Traffic Vehicular Communication With Zigbee Protocol

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ABSTRACT

As a result of distant travels and personal vehicles for transportation, the consumption of fuel is increasing. When the signal is red which indicates the vehicles to wait in order to cross the intersection, the person driving the car keeps the engine on and thus resulting in extra fuel consumption. On aggregating, the amount of fuel wasted sums up to a large quantity of fuel. It is relatively easy for the engineers to bring a new technology to reduce the idling but, it is a difficult task to change people's behavior. Hence our aim is to provide a method which automatically detects the signal and make the car's engine to react according to the signal status, thus reducing the idling time. This will conserve more fuel than normal condition. Our proposed system would be able to receive information from vehicles waiting at red signals and determines a queue for the vehicles participating. It would then determine the time still to elapse before the green signal. And if, this time is over a set threshold (say 2 minutes) the traffic light would then send signals to the vehicle engines to stop them. At the green signal, a "start-engine notification" would be sent to the first vehicle to start its engine, and a signal would be sent to the other vehicles in the queue as an "optimal time" later, so on.

KEY WORDS: Receivers, Transmitters, vehicles, Zigbee.

1. INTRODUCTION

In the rapidly urbanizing world, traffic signals play a vital role in ensuring the smooth flow of traffic and in preventing accidents (Mohanapriya, 2013). Loss of fuel due to the idling of vehicles is the biggest drawback. By 2035, it is estimated that the amount of cars would rise for about 2 Billion (Palanivel Rajan, 2014). Ultimately, this increases the traffic congestion and more fuel wastage. Idling refers to running a vehicle's engine when the vehicle is not set into motion. Thus the major reason behind reducing the idling process is the cost and environmental pollution. 10 minutes of idling varies between 1/3 and ½ of a liter. This amount depends on the particular vehicle. When the driver forget to shut down the engine, our method automatically shuts the engine down (Renuka, 2013).

Early Use: Existing method like stop-start technology, shuts the engine down during idling and restarts it when the person driving releases the brake pedal or when the clutch is pressed. They offer 5-10 percent of fuel savings. Stop-start function is the major advantage of micro hybrid. Under different researches it is evident that, in urban areas automobiles are idle or $1/3^{rd}$ of time. They are used to decrease the emissions from exhaust pipes, increase the fuel efficiency (Sridevi, 2016). The engine is shut down when the vehicle is set to complete idle state, in case of a stop-start system. When the brake pedal is set free, the engine is switched on automatically. This results in no consumption of fuel, noise or vibration, gas emission at idle state. As the research concludes, it is found that consumption is reduced by 6% and also in hectic traffic time, 25% is saved. This improves the standard of the life in urban areas as there is no mechanical noise when the vehicle is shut down (Palanivel Rajan, 2015). The future steps taken by the companies for the benefit of the customers and society, produced quick to the market cost effective solutions. Thus the stop start system increased the corporate average fuel economy (CAFE). Many manufactures have started to manufacture hybridized vehicles. To improve the overall vehicle efficiency, a control is done for the components electrified which minimizes the losses during the driving action.

2. PROPOSED SYSTEM

XBEE S2 Radio: XBee (S2) 2mw XBee ZB (a.k.a. series 2) module provides wireless end-point connectivity to devices. It is used for the embedded solutions. This permits us to create complex mesh networks. Its range is of 40 meters indoor and in case of outdoor it is 120 meters (Palanivel Rajan, 2013). It is possible for us to connect it to a serial port of a microcontroller and data rate up to 250 kbps. They are specifically designed for applications requiring high-throughput (35kbps) which in turn requires low latency and Communication timing that is predictable.

ATMEGA 328 Micrcontroller: ATmega48PA/88PA/168PA/328PA is a low power CMOS 8 bit microcontroller based on the AVR enhanced RISC architecture. The system designer optimizes the power consumption and speed of processing (Sundaravadivu, 2013).

