Vehicle Collision Avoidance System using Wireless Sensor Networks

S.Ramesh, Ravi Ranjan, Ranjeet Mukherjee, Swarnali Chaudhuri

Abstract - Collision Avoidance systems, as a subsequent step to collision mitigation, are one of the Great challenges in the area of active safety for road vehicles. In India the total annual deaths due to road accidents has crossed 1.18 lakh, according to the latest report of National Crime Records Bureau (NCRB). If these deficiencies are not controlled at early stages they might cause huge economical problems affecting the road side networks. The main part of the work was to carry out a feasibility study on vehicle collision avoidance system using wireless sensor networks. The collision avoidance can be done by Laser sensor. Vehicle collision avoidance system can be identified by using Laser rays with the laser transmitter and laser receiver. Laser transmitter is connected to the laser sensor. Can controller is connected to the all sides of the nodes and send the information via Zigbee and transmit the message to the LCD output on the driver side. Laser receiver is connected to the can controller.

Keywords: Can controller, Collision, Laser, Zigbee, LCD.

I. INTRODUCTION

Although there have been a number of technological innovations in vehicle safety, the number of accidents continues to rise. This is especially true for intersection accidents. It has been reported that nearly 30% of the reported accidents in the India are due to intersection collision. Most of these accidents take place at rural areas. Intersection areas are equipped with traffic signals or stop signs. As a result, it is recommended that an intersection collision warning system be implemented as a part of vehicle safety systems, thus reducing the number of accidents. To be most effective, such a system should have the capability of supporting real time systems that can warn potential drivers of an impending collision. It also should be adaptable to different types of intersections. Vehicle collision avoidance system can be identified by using Laser rays with the laser transmitter and laser receiver. Laser transmitter is connected to the laser sensor. Can controller is connected to the all sides of the nodes and send the information via Zigbee and transmit the message to the LCD output on the driver side. Laser receiver is connected to the can controller.

II. CAN CONTROLLER

Controller area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host Computer.

Manuscript Received on October, 2012.

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CAN is a message based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment. Development of the CAN bus started originally in 1983 at Robert Bosch GmbH. The protocol was officially released in 1986 at the Society of Automotive Engineers (SAE) congress in Detroit, Michigan. The first CAN controller chips, produced by Intel and Philips, came on the market in 1987. Bosch published the CAN 2.0 specification in 1991.CAN is one of five protocols used in the OBD-II vehicle diagnostics standard. The OBD standard is mandatory for all cars and light trucks sold in the United States since 1996, and the EOBD standard, mandatory for all petrol vehicles sold in the European Union since 2001 and all diesel vehicles since 2004.

Automotive - A modern automobile may have as many as 70 electronic control units (ECU) for various subsystems. Typically the biggest processor is the engine control unit,

Which is also referred to as "ECU" in the context of automobiles; others are used for transmission, airbags, antilock braking, cruise control, audio systems, windows, doors, mirror adjustment, etc. Some of these form independent subsystems, but communications among others are essential. A subsystem may need to control actuators or receive feedback from sensors. The CAN standard was devised to fill this need. The CAN bus may be used in vehicles to connect engine control unit and transmission, or (on a different bus) to connect the door locks, climate control, seat control, etc. Today the CAN bus is also used as a field bus in general automation environments; primarily due to the low cost of some CAN Controllers and processors. Bosch holds patents on the technology, and manufacturers of CAN-compatible

Microprocessors pay license fees to Bosch, which is normally passed on to the customer in the price of the chip. Manufacturers of products with custom ASICs or FPGAs containing CAN-compatible modules may need to pay a fee for the CAN Protocol License.

Technology

CAN is a multi-master broadcast serial bus standard for connecting electronic control units (ECUs).Each node is able to send and receive messages, but not simultaneously. A message consists primarily of an ID usually chosen to identify the message-type or sender and up to eight data bytes. It is transmitted serially onto the bus. This signal pattern is encoded in NRZ and is sensed by all nodes. The devices that are connected by a CAN network are typically sensors, actuators, and other control devices. These devices are not connected directly to the bus, but through a host processor and a CAN controller. If the bus is free, any node may begin to transmit.

If two or more nodes begin sending messages at the same time, the message with the more dominant ID (which has more dominant bits, i.e., zeroes) will overwrite other nodes' less dominant IDs, so that eventually (after this arbitration on the ID) only the dominant message remains and is received by all nodes. Each node requires a host processor. The host processor decides what received messages mean and which messages it wants to transmit itself. Sensors, actuators and control devices can be connected to the host processor. CAN controller (hardware with a synchronous clock).

