Time-Change-Fuzzy-based Intelligent Vehicle Control System for Safe Emergency Lane Transition During Driver Lethargic State

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Received: 15 July 2017  Accepted: 20 September 2017

Driver’s physical condition may contribute to traffic accident when it is in a lethargic state that result in faulty maneuvers of his vehicles. Due to these possibilities, many research focuses in developing automatic speed control systems that considers the environment condition, with which relieving the human from the control task when the driver’s judgement is not suitable for the environmental condition. Time-change-fuzzy-sets has been proven successful in analyzing safety level in traffic condition. This paper proposes an intelligent vehicle control system based on Time-Change-Fuzzy that can safely transit a moving vehicle from its original lane towards the emergency lane automatically when the driver is in lethargic state and the effectiveness was evaluated in a series of simulation.

**Keywords:** Computational Intelligence, Fuzzy, Intelligent Control, Autonomous Vehicle.

1. INTRODUCTION

Traffic accidents contribute to multiple correlating events such as congestions, inducing loss in time, energy and resources. Traffic accidents may happen due to environmental influences, vehicles condition or human error from which, safety in development of modern vehicles are based on. One of the contributor to such cases is due to driver’s physical condition that leads to faulty maneuvers of his vehicles, result in traffic accidents. The physical conditions that commonly leads to accident is due to the driver facing lethargic states.[6]

Among cases of traffic accidents, 10 to 30 percent of those tragedy related personal injury accidents are caused by sleepiness and fatigue-ness. Sleep and fatigue is classified as a driver’s lethargic state when which the driver loss consciousness in withholding control of the vehicle during driving operation. Many research has been focusing in the condition of the driver, typically in supporting the driver to reduce the possibility of lethargic state during driving operation [9], [11], [12]. Our past research relates to fatigue assessment system where real-time face and gesture recognition could categorize potential of lethargic state before it happens, with which we embedded in an assisting system to ensure the driver do not advance up to the lethargic state during driving through an alerting system. However, in some cases, drivers could not recover their consciousness, where controls are totally loss, therefore, a method to ensure that the vehicle are not in free-run (the state where the vehicles is out of control) during driver’s lethargic condition is required [1], [2].

Autonomous vehicle has been a wide sensation in modern automotive development. Technologies that help ensure safe driving, without human intervention has been a focus by many researchers. Most traffic accidents are caused by excessive speed and inappropriate speed according to the road condition. Due to this, most automotive researcher focuses in developing automatic speed control systems that can considers the environment condition, with which relieving the human from the control task when the driver’s judgement is not suitable for the environmental condition [3]- [8]. Here, driver’s lethargic state may requires a form of automatic speed control systems that may avoid the vehicle from a free-run condition [17], [18], [19].

Numerous intelligent control systems based on fuzzy