Volume: 05, Issue: 02, December 2016, Page No.144-148
ISSN: 2278-2427

Co-operative Autonomous Truck Platooning System Based on Vehicle to Vehicle Communication over Wireless Technology

M.Shanmugam[1], D.Karthick Raj [2]
[1,2]Assistant Professor, Department of Electronics and Communication Engineering
Mahendra Engineering College (Autonomous), Namakkal, Tamilnadu, India

Abstract - Truck Platooning is an auto development that permits gathering different trucks into a separate component where one truck eagerly takes after the other that results in an extended road restrict. Our point is to plan and display a self-decision truck platooning structure in perspective of vehicle-to-vehicle (V2V) communication advancement. The structure uses IEEE 802.15.4 remote tradition joined with division going sensors to empower trucks inside the organization to securely exchange information logically and normally brake in light of the lead truck. The fast of remote communication used in lead vehicle and following vehicle. In this paper, we Endeavour to amplify the measure of fuel spared by organizing unit arrangement using a conveyed system of controllers. These virtual drivers, set at real convergences in the street arrange, help organize the speed of moving toward vehicles so they land at the intersection at the same time and can accordingly lack of involvement. This control is started just if the cost of framing the company is littler than the funds brought about from platooning.

Keywords - Sonar, IR Range Sensor, MEMS Compass and Wireless Network

I. INTRODUCTION

The transportation is continuously increasing while the environmental impacts need to be reduced significantly. Transportation is responsible for the central part of the growing oil consumption during the last decades, and it is expected to continue to grow. Fortunately, the developments within intelligent transportation systems (ITS) have enabled solutions to mitigate the environmental impact. One approach is to form heavy duty vehicle (HDV) platoons, which are convoys of HDVs driving at small inter-vehicle distances, such that the trailing vehicles experience reduced pollution, as illustrated Figure 1.

This reduces the overall fuel consumption, and therefore it reduces the operational cost for vehicle owners in addition to reduce greenhouse gas emissions. Truck Platooning presented a remote creative innovation. Presently a day's the greater part of the issue happened in vehicle unit [1]. Be that as it may, in this paper overcome this problem. The essential advantages of this innovation are recorded below.

- With the additional trucks braking quickly, with zero response time, platooning can enhance movement well-being [2].
- The Smaller crack between trucks reduces the air resistance, and in this way gives more notable efficiency. This implies bring down fuel utilisation and less CO2 outflows.
- Efficiently helps movement streams consequently decreasing activity of traffic.
- The little separation between vehicles means less space taken up out and about, and subsequently, expanded street limit [3].
- Smoother and more unsurprising movement stream.

Beyond the motion segment, it offers opportunities to enhance the work market, coordination's and industry. The majority of the literature on vehicle platooning has focused on vehicles staying in the platoon throughout the trip. However, in practice, vehicles have different origins and destinations meaning that platoons will have to be formed, merged, and split. Many studies have been conducted regarding how vehicles should enter or leave detachments in traffic on- and off ramps, respectively [4]–[5]. The focus was on safety and performance rather than fuel efficiency. Studies about fuel-efficient platoon coordination are limited and have been neglected until recently. In [6], the authors attempt to increase platooning throughout a network by using data-mining techniques to identify common routes where platoons can be formed. The authors in [7] introduce controller at junctions in a road network with each controller coordinating and rerouting vehicles to create platoons for fuel savings. In [8], real vehicle position data were studied to analyse platooning potentials through simple coordination schemes. The authors in [9] propose a centralised coordination system to form platoons at

Volume: 05, Issue: 02, December 2016, Page No.144-148
ISSN: 2278-2427

junctions of a network based on each vehicle's shortest path to its destination. Lastly, the work in [10] studied through simulations how traffic would influence and delay a platoon formation.