Receiving

The CAN controller stores received bits serially from the bus until an entire message is available, which can then be fetched by the host processor (usually after the CAN controller has triggered an interrupt).

Sending

The host processor stores it's transmit messages to a CAN controller, which transmits the bits serially onto the bus. Transceiver (possibly integrated into the CAN controller)

Receiving

It adapts signal levels from the bus to levels that the CAN controller expects and has protective circuitry that protects the CAN controller.

Sending

It converts the transmit-bit signal received from the CAN controller into a signal that is sent onto the bus. Bit rates up to 1 Mbit/s are possible at network lengths below 40 m. Decreasing the bit rate allows longer network distances (e.g.,500 m at 125 Kbit/s).The CAN data link layer protocol is standardized in ISO 11898-1. This standard describes mainly the data link layer composed of the logical link control (LLC) sub layer and the media access control (MAC) sub layer and some aspects of the physical layer of the OSI reference model. All the other protocol layers are the network designer's choice.

III. LASER

Many scientific, military, medical and commercial laser applications have been developed since the invention of the laser in 1958. The coherency, high monochromaticity, and ability to reach extremely high powers are all properties which allow for these specialized applications. A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the emission of photons. The term "laser" originated as an acronym for *Light Amplification by Stimulated Emission of Radiation*. The emitted laser light is notable for its high degree of spatial and temporal coherence.

Spatial coherence typically is expressed through the output being a narrow beam which is diffraction-limited, often a so-called "pencil beam." Laser beams can be focused to very tiny spots, achieving a very high irradiance. Or they can be launched into a beam of very low divergence in order to concentrate their power at a large distance.

Temporal (or longitudinal) coherence implies a polarized wave at a single frequency whose phase is correlated over a relatively large distance (the coherence length) along the beam. A beam produced by a thermal or other incoherent light source has an instantaneous amplitude and phase which vary randomly with respect to time and position, and thus a very short coherence length.

Most so-called "single wavelength" lasers actually produce radiation in several modes having slightly different frequencies (wavelengths), often not in a single polarization. And although temporal coherence implies monochromaticity, there are even lasers that emit a broad spectrum of light, or emit different wavelengths of light simultaneously. There are some lasers which are not single spatial mode and consequently their light beams diverge more than required by the diffraction limit. However all such devices are classified as "lasers" based on their method of producing that light: stimulated emission. Lasers are employed in applications where light of the required spatial or temporal coherence could not be produced using simpler technologies.

IV. LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly.

LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

The LCD is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystalsand arrayed in front of a light source (backlight) or reflector to produce images in colour or monochrome. Liquid crystals were first developed in 1888. By 2008, worldwide sales of televisions with LCD screens exceeded annual sales of CRT units; the CRT became obsolete for most purposes.

V. WIRELESS SENSOR NETWORKS

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity.

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Blue Eyes Intelligence Engineering & Sciences Publication

The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding. In computer science and telecommunications, wireless sensor networks are an active research area with numerous workshops and conferences arranged each year

VI. NATURE OF WORK

Here we are going to discuss about the proposed model for Detection and Avoidance of collision in the road side network. The vehicle collision avoidance system can be done by laser rays i.e., laser transmitter &laser receiver. Our nature of work is used to avoid the collision of vehicles in all directions. For this we are calculating for all side of directions. In case the cars are moving in front direction so need to worry about the other directions like back and other two sides. For this we had given the example.

Intersection collision

To avoid in intersections junction i.e. four junctions joining sides. In case our car is going in 90km when the intersection junction is coming means our sensor senses the other side of directions and give the message to the LCD.The driver can assume that some vehicle coming in other directions and we can easily stop the car at the same time in case the driver is not listening to the LCD means we can fix one alarm for indication purpose also. So our sensor will sense and send the message to the LCD and alarms also rings means we can easily save the car from accidents.

