ISSN 2395-1621

Vehicle Platooning

#1Prof. Dr. S.L.Lahudkar, #2Bhushan Amodekar, #3Bhujbal Nachiket, #4Tapkire Vaishnavi

[1]amodekar94@gmail.com
[2]nachiket.bhujbal@gmail.com

#1Prof. Department of Electronics and Telecommunication
#234Department of Electronics and Telecommunication

JSPM's Imperial College of Engineering and Research, Wagholi.

ABSTRACT

Platooning, the idea of cars autonomously following their leaders is a hot topic in research. It has huge potentials to improve traffic flow efficiency and most importantly, road traffic safety. Platooning is a way to increase the traffic flow and capacity on roads to handle the upcoming problems of traffic congestion and exhaust emissions. Wireless communication is a fundamental building block it is needed to manage and to maintain the platoons. To keep the system stable, strict constraints in terms of update frequency and reliability must be met. We developed communication strategies by explicitly taking into account the requirements of the controller, exploiting synchronized communication slots as well as transmit power adaptation. Wireless networking is fundamental for this application, as it is needed to manage and maintain the platoons and, clearly, has strict requirements in terms of frequency update and delay constraints. This paper surveys the literature about platooning systems and related research, identifies some open challenges, presents a simulation framework which can be used to tackle them, and outline promising approaches.

ARTICLE INFO

Article History

Received :16th March 2016

Received in revised form :

18th March 2016

Accepted : 20th March 2016

Published online :

23rd March 2016

Keywords :

I. INTRODUCTION

Vehicle platooning is an important innovation in the automotive industry that aims at Improving the safety, mileage, efficiency and the time needed to travel. Autonomous Capable vehicles in tightly spaced, computer controlled platoons will lead to savings in fuel, increased highway capacity and increased passenger comfort. The introduction of Automation into road traffic can provide essential solutions to the mainstream issues of Accidents, traffic congestion, pollution and energy consumption. Under cooperative Driving, automated vehicles drive like the migration of birds or a group of dolphins; the formation of birds in the migration is aerodynamically efficient, and Dolphins swim without collision while communicating with each other. The cooperative driving, simulating the formation of birds or dolphins, will contribute to the increase in the road capacity as well as in the road traffic safety.

This platoon demonstrated the ability to start, stop, accelerate and decelerate as a unit. Also demonstrated was the ability to split the platoon to allow for the entry of vehicles and then to rejoin as one platoon. A Heads-Up-Display unit was used to communicate to the driver information such a speed, distance to destination and whatever maneuver the vehicle is currently executing.

Following the concept presented earlier, we can say that Vehicle Platooning is an approach to improve the current transportation system both economically and technologically. The author says there are 2 main approaches for the implementation of an AHS, hierarchical structure and autonomous vehicle approaches, of which the first approach is centered around the concept of platooning.

In this approach, different layers of control hierarchy are responsible for performing different tasks needed to implement an AHS. Since each vehicle knows the dynamics of its leading car and might also know the platoon's leading car, such short distances are safe enough for the vehicles. Usually, the vehicles need to use radar, laser sensor to directly measure the preceding car's speed and their gap. In many recent approaches, inter-vehicle communication is also employed to transmit the required messages, i.e. the speed and position of the platoon's leading vehicle".

II. LITERATURE SURVEY

F. Michaud, P. Lepage, P. Frenette, D. Létourneau, N. Gaubert

Michon identified three levels in a driving task: strategic (highest level, for route planning and goal selection);tactical (intermediate level, selecting maneuvers to achieve short-term objectives such as passing cars, making an exit, merging); and operational (lowest level, for control operations). Mobile robot research successfully addresses all three levels to different degrees. Platooning is considered a special case of a formation control problem in mobile robotics. Formations are defined as groups of mobile robots establishing and maintaining some used radar sensors to measure distance between vehicles, and magnetometers for lateral position control (providing vehicles with relative positioning information). Vehicles were controlled using a three-layer hierarchical distributed approach. Only one maneuver at a time was allowed in the platoon, and the leading vehicle was responsible for coordinating the actions required. For instance, a vehicle wanting to exit the platoon would first request permission to the leading vehicle; if granted the vehicle would change lane and the leading vehicle would allow the following one to close the gap. This is usually known as a centralized coordination approach.