Figure.1. Connection of receiver and transmitter arduino boards

Global Positioning System: GPS provides information regarding location and time in different conditions of weather, anywhere on or near earth (Gayathri, 2015). Military, civil, and commercial users are provided with the capabilities of critical positioning by the global positioning system. At least four GPS satellites are ‘visible’ at any time to locate our position wherever we are on the earth. At tabulated intervals (regular), each satellite transmits information regarding the current time and location of our position. These signals travel at the speed of light, and are intercepted by the receiver of GPS, which calculates how far away each satellite. It is based on the time taken for the messages to arrive (Palanivel Rajan, 2012). When the information is sent to at least 3 satellites, ‘Trilateration’ is the process used by the global positioning system’s receiver to point our location.

Interfacing Input/Output Modules: Arduino Uno R3 is a low power prototype board for Atmega 328. It can be connected and programmed via a USB cable and Arduino IDE (Kavitha, 2013). It has numerous options like connecting with another Arduino or computer like Bluetooth, USB, I2C, wire etc. Here we are interfacing XBee GPS module and LCD monitor and buttons. Here 1 Arduino communicates with another using XBee (Kavitha, 2015).

XBEE With Arduino UNO: The XBee modules are connected with Arduino through the serial data transmit and receive pins (Palanivel Rajan, 2016). Using the serial data lines data can be transmitted up to maximum baud rate of 115200. Here XBee in the transmitter side transmits the positional details and signal’s status. For example, the data transmitted would be in the following form,11.356267 8.908457 11.336478 8.917346 11.357876 8.902343 11.334978 8.915463 50

Implementation: The communication is set between a car and the traffic signal. The car is integrated with an XBee radio receiver, GPS receiver, and a microcontroller. When the car approaches the traffic signal, it gets connected with the traffic system (Vijayprasath, 2015). The traffic signal is integrated with XBee transmitter, timer and a controller. The traffic signal establishes its range within 150 meters (If the car is found within the specified range, the receiver in the car receives the transmitting signal from the transmitter of the traffic signal. The GPS (Global Positioning System) module in the car sends its location to the traffic signal.

Figure.2. LCD screen showing the seconds to wait

Controller in the traffic signal is programmed for finding the locations from all the sides. If the location of the car received by the traffic signal is within the range of the transmitter, the car receives the essential data required for the operation to be performed (Palanivel Rajan, 2010). Consider a four-way road, where each turn has different seconds for the vehicles to wait. The traffic signal compares the location of the car and sends the exact time (in seconds) for the destined car to wait. The time received is compared with the set point 1 (say 30 seconds) respectively (Vivek, 2016). The minimum value above which the car tends to stop is called the set point 1. If the time from the traffic signal is more than that of the set point, the counter is loaded with this time (in seconds) and gets decremented. When the time received by the car is 78(say), the counter is decremented, as a result the engine is set to off mode. The minimum value below which the car tends to start is called the set point 2. When the decremented time reaches the set point 2, the engine starts to work just before the signal is green.

3. RESULTS FOUND

A car C1 approaching the traffic signal within 150 meters (say) gets connected with the traffic system. Signal from the traffic system is integrated with XBee transmitter, timer and a controller. GPS module in the car sends its location to the traffic signal 10^{0}57’ 36.28” N 78^{0}4’ 35.773” E. This location is found by the controller which is programmed for finding locations from all sides. When the range of the car matches the traffic signal, the car C1 receives the set point 1 as 75 seconds (say), the time to wait.Thus is gets decremented by shutting the engine down.

When the time decremented reaches the set point 2 as 15 seconds (say), the engine is started again.As a result, the car C1 showed a reduction of fuel consumption.

4. CONCLUSION

Thus this project can effectively reduce fuel consumption in traffic signals where the drivers forget to turn off their cars. We believe this system will overcome the drawbacks of existing stop-start system. It would also reduce the driver's stress on starting the car when the signal changes from red to green. By using this system we can save more fuel, money and prevent pollution in a considerable amount at traffic signals.

Future scope: As our proposed work well suited for the approaching vehicles from all four directions. But, the method becomes more complex when the number of vehicle is increased in case of six-way and eight-way roads. Thus our next step is to reduce this drawback.

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