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Vehicle-To-Vehicle Communication: Traffic Safety Over RF Communication

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Abstract

Vehicle-to Vehicle Communication is the type of communication which provides communication among nearby vehicles for improving and reducing traffic. Traffic is increasing day by day and still we cannot save ourselves with this increasing traffic. With the help of this technology we can take one step towards to reducing traffic. This technology is called vehicle-to vehicle communication because one vehicle is communicating with the other vehicle or we can say one vehicle is sending its information to other vehicle. The communication is done with the help of RF communication. This paper offers a brief introduction of various communication technologies and different features used in vehicle-to-vehicle communication

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Key Words: *Vehicle-to-Vehicle Communication, RF Communication, Traffic etc....*

I. INTRODUCTION

Everyone nowadays needs to have a guarantee of safer transport. As computerized technology advances, there is a push towards Vehicle-to-vehicle Communication [4]. Vehicle-to-Vehicle Communication can help to get it. The main motivation for car-to-car communication systems is safety [6] and avoiding accidents due to collisions.. According to World Health Organizations (WHO), road accidents annually cause approximately 1.2 million deaths worldwide [7]; one fourth of all deaths caused by injury. Also about 50 million persons are injured in traffic accidents. If preventive measures are not taken road death is likely to become the third-leading cause of death in 2020 from ninth place in 1990.

The vehicle-to-vehicle communication system is not designed for a particular brand or vehicle. This can be used in every vehicle with a little modification. The system is designed considering the normal car user can also use it.

Automobiles have become one of the greatest commercial achievements of mankind in the past century but unfortunately during travel they are prone to accidents and become victims. A study by many research scholars found that 57% of accidents were due solely of driver factors which include his behavior, decision-making ability, reaction speed, alertness etc. Much has been done related to vehicle design but robust solution has never been made which alert the driver with direction of threat, warnings, collision-detection warning etc. A smart vehicle always looks after all its devices which are sensed every time [5].

II. PROBLEM STATEMENT

Traffic congestion is the main problem of any individual nowadays and it leads to traffic accidents of thousands of people and taking thousands of people lives each year [8] [9]. There are various reasons for traffic congestion and some are too inane. People don't follow any traffic rules which are the main reason of traffic congestion. Instead of finding out the solution people start to make chaos on the road which leads to traffic jam. In the peak hours more than 60% of population gets stuck on the road due to heavy congestion. This heavy congestion in turn is affecting each and every individual's life. Apart from traffic congestion there is problem when some by mistake take a wrong road and leads to a diversion or where there is road is blocked. Studies show that these situations can be avoided if driver was provided warning some half-second before so that they can take some alternate route to avoid traffic or road blockage.

III.BLOCKDIAGRAM

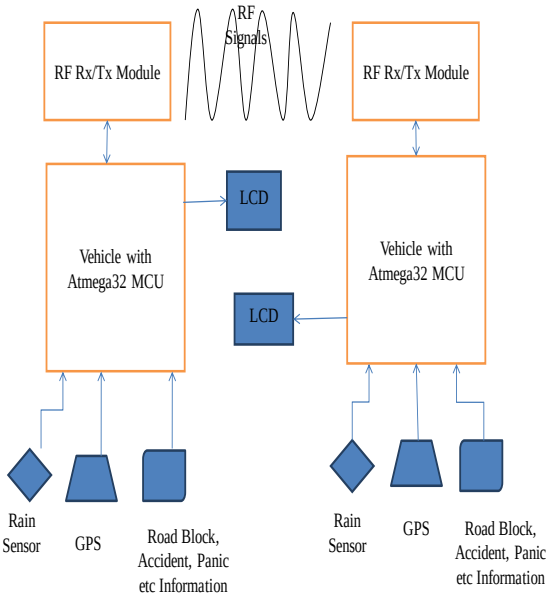

Figure 1: Block Diagram of Vehicle-to-Vehicle Communication

IV. TYPES OF SENSORS

Collision Avoiding Sensor

- They include radar, camera, ultrasound, lidar etc. LIDAR uses pulsed laser light to measure distances. Blind-spot detection and lane-departure warning systems uses radar and camera.
- Camera in cars is used so that we can record everything inside and outside your car. If you are driving in a single carriage lane and a car is approaching from a wrong side then camera will take its image or record video of the road and that image can work as evidence if anything happened on that road due to that car. We can also send the information to other vehicles behind us who cannot see the approaching car from the wrong side.
- Driver Sleep Detection: There are some possible techniques for detecting sleep in drivers [11]. One method is by monitoring its physiological characteristics like posture, leaning of the driver's head or open-close state of the eyes. Other method is monitoring the steering wheel movement, accelerator or brake patterns, vehicle speed etc. If car system detects driver is asleep it will immediately generate an alarm or buzzer or the steering wheel vibrates to help rouse the driver.
- Vehicle Attitude Sensor: GPS receivers receive manual data from the satellite and calculate their position by calculating its distance from visible satellites and then using triangulation method to calculate its position. After receiving the data and position, the data is arranged according to the NMEA (National Marine Electronics Association) standards and is serially transmitted at a baud rate of 4800 bps.The National Marine Electronics Association (NMEA**)** has developed standards that describe the interface between various marine electronic equipments. Marine electronic equipments are the devices which are designed for use in marine environment. Some of the marine electronic devices include GPS. The standards allow marine electronics to send information to computers and to other marine equipments. GPS receivers works on these NMEA Standards. The data given by the GPS receiver includes many information like speed, direction (heading), location (latitude and longitude), altitude, time etc. In its standards, NMEA has précised to send a series of data in a sentence.

