Reducing Man Made Error and Improving Truck Fuel Economy by Truck Platooning System over WSN

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Abstract – Truck Platooning is an automotive technology that allows grouping a number of trucks into a single entity where one truck follows other that results in an increased road capacity. Resolving network access conflicts in Heavy duty vehicular and adhoc networks. We propose a coordination algorithm to form platoons of several vehicles that coordinates neighboring vehicles pairwise. The problem of controlling the vehicles within a group so that they converge to their desired velocities and intervehicle distances, is formulated as a high-order network consensus problem. In this paper, we study how two or more scattered heavy vehicles can cooperate to form platoons in a fuel-efficient manner And Maximize the amount of saving fuel by a distributed networks of controllers. Trucks driving close together at a constant speed results in lower fuel consumption and less CO2 emissions.Smart and Safe Highways Leading to Less Pollution and Less Congestion. No need of human driver in the trucks that follows taking some weight out of the drivers shoulder. This reduces chance of Human errors. Platooning system can improve Traffic safety by immediate braking system and accelerate in response to the lead Truck. The short distance between vehicles means less space taken up on the road, and hence increased road-capacity.

Index Terms – Truck, Automotive, Networks, Vehicular, Ad Hoc.

1. INTRODUCTION

Heavy Duty vehicles driving in a platoon use significantly less fuel than when driving separately. By traveling in single file with small inter vehicle distance, trailing vehicles experience reduced aerodynamic drag. This reduces the cost to vehicle owners. Since vehicles in a platoon are dynamically coupled, a string of vehicles as a whole maybe unstable even if all the individual vehicles are stable [5]. In particular, by exploiting wireless communication, vehicles will exchange their driving intentions and enable cooperative driving [6]. The idea is to enable the communication and cooperation among neighboring vehicles in a sequence, to safely reduce their distance between them. This driving system is set of algorithm, deployed on the vehicle into a single entity that shows a cluster into a unique lead which comprises of vehicles.

2. RELATED WORK

The requirement, design and implementation of a platooning system were proposed. The main contribution of this paper is the proposal and study of a novel algorithm to coordinate scattered vehicles to form platoons for fuel savings[9]. The algorithm is based on coordinating vehicles pairwise. We develop a system of distributed controllers that coordinate platoon formation by slightly adjusting the speeds of HDVs as they approach an intersection in the road network[7]. Practical road networks see HDVs entering and leaving the network haphazardly; it is more appropriate to coordinate platoon formation in real time as vehicles intersections, by adjusting their speed, as opposed to planning routes show the strengths of our proposed algorithm for several different scenarios. Our work is a natural and significant extension of [3], which addresse a single HDV increasing its speed to catch up with other vehicles or platoons[8].

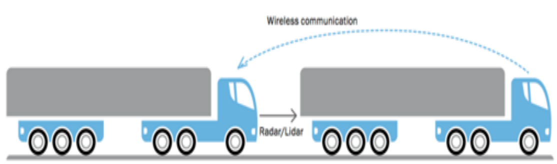
The authors attempt to increase platooning throughout a network by using data-mining techniques to identify common routes where platoons can be formed. The authors introduce controller at junctions in a road network with each controller managing and rerouting vehicles to form platoons for fuel savings. String stability measures the capability of cooperating vehicles in attenuating the propagation of perturbations of the leader motion along the platoon[3]. Perturbations of interest are spacing errors or accelerations. Itis well known that string stability cannot be achieved when constant spacing policies are enabled, without establishing a communication link with the platoon leader [4]. The architecture for automated highway systems described in [5] captures the necessary information between layers needed in any such complex transport system based on vehicle platooning. There are several reasons why few studies on large-scale optimization of HDV platooning exists today. First, because there is no central location to find every HDV's current location and eventual destination, information that would apparently be necessary to route vehicles in a inline manner. Second, there is no global controller with the authority to suggest routes that provide platooning opportunities[10]. Third, even if complete knowledge of every HDV was available and a global coordinator could direct vehicles along any route, the general problem of finding fuel-optimal routing using platooning is networks [6].