John Lygeros, Datta N. Godbole and Mireille Broucke

In this paper is to propose an AHS design that will perform well under most conditions.1 A common practice when designing such fault tolerant control schemes is to make use of two modules a fault detection module, to determine whether a certain fault has occurred and a fault handling module, where special controllers are implemented to minimize the impact of the fault on the system performance. Because the system performance is likely to degrade anyway, we will use the term degraded modes of operation to describe operation under these special controllers. The extended control scheme should guarantee graceful and gradual degradation in performance. Detection of failures in an AHS is a very challenging problem. Fault detection filters can be designed to identify faults in the on-board sensors and actuators. Due to the distributed, multiagent character of the AHS problem, communication with neighboring vehicles may also be required (in addition to the fault detection filters) for complete diagnosis and isolation of faults.

Jeremy Diez and Kevin Burton

The system used for this testing disengages the platoon formation if a gear shift, transmission neutral, or brake pedal activation is detected. This necessitated a speed trace that the vehicles could accomplish while staying in top gear and using only engine braking to vary the speed. The “Cruise Mode” section of the California Air Resources Board (CARB) Heavy Heavy-Duty Diesel Truck (HHDDT) schedule was used as a starting point, but the speed range was too low for top gear for a standard line haul tractor; therefore, 10 mph was added to all speed points of the HHDDT to bring the trace into the range of highway driving accomplished in top gear for these tractors. This modified HHDDT schedule was repeated roughly 2.5 times to approach 56 miles, intentionally short of the test distance of 59.5 miles. The variable-speed distance was set shorter than the normal test distance both to allow for error in meeting the trace and to allow the vehicles to enter and exit the test under 60 mph in the cruise control condition using normal test procedures.

Mårtensson, J., Nybacka, M., Jerrelind, J., Drugge, L.

Due to elimination of human reaction time automated platooning decreases the safety distance between the vehicles. The overall aim with this work is to evaluate the safety distance of platooning vehicles when both lateral and longitudinal control is implemented in comparison with only longitudinal control. Most previous studies on lateral control of vehicle platoons have concerned designing a controller with respect to a desired path of the road or with respect to the relative position of the lead vehicle with the overall aim to make the following vehicle to follow the lead vehicle in a better way. The advantage with the proposed control is that if the lead vehicle suddenly brakes (emergency braking) the following vehicle can both steer and brake to avoid a collision is allowed to pass the lead vehicle before stopping. If there is a platoon of several vehicles the idea is that every other vehicle steer to the right and every other to the left, including the lead vehicle. Thus the vehicles directly following each other do not need to steer as much in order to avoid a collision since they steer in opposite directions. The safety distance is analysed with an evader/pursuer game theoretic approach to determine the safety regions for platooning vehicles, inspired by. The approach originates from where these methods are used to generate alerts for aircraft.

III. PROPOSED SYSTEM

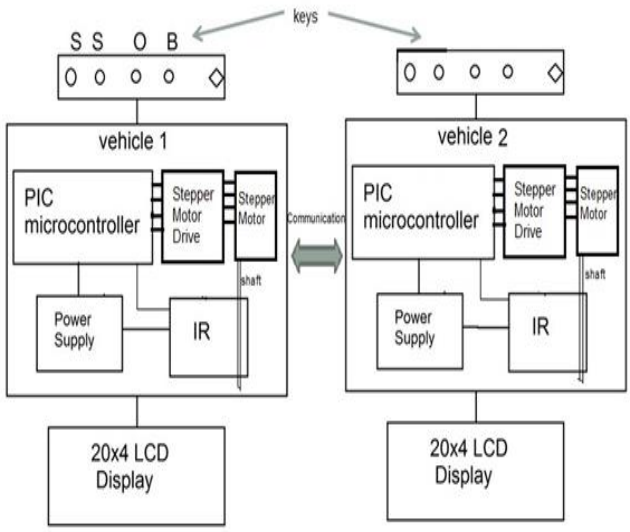

Fig 1. Block Diagram

The Block Diagram consist of two separate sections i.e. Vehicle1 and Vehicle2 and consist of PIC, Stepper Motor Drive, Stepper Motor, IR Trans-receiver, LCD Display, Keys. IR sensor mounted on car with stepper motor will rotates and detects surrounded vehicles. Position where vehicle is detected, IR trans receiver mounted on stepper motor stops at that position and communicates with surrounded vehicle to transfer data.