Weather Sensors

- Rain Detector: The rain sensor will automatically regulate the frequency of your windscreen wipers, according to how heavily it is raining. Our rain sensors won't have to keep switching wipers on and off. It will use an LED sensor, fitted behind the internal mirror, to detect the amount of rain falling on the windscreen and adjusts the wiper accordingly.
- Snow Detector: The snow sensor is an in ground sensor used with snow melting controls to automatically detect snow or ice on a driveway.

V. GPS MODULE USED

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. It is a flexible and cost effective receiver which offers power and memory options which makes it ideal for many mobile applications. It has 50-channel, 6 positioning engine with TTFF (Time-To-First-Fix) speed. Its receiver's -162dBm tracking sensitivity allows continuous position coverage in nearly all application environments. [2]

VI. FLOWCHART AND ALGORITHM

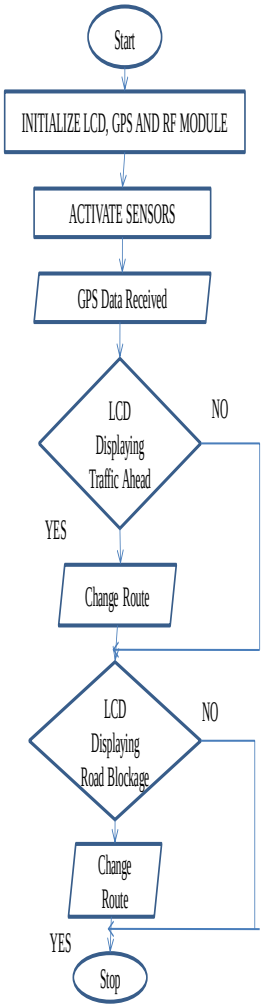

Figure No.2: Flowchart and Algorithm

1. Each vehicle will be given an unique ID by which they will be identifiable.

2. At system start, it checks all sensors and report if there is a failure.

3. If there are no critical failures (one has to define the critical failures) then the system will start normal function.

4. The system will check its date and time from GPS and if there is a significant display update the RTC with the GPS clock data.

5. System will start broadcasting vehicles speed, position, direction and other sensor data with date and time stamp.

6. In between two successive transmissions, the system will turn on its receiver to receive data from other vehicles fitted with the same system and process the data..

7. System will categorize data based on proximity of the vehicles. Data from the vehicles closer to the receiving vehicle will be given priority over data from distant vehicles.

VII. APPLICATION AREA

Vehicle-to-vehicle communication is a broad topic and therefore it has broad application areas. In this research paper some application areas are covered as follows:

- Traffic Updates- This system can give updates on traffic [3]. For example, if one vehicle user gets stuck in traffic it will immediately send this information to other vehicles so that they can avoid the traffic and find alternate route for their destination. Also, one can itself find the traffic condition, say, if vehicle is receiving constant speed from other vehicle's he/she can guess what traffic condition might be.
- Vehicle Traffic Monitoring- By passing information about traffic flow vehicle users can be aware of congested area and will be able to figure alternate route [1].
- Collision and Congestion Avoidance- If information like collision and congestion is relayed from one vehicle to another vehicle then these situations can be avoided and user can figure alternate route [10].
- Emergency Electronic Brake Light- When a forward vehicle brakes immediately, information is sent to other vehicles to give advance warning even if driver's visibility is less due to some weather condition or any other reason.
- Road Condition Warning- If driver detects some bad road condition, a warning message can be transmitted to other vehicles to generate speed recommendations or figure alternate route.
- Panic Situation Warning- If driver is having any panic attack a warning message is broadcast to other vehicles so that necessary action can be taken after identifying the car.
- Sleep Detection- if car system is detecting that driver is asleep it will try to wake the driver using sensors but if driver is having a panic attack or heartache the system itself will generate a panic information and transmit it to other vehicles.

VIII. ADVANTAGES & LIMITATION

Vehicle-to-vehicle communication system is easy and simple to use. One just has to press a button to share or transmit its information. Also to transmit some warning one has to press a button. With vehicle-to-vehicle communication, the main problem of any commuter which is traffic can be reduced. Road accidents which are increasing day by day can also be cut down because of V2V technology. Panic situations on road can be controlled on road itself with this technology. In short, everyone is sharing its information with each other, but the decision-maker will remain only the user itself. The vehicle user has to take the necessary action after receiving the information.

To make vehicle-to-vehicle technology more profound the communication protocol should be strong so that information or warning messages will take no time to transmit. This should happen because decision-making time for the driver on normal and emergency conditions is less than some seconds. Some sensors are very costly to be used

in vehicle communication. Therefore, to improve this technology cost should also increase.

IX. CONCLUSION & FUTURE SCOPE

Communication has offered many new opportunities for the automotive industry. This paper proposes a technology to improve traffic congestion and road safety. Also we have analyzed situations like collision, delay and redundancy etc. which can be improved or overcome with simple warning message transmission. GPS is used so that V2V system processor can identify the speed, direction and location of the other vehicle.

More sensors can be included for better working and accuracy. Future cars will be more intelligent which can make its own decision for the safety purpose. Quick help will be provided by knowing the location if the advance system also embedded in ambulance.

X. ACKNOWLEDGEMENT

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