3. PROPOSED SYSTEM

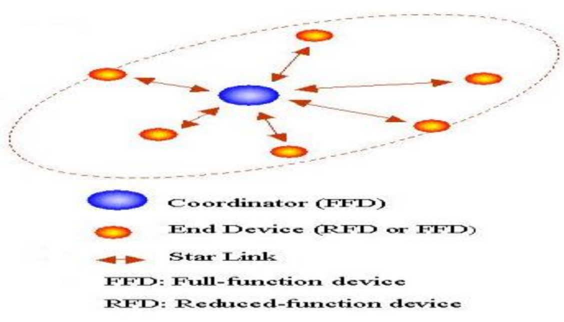
The system uses IEEE 802.15.4 wireless protocol combined with distance ranging sensors to empower trucks within the platoon to securely exchange information in real time and automatically brake and accelerate in response to the lead truck. The high speed of wireless communication allows extremely tight distances and truly synchronous driving between the platooning trucks. The vehicles are wirelessly networked using IEEE 802.15.4 radios, which allow them to communicate important information such as direction of travel and proximity to one another. This helps us to control the lead vehicle motion, emulating a human driver.

MODULE1: TRUCK PLATOONING

Truck Platooning is an automotive technology that allows grouping a number of trucks into a single entity where one truck closely follows the other that results in an increased road capacity. This type of platoon allows extremely tight distances and truly synchronous driving between the vehicles. Truck platooning is innovative and full of promise and potential for the future of transport sector. The primary benefits of this technology is With the following trucks braking immediately, with zero reaction time, platooning can improve traffic safety.



MODULE2: WIRELESS NETWORK COMMUNICATION



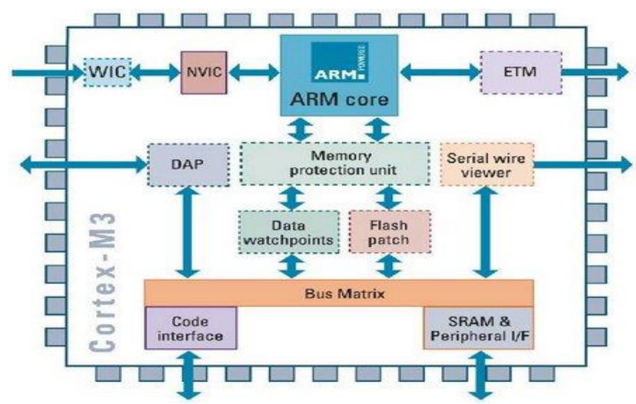
Wireless pan(WPAN) focuses on low-cost, low-speed ubiquitous communication between devices. WPAN has a range of 10-100 meter communications area which Transfers at a rate up to 250 Kbit/s.It is also used for secure communications and can be used in any topology that Uses Offset Quadrature Phase Shift Keying (OQPSK) modulation. WPAN uses 2400-2483.5Mhz frequency band

MODULE3: FOUR WHEELER ROBOT:

A four wheeler robot with differential drive wheels which is connected to the motor driver circuit that has a high torque motor. This four wheeler robot includes strong chasis to carry loads. This four wheeler robot is controlled by the range of sensors and by the lead robot vehicle over the wireless network.

4. SYSTEM ARCHITECTURE

On the plan premises we have various hardware setups along with the software tools. some of the components used in the system are cortex-M3 microcontroller, MRF24J40 WPAN transceiver, HC-SR04 sonar, MEMS compass, L293D motor driver and Bluetooth module.



Cortex-M3 microcontroller

A project of this sort needs a very capable microcontroller and asufficient amount of memory. Hence LPC1313 microcontroller is use in this project .an important factor of this microcontroller is less power consumption.LPC1313 is a Arm Cortex-M3 based microcontroller that operates at a frequency of upto 72 MHz . this microcontroller includes of upto 32KB of flash memory and a 8KB of SRAM memory. It also includes an UART interface.

Bluetooth

This project includes a Bluetooth module to control the lead truck by the user via smartphones. Thus HC-05 bluetooth is used that supports 3Mbps modulation with 2.4 GHz radio transceiver and baseband.

MEMS Compass

Mems compass provides an tilt compensated direction information.It also includes 3-axis accelerometer and 3-axis magnetometer. It can be embedded with digital sensor interface using I2C protocol.

SONAR

HC-SR04 Sonar is used in the system which is a sensorSSS that is used to detect the objects through the use of high or low frequency sound waves.It provides 2 - 400 cm non contact measurement function.

MOTOR DRIVER

A motor driver L293D is used in the project which is designed to provide bidirectional drive currents of upto 600mA at voltages from 4.5V to 36V.some of the features of this driver is High noise immunity inputs and thermal shutdown.

5. CONCLUSION AND FUTURE WORK

In this paper we proposed a approach to design an autonomous truck platooning system based on vehicle to vehicle communication technology .In this system WPAN protocol is combined with distance ranging sensors to empower trucks within the platoon and securely switch over information in real time and automatically brake and accelerate in response to the lead truck. In future work a monitoring camera is embedded along with the lead truck that can be used to monitor the activities of the driver along with the tracking of the vehicle.

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