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Review Paper on Vehicle to Vehicle Communication for a Platooning System using CAN Bus

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Abstract: This topic explains communication between vehicles. The aim of this project is to create a technology which is helpful to drive vehicles in platoon. A platoon is known as a number of vehicles where a master lead vehicle is followed by many slave trucks and passenger cars. Data such as speed, direction, braking, and destination place can be shared between the vehicles while they are in motion.
Index Terms: Platoon system, vehicle to vehicle system etc.

[1] Introduction:

In this paper we are discussing about the communication in vehicles. The aim of this project is to construct a solution which allow vehicles to run in platoons. The meaning of platoon is the road train. Platoon is a system consisting of a master vehicle driven by person, followed by many slave vehicles such as cars, trucks etc. Slave vehicles are partially control by Master vehicle. Vehicles can leave or join the platoon system. For example vehicle can leave on arrival at the desired destination.

[2] Litterateur Review:

Rencheng Zheng, "Study on emergency avoidance braking for the automatic platooning of trucks"[1]. This paper presents a detailed experimental study on emergency avoidance braking for the automatic platooning of trucks using a driving simulator (DS).

The paper presented on "PROMOTE-CHAUFFUR II &5.8 GHz vehicle to vehicle communication system,"[11][12] by B. Harker. According to survey in Europe country 80% of passenger transport and about 70% of goods transport takes place on the road. The "Tow-Bar" is the key of the CHAUFFUR project. In this project two trucks will be coupled electronically. The leading truck will be driven typically; the other towed one is planned to be driver less. During the project the :TOW-BAR" application and its interoperability will be validated in conduct installations. Next, the work is going on to electronic coupling of more than two trucks. This is the main distinguishes between "Platooning", where the leading Master Vehicle needs a driver and the fully automated, and driver less "Automated Platooning" application.

Referring to "KONVOI Development and examination of the application of electronically coupled truck conveys on highways"[13]. According to different survey in Germany 20% passenger traffic is increased and 60% truck transportation is increased.

The aim of KONVOI project is analyzing the effectiveness of the KONVOI which are electronically controlled trucks on the road. Virtual test drives in RWTH truck driving simulator software and real test drives using 5 experimental cars should be used to study the traffic. Specification related to product should be within the scope of MFG. the result and scope of application is dependent on result of previous project and EFAS, MFG response. The further development of result can be later improvised on commercial vehicles such as trucks.

FIVE vehicles will be provided with all information, automation and vehicle technology to develop communication for long and short distance in real traffic conditions. Hence, for success of this experiment these 5 vehicles will be provided the information of intervention in steering, drive train, brake, environmental sensors for object detection in near and far range as well as equipment for the inter vehicle to vehicle communication and a man machine –interface for the system's handling.

The reference "PATH at 20 – History and Major Milestones", IEEE Transactions on Intelligent Transportation Systems by S. Shladover [9]. The PATH is known as the Partners for Advanced Transit and Highways (PATH) Program. The California Partners for Advanced Transit and Highways (PATH) Program was

started in 1986. It was the first research program focused on the subject now known as Intelligent Transportation Systems (ITS) in North America.

To develop platooning technology Grand Cooperative Driving Challenge (GCDC) [16], took place in 2011. Longitudinal cooperative driving is the major scope for GCDC and lateral control is included at SARTRE.

The reference "Evaluation CALM M5- based vehicle to vehicle communication in various road settings through field trail by A. B. Bohm [7]. A. B. Bohm performed real measurement of vehicles. Moving vehicles and moving obstacles were used by A. B. Bohm to carry out his experiment. Obstacles where located between transmitting and receiving ends. Speed, distance and type of obstacles were the parameters which were changed. This type of environment is called is non-line of sight of environment.

The reference "On Medium Access and Physical Layer Standards for Cooperative Intelligent Transport System in Europe by E. G. Strom [5]. The IEEE 802.11p is used as the major communication channel which is modification to the IEEE 802.11 standard (WAVE). The change to PHY and MAC layer helps to achieve robust connection and fast setup for moving vehicles. The 5.9 GHz licensed frequency band is used for ITS.

Pedro Ferneands, "Multiplatooning leaders positioning and cooperative behavior algorithms of communicant automated vehicles for high traffic capacity" IEEE Transactions on Intelligent Transportation System [4]. This paper explain the theory to attain high traffic capacity. To achieve multi platooning base element is consider as distance between the two vehicles must be constant and same. Some new algorithms and techniques are proposed to maintain constant distance between vehicles. These new algorithms are used to improve the safety and allow vehicles to enter into main platoon track. In this method they developed a new novel agent-based architecture in which each vehicle having two different modules, which are known as a leader and a follower. This paper gives the simulation result using MATLAB/Simulation software of newly proposed algorithms.