For every transfer of data between single vehicle needs upto 300msec maximum.

In our system it requires 200mSec for data transfer.
That is, 1.5 sec are enough to communicate and collect data from surrounded vehicles.

According to data, position of surrounding vehicles is displayed and parameters such as speed, break information and any vehicle wants to overtake or not is displayed.

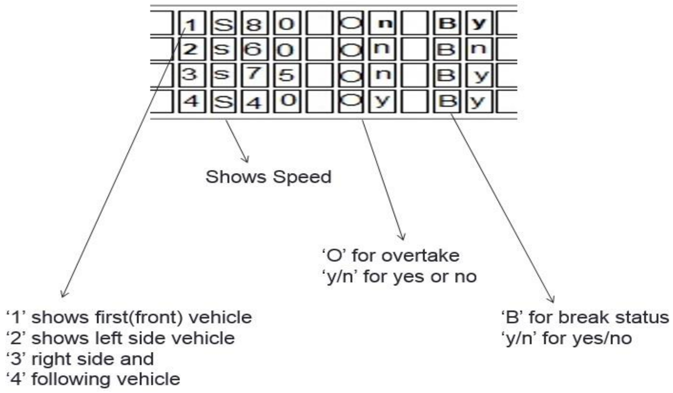

Fig 2. Display Parameters Description

IV.ADVANTAGES AND APPLICATION

Advantages

- Traffic efficiency.
- Driver comfort.
- Improvement in safety.
- Avoid Road Accidents

Applications

- Autonomous Driving.
- Intelligent Highway system.

V. CONCLUSION

It is important to demonstrate that vehicle platooning brings major transportation benefits in terms of safety, efficiency, affordability & usability, & environment in order to achieve its development goals. Yet, as we can see in the case of vehicle platooning, program acceptance is not just based solely on technological capabilities but also on people's social, economic, & environmental concerns.

REFERENCES

1. The SARTRE homepage: www.sartre-project.eu. Bergenhem, Q. Huang, A. Benmimoun, T. Robinson, "Challenges of Platooning on Public Motorways," 17th World Congress on Intelligent Transport Systems, October 25-29, 2010, Busan, Korea.

2. GCDC homepage: www.gcdc.net

3. S. Tsugawa, S. Kato, and K. Aoki: "An Automated Truck Platoon for Energy Saving," IEEE/RSJ International Conference on Intelligent Robots and Systems 2011 (CD-ROM), 2011

4. KONVOI project: www.ika.rwth-aachen.de/pdf_eb/gb6-24e_konvoi.pdf

5. C. Bergenhem, E. Hedin, D. Skarin, "Vehicle-to-Vehicle Communication for a Platooning System", Transport Research Arena– Europe, 23-26 April ,2012, Athens.

6. Michael, J. B., D.N. Godbole, J. Lygeros and R. Sengupta, "Capacity Analysis of Traffic Flow Over a Single-Lane Automated Highway System", ITS Journal, Vol. 4, 1998, pp. 49-80.

7. Carbaugh, J., D.N. Godbole and R. Sengupta, "Safety and Capacity Analysis of Automated and Manual Highway Systems", Transportation Research Part C: Emerging Technologies, Vol C6, 1998, pp. 69-99.

8. Rajamani, R., H.-S. Tan, B.K. Law, and W.-B. Zhang, "Demonstration of Integrated Longitudinal and Lateral Control for the Operation of Automated Vehicles in Platoons", IEEE Transactions on Control Systems Technology, Vol. 8, No. 4, July 2000, pp. 695-708.

9. F. Browand, J. McArthur and C. Radovich, "Fuel Saving Achieved in the Field Test of Two Tandem Trucks, PATH Research Report UCB-ITS-PRR-2004-20.

10. Alam, A., "Fuel-Efficient Distributed Control for Heavy Duty Vehicle Platooning" Licentiate Degree Thesis, Royal Institute of Technology (2011)

