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Zigbee based vehicular adhoc networking

Neha Shinde, Shobha Bhor, Trupti Wable,Sayli Dubule

Department of Electronics and Telecommunication, Lokmanya Tilak College of Engineering, Navi Mumbai
Prof .Pranita Potey

***Abstract* – It is well known that the security of our vehicle plays a vital role in vehicle to vehicle adhoc network. Zigbee is the most flourishing wireless communication technology which supports low cost , low power, short range and low maintenance wireless communication. Due to drastically changing environment , various schemes are required which allow adhoc networking of predetermined devices. In this paper we discuss the problems related to a particular scenario and try to find out the solutions using Zigbee module. We present a generalize flow for combining various aspects into a single solutions and making future developments in this field. On the other hand reducing contention and maximizing the total network throughput is the most important aspects to be focused on in accident prone areas Zigbee is the latest technology which can be used to establish a temporary network for communication between the vehicles.**

Index Terms* – *Zigbee , IEEE 802.15.4, Sensor Network, Ad Hoc Network, VANETs .

I. INTRODUCTION

Our goal is to create transmitter and receiver environment in order to avoid collision in the traffic. Every year, road accidents cause almost 1.2 million deaths worldwide [1]. In Spite of the large number of these accidents, they are, in range, avoidable. Of 43,000 road accident deaths yearly in the US, 21,000 are caused by road departing and intersection oriented incidents [2]. This number can be significantly lowered by deploying active/cooperative safety systems enabled by vehicular communications.

Vehicular adhoc network- (VANETs) have become a prominent technology for improving the standard of the safety levels in transportation schemes. VANETs consist of roadside units vehicle to vehicle communication nodes that respectively allow vehicles to transmit signals via establishing a temporary network in emergency cases like road accidents, landslides etc. Due to wireless communication it is possible for vehicles to communicate to zigbee so that large range of area can be covered as per requirements. Here, spontaneous message generation through ultra sonic sensor , message authentication and message integrity is also maintained throughout the communication process. Ultra Sonic sensors are implanted on the vehicles through which the message transmission becomes serially aligned . Hence VANETs cannot totally depend on short life time strategies,as a malicious vehicle can harm other vehicles until its strategic life time expires.Thus efficient coordination becomes the most important parameter in message generation and transmission in that particular order.

For a practical demonstration method it is required that the allocation of misbehaving vehicles should take place as early as possible to prevent this vehicles from accidents. According to vehicular ad hoc network, it will completely rely on the public key maintenance as a perfect method to achieve these security requirements. A central authority issues and authentic certificate for each node used in communication through Zigbee. Following are the most important situations which come into picture through (V2V) communication using Zigbee :-

1) If obstacle is detected in front of our ultrasonic sensor-It will detect the obstacle upto(6ft/180cms) and if distance is less than 50cm even if input is given to the transmitter remote the car will not start.
2) If there is collision ahead on the highway-This information will be received by our car and our car will automatically stop.

II. SAFETY TRAFFIC SITUATIONS IN VANETs

We assume that sensors are installed on each vehicle require a location of positions of the vehicles nearby. Neighbours of a vehicle are vehicles adjacently “close” to it. Here, two vehicles are neighbours if they are within each other’s adaptive range.
Of positions of neighbouring vehicles are known, many collisions can be avoided. If the speed of the vehicles is also known, each vehicle can predict next positions and avoid possible accidental situations.
Building a brief summary in each vehicle requires that: 1) each vehicle should be able to locate its own absolute or probable position, and 2) vehicles ought to broadcast position status information to their neighbours. Discovering the position of a vehicle can be done via GPS [3], radio ranging and mensuration techniques [4], and/or, radar.