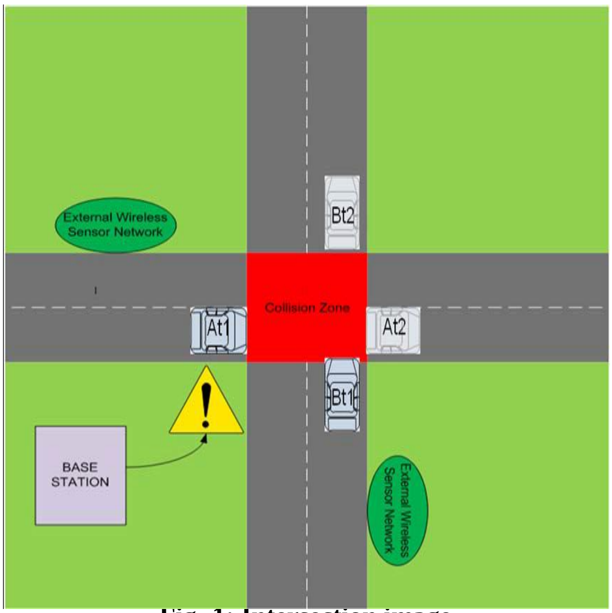

Fig.-1: Intersection image

Front and back side collision

Secondly we had given the example for front and back side image collision

Fig.-2: Front side image collision

This is our proposed model image for front and back side image collision. This image can be taken as front and back side image collision. Here we were using the concept based on the avoidance of collision in Laser rays.In case we are going to implement in real time means we can prefer on Radar also. The car is going in front side means if any vehicles coming in front or back side means our sensor will sense and send the message to the LCD or alarm.The driver can easily save the car from accidents.

Left side and right side collision

Here we had given the example on both sides of the collision.

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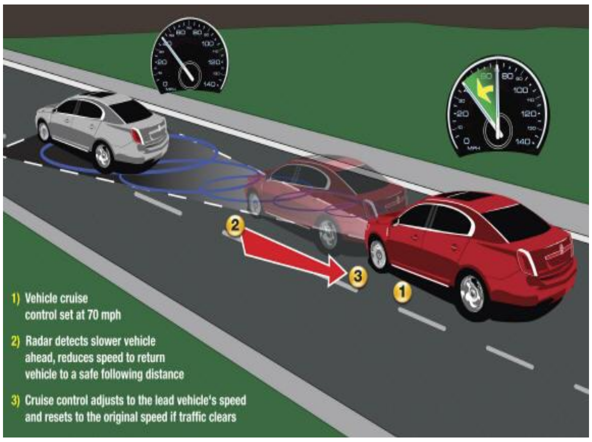

Fig.-3: Side View collision

In case the car is going in front side if there is any vehicles is coming in side direction means our both sides of the sensor will detect and send the message to the LCD or alarm.The driver can easily stop or save thecar from accidents.

Like that we can save the vehicles from all directions. This is the demo model we were given the idea in case real time we are implanted the concept means we can avoid the four side crash i.e.,frontside, back side,rightside and left side.

VI. RESULTS AND DISCUSSIONS

The main result for this paper is to avoid the avoidance of collision between the road side vehicles.

Fig.-4: Road side Collision

In future we are implanting this concept means we can save the vehicles from accidents and save the people also. Like that we have already mentioned that to fix the sensor on four sides of the vehicles to save the vehicles from accident free system. This is the demo model we were given the idea in case real time we are implanted the concept means we can avoid the four side vehicle crash i.e. frontside, back side,rightside and left side. This is not for only based on vehicles collision at the same time if any obstacles like wall,trees, people, etc are coming on the road lane means our sensor will detects all things and send the message to the LCD and then we can save the car from such type of accidents. So simply we can say if this concept was implements in real time systems it will get success means we can say as Accident free vehicle collision system.

VII. CONCLUSION

Our proposed model is facing a new challenge to further improve the reliability of road side testing techniques, while seeking for new and emerging technologies in Laser rays or that aid the avoidance of collision in the road sides networks. With the Laser rays test equipment, focus has been on better understanding of the Laser receiver at the Can controller and the interaction of with the can controller with the defects through the main CAN node to the Zigbee. Further results, such as the avoidance location, depth, type etc. can be deduced through the analysis of the Laser Ongoing work is under way to develop improved vehicle collision system, mostly in the field of employing the proposed model for avoidance of collision of vehicles. Development of new processing algorithms to avoidance collision vehicles has become the major focus of most research activities to avoid vehicle collision system. But our concept is mainly to avoid the collision in the road side vehicles will be carried out successfully. So simply we can say if this concept was implements in real time systems it will get success means we can say as Accident free vehicle collision system.

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