AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics Engineering and Electrical Communications

Safety improvement in Vehicular Communication Systems

A Thesis submitted in partial fulfilment of the requirements of the degree of

Master of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

by

Aia Abd-Elhamed Yousef Abd-Elhamed

Bachelor of Science in Electrical Engineering

(Electronics Engineering and Electrical Communications)

Faculty of Engineering, Ain Shams University, 2012

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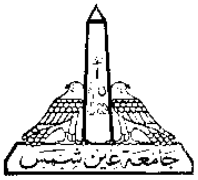
Cairo - (2019)



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Date:23 January 2019

Statement

This thesis is submitted as a partial fulfilment of Master of Science in Electrical Engineering , Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Abstract

Recently, transportation has become very important because of the high rate of the daily life, and vehicles are the most commonly used in countries around the world, which lead to the increase of the percentage of deaths and injuries caused by road accidents. This growing rate of fatal accidents required an innovative solution to be able to face the continuous increase in the death and injuries rate. Revolution in the luxury of the produced vehicles comes as a promising solution to reduce the percentage of deaths and injuries. The recent researches demonstrate that integrating the vehicles with radars, cameras and some developed devices will make the vehicles safer and reduce the expected accidents. Therefore Sensor-Based collision avoidance systems are the technologies used to avoid crash accidents to ensure a safe transport system for all road users.

Sensor-Based collision avoidance systems are the rising new technology which aims to reduce the accidents rate. Although it has succeeded in reducing the rate of the accidents, it has some limitations according to the type of the used sensor. One of these limitations is the coverage of the used sensor which cannot cover all environment surrounded by the vehicle. This problem can be a fatal impediment against avoiding the possible accidents.

Vehicle To Vehicle (V2V) is one of the promising solutions to reduce the rate of all the expected vehicle accidents. V2V is one of the applications of the Internet of Things (IoT) whose main idea is to share the information between the vehicles, this information includes the vehicle's velocity, headings, acceleration, yaw rate, position, ID, etc. So the vehicles literally see each other whatever their positions are to each other. Many previous algorithms used V2V technology to avoid the collision and reduce the accident rate using the most important factor, which is Time To Collision (TTC). TTC is calculated based on both the relative distance and relative velocity between the vehicles and compared with a fixed threshold.

The main object of this thesis is to present a new algorithm in the Intelligent Transportation Systems (ITS) using V2V by TTC. The threshold value of the TTC is calculated in the proposed algorithm where the friction of the road is taken into consideration. This leads to a correct decision about the current

situation of the vehicles, and as a result, the vehicles behave correctly. If the vehicle's current situation was classified as "accident situation", the vehicle would totally stop, if it was "expected soon accident situation", the vehicle would reduce its velocity by a certain percentage related to the relative distance, and finally, if the current situation was "no accident situation", the vehicle's velocity wouldn't change. This way, any collision between vehicles can be avoided.

Simulation results demonstrate that the proposed algorithm reduced the collision rate between vehicles; it also covered almost all possible collision scenarios. It succeeded to avoid the collision at intersections where the vehicles are not visible to each other, also, it succeeded to adapt the velocity of vehicles to each other by changing their velocity with relative percentages. Finally if reducing the velocity of the vehicle will not prevent the collision, the vehicle can change its current lane to the adjacent one which leads to collision avoidance in all vehicles situations on the road.

Key words:

Sensor-Based systems, Intelligent Transportation Systems (ITS), Vehicle To Vehicle (V2V), Internet of Things (IOT), Time To Collision (TTC).

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