Figure 1: Vehicle Platooning

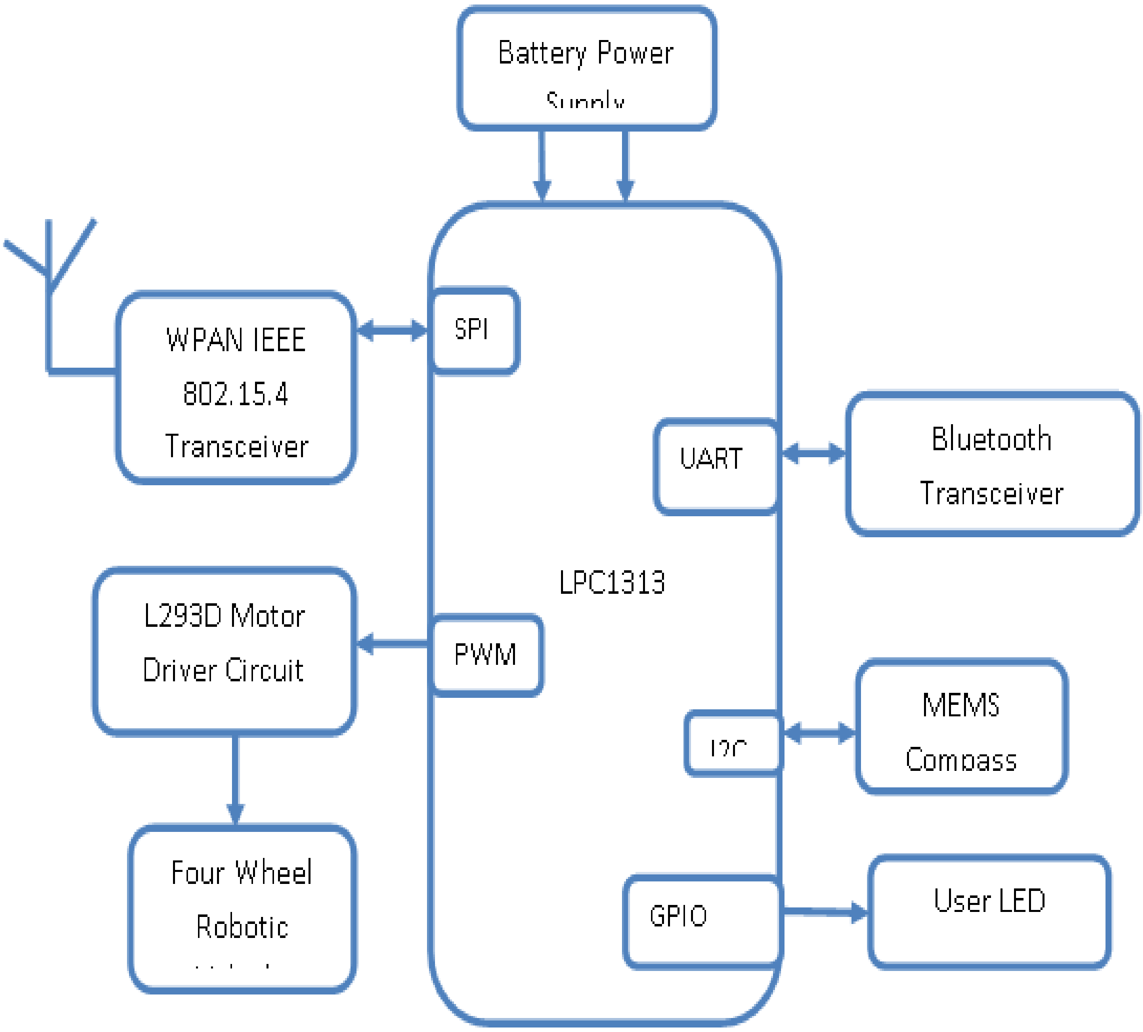

Figure 2: Lead Vehicle

Volume: 05, Issue: 02, December 2016, Page No.144-148
ISSN: 2278-2427

Figure 3: Demonstration

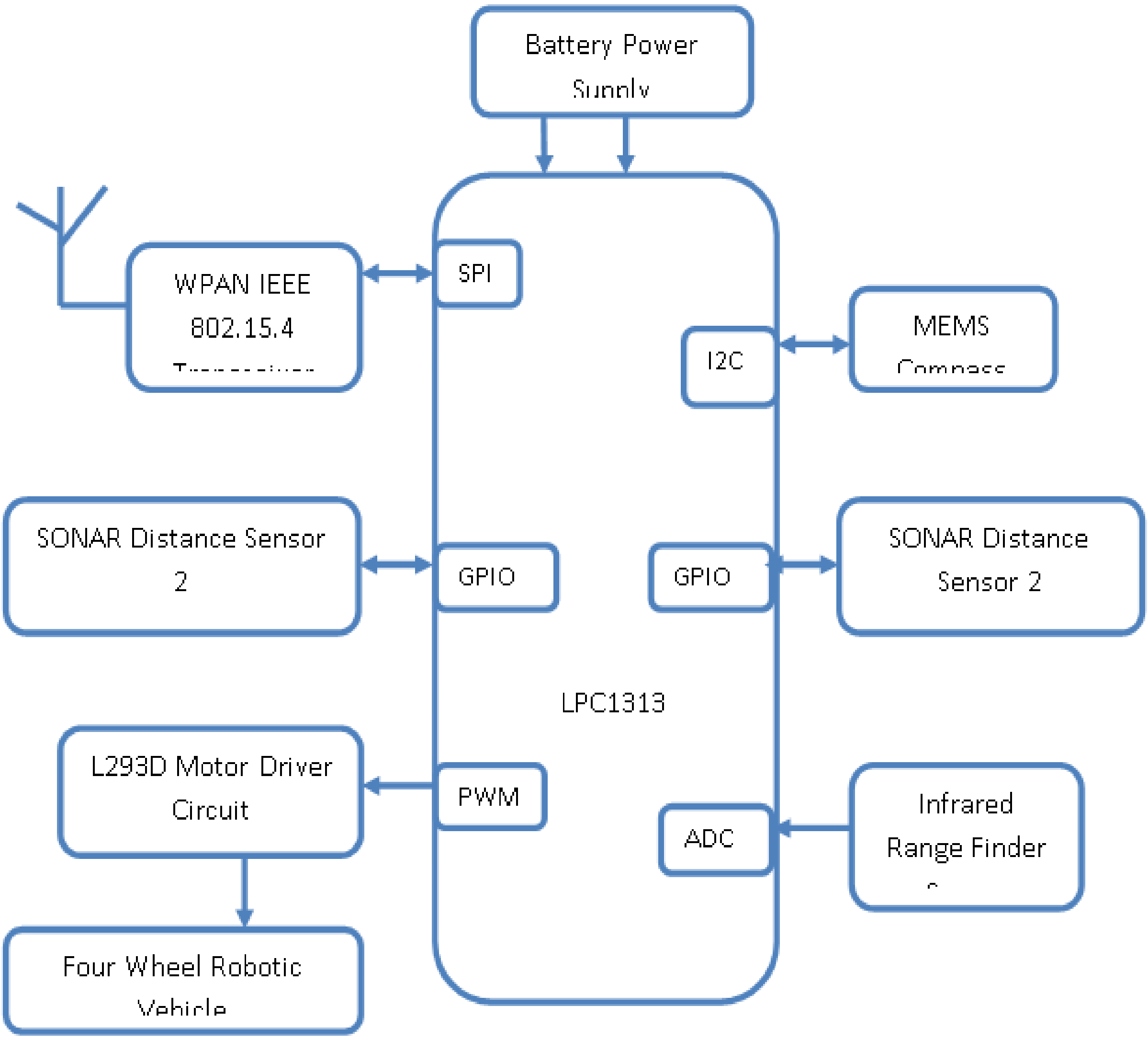

Figure 4: Follower Vehicle

II. PROPOSED SYSTEM

The system is demonstrated with two robotic vehicles capable of moving in forward, reverse, left, and right directions. In this paper introduced by wireless technology using IEEE 802.15.4 radios. It is a robotic module vehicle shown in figure 3.This establishes a V2V communication system where a 'lead' vehicle shown in figure 2 conveys its status/actions to a 'follower' vehicle for synchronized movements. The lead vehicle is also constantly in communication with a smart phone app over a Bluetooth link. Each vehicle has to overcome the road friction to transport the goods. Figure 4 shown in follower vehicle. The gravity, depending on the road slope, can either be a resistive force that increases the fuel consumption or be an assistive force which can reduce the fuel consumption. We are interested in comparing the cost. Hence the relative fuel cost contributed by the rolling resistance and gravity will cancel out since they are not speeding dependent.

III. RESULTS AND DISCUSSION

Several different movements of the platoon are possible.

- Forward,
- Right turn,
- Left turn,
- Reverse,
- Braking

The lead vehicle at that point illuminates its status to the following vehicle through IEEE 802.15.4 communication. The following vehicle utilizes an arrangement of separation measuring sensors like SONAR and IR sensors to measure the accurate separation amongst itself and the lead vehicle with the goal that it can dependably take after. Each wheel is controlled utilizing a DC motor. Motor control is accomplished utilizing motor driver circuit. Figure 5 and 6 shows that the hardware implementation. Each vehicle has an onboard MEMS compass sensor, which is a combination of an accelerometer and a magnetometer sensor that helps to estimate the direction of motion and also used to identify a collision situation. Every single one of the operations of the vehicle is controlled and done by an LPC1313 microcontroller.

