the biceps brachii of each 15 subjects during playing Need for Speed (NFS) game for two hours. Before that, subjects will answer a set of questionnaires and the scores obtained will be calculated. From the questionnaires, driver condition can be determined whether the driver is non-fatigue or mild fatigue or fatigue. Then signal preprocessing is applied to remove artifact in EMG signal. Next, the EMG signal is analyzed by using frequency domain analysis and Energy Spectral Density (ESD) extracted from the analysis. Mean, variance and peak energy of ESD is obtained from all the samples. Based on result obtained, the normalized mean (non-fatigue: 0.0514-0.1255), (mild fatigue: 0.0554-0.0802) and (fatigue: 0.0069-0.0188). For the variance range (non-fatigue: 0.0050-0.0311), (mild fatigue: 0.0054-0.0802) and (fatigue: 0.0006-0.0047). While for the peak energy of ESD (non-fatigue: 28480-2943000 J/Hz), (mild fatigue: 99440-120500 J/Hz) and (fatigue: 537.7-11440 J/Hz).

**Keywords:** Fatigue; ESD; EMG;

## 1 Introduction

Recently, the numbers of car crashes or road accidents are still increasing even though lot of improvements in road and vehicle design for the driver safety. According to the statistics from the Malaysian Institute of Road Safety Research (MIROS) 489 606 road crashes with 6706 road deaths in the year 2015, and the number of crashes is two times higher than a year before[1]. Scanning for the countermeasures to decrease the measure of car crashes and upgrade the public road safety has turned into an earnest issue for the governments and automakers. It is very important to create an automatic system that intelligently can recognizes the driver's unfit status and makes warning to the drivers once necessary.