To develop advanced transportation system highway platooning of vehicles has been consider as a promising policy. By fully autonomous or semi-autonomous vehicle control and vehicle to vehicle communication system provide potentially high safety, improved highway utility, reduced emission and increased fuel economy. This paper is mainly describing the characterization of vehicle to vehicle communication information structures and platoon safety.

This paper gives comparative study of different information structures such as front sensors, rear sensors, wireless communication channels and different information contents for example distances, speeds and driver's actions. An author reveals a number of intrinsic relationships between vehicle to vehicle communications in platoon system. The results of this paper give important information about sensor selections, vehicle coordination and communication resources allocations etc.

[3] Related Work:

Problem:

Now a day the amount of accidents are increased. The main reason of these accidents is carelessness of driver and high speed of vehicles. The driver cannot control their vehicle speed immediately. So vehicles behind get collide to next vehicle. To avoid such accidents I am proposing the new idea i.e. Platooning system. In this system, acting as a master unit whereas the vehicles entering into platooning system are acting as slaves. Where leading vehicle (Master unit) is manually controlled and remaining vehicles (slave units) are controlled by leading vehicle.

Objective:

1) Establish vehicle to vehicle communication.
2) 2) Leading vehicle(Master) is manually driven and slaves are controlled by master.
3) Vehicles may join or leave the platoon dynamically i. e. vehicle can leave the system either on arrival of desired destination or wish to overtake vehicle.
4) Keep distance between two successive vehicles constant.

Introduction:

This topic helps to understand communication between vehicles. The aim of project is to develop and find the solution to allow vehicles to run in system called "platoon". A platoon or road train is a system where number of slave vehicles follows the master vehicle automatically. The slave vehicles are partially controlled by

the Master vehicle. Slave vehicles can exit or join the system at any time. For example passenger vehicle can leave on arrival at the desired destination.

The platoon is called aa a co-operative system where the following vehicles are called as subsystems. In such a cooperative system all operations such as sensing, actuation and control algorithm is considered in the system and information is transferred between vehicles. For lateral and longitudinal communication in the platoon system local sensors are important in every vehicle. Local sensors are measuring all parameters in the adjacent vehicle only i. e. vehicle to vehicle communication is important. The master vehicle directly informs about command to slave vehicles. The slave vehicle is in continues contact directly with the master vehicle. To establish the vehicle to vehicle communication is very important for the safety of the platoon system.

The platooning technology aims at implementation the technology on the existing roads on without change in infrastructure. The project aim is to use new technology for platooning on roads without changes to the current infrastructure. It also helpful to identify that if is safe to allow mixing platoons with other users of public roads. The system is also helpful to reduce in fuel consumption, increased safety of driver and convenience to driver.

The technologies developed will be demonstrated in a prototype platoon with three vehicles where one is Master vehicle and two are slaves i. e. trucks and passenger cars. Hardware design, algorithms and sensor function is a major challenge to establish technical communication between the vehicles. This project is full of technical challenges such as the design of hardware, control algorithms and sensor-fusion etc. The main challenge is to establish the vehicle to vehicle communication.

In this project microcontroller is the heart of the hardware. Communication in vehicles i. e. devices in vehicles use CAN known as a common wired communication bus standard. Sharing of signals in between the vehicles is possible due to this network protocol.

Such devices are called as nodes or ECUs. A vehicle can contain different functional areas such a power train, body function etc. which may use different CAN buses. For vehicle to vehicle communication is done by RF sensors. Data communication is established by which allows sharing the signals among the vehicles. Later these data is used in algorithm control. Input to the controller is either a command or a request. The possible cases are a passenger vehicle want to enter into the system, a passenger vehicle want to permanently leave the system a passenger vehicle want to overtake.

A passenger vehicle wants to enter into system will send request messages as an input to controller. Controller will send this request message to leading vehicle with the help of RF wireless module. Leading vehicle will serve to passenger vehicle by sending a message that the request has been accepted. This message will be displayed on LCD. Then the passenger vehicle will enter into the platooning system. Now passenger vehicles controlled by leading vehicle.

In case, any of the passenger vehicles among the platooning system wants to leave the system, the command signal will be sent to leading vehicle. Leading vehicle will respond to this command. Then control of the passenger vehicle is transferred back to the driver. Now the passenger vehicle will leave the platooning system.

[IV] Conclusion:

This project describes a platooning system a phenomenal change in the current traffic and transport system.

The aim of this project here is drive the vehicles in platoon train system to develop and integrate solution that allow vehicles to drive on platoons. The benefit of this system are less fuel consumption, more safety and increased driver convenience. A manually controlled lead vehicle with a number of automatically controlled following vehicles is called as platoon.

More technical challenges are involves to achieve the platooning of vehicles.

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