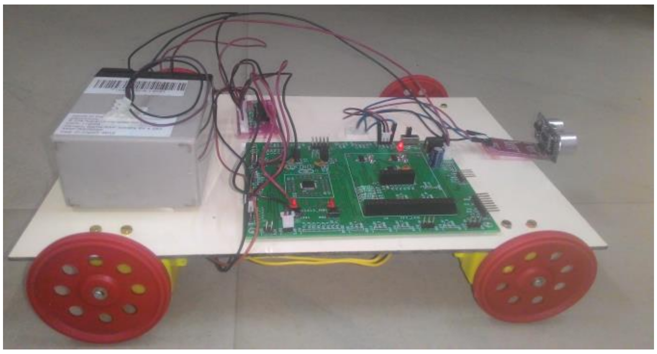

Figure 5: Cooperative Autonomous Truck

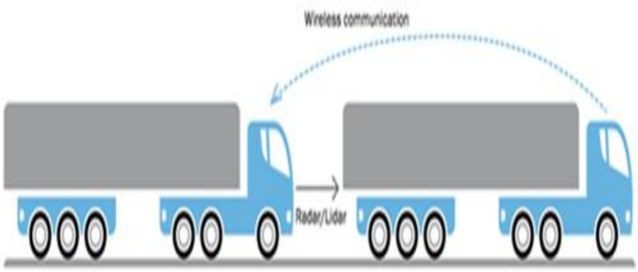

Figure 6: Vehicle to Vehicle Communication

IV. CONCLUSION

There is still a lot of continued development required before this technology can be introduced to the market. LPC1313 is an ARM Cortex-M3 based microcontroller that can keep running up to 72 MHz. It has 32 kb of impact memory and 8 kb information memory. There is up till now an amazing measure of proceeding with the change required before this progression can be familiar with the market. This demonstrates that truck platooning is possible. This demonstration should make arranged for truck makers to be permitted to complete also testing of this advancement on open roads with a specific genuine target to get widely more experience. Facilitate examination is likewise required keeping in mind the end goal to enhance and stretch out the calculation to a system of vehicles and for more fuel reserve funds. Exploring these is left for future work.

Reference

[1] Pipes, L.A., 1953. An operational analysis of traffic dynamics. Journal of applied physics, 24(3), pp.274-281.
[2] Levine, W. and Athans, M., 1966. On the optimal error regulation of a string of moving vehicles. IEEE Transactions on Automatic Control, 11(3), pp.355-361.
[3] Pagliarella, R.M., Watkins, S. and Tempia, A., 2007. Aerodynamic performance of vehicles in platoons: the influence of backlight angles (No. 2007-01-1547). SAE Technical Paper.
[4] Khatir, M.E. and Davison, E.J., 2004, June. Decentralized control of a large platoon of vehicles using non-identical controllers. In American Control Conference, 2004. Proceedings of the 2004 (Vol. 3, pp. 2769-2776). IEEE.
[5] Yanakiev, D. and Kanellakopoulos, I., 1995, December. Variable time headway for string stability of automated heavy-duty vehicles. In Decision and Control, 1995., Proceedings of the 34th IEEE Conference on (Vol. 4, pp. 4077-4081). IEEE.
[6] Ploeg, J., Shukla, D.P., van de Wouw, N. and Nijmeijer, H., 2014. Controller synthesis for string stability of vehicle platoons. IEEE Transactions on Intelligent Transportation Systems, 15(2), pp.854-865.
[7] Alam, A., Gattami, A., Johansson, K.H. and Tomlin, C.J., 2014. Guaranteeing safety for heavy duty vehicle platooning: Safe set computations and experimental evaluations. Control Engineering Practice, 24, pp.33-41.
[8] Bonnet, C. and Fritz, H., 2000. Fuel consumption reduction in a platoon: Experimental results with two electronically coupled trucks at close spacing(No. 2000-01-3056). SAE Technical Paper.
[9] Liang, K.Y., 2014. Coordination and routing for fuel-efficient heavy-duty vehicle platoon formation (Doctoral dissertation, KTH Royal Institute of Technology).
[10] Turri, V., Besselink, B. and Johansson, K.H., 2017. Cooperative look-ahead control for fuel-efficient and safe heavy-duty vehicle platooning. IEEE Transactions on Control Systems Technology, 25(1), pp.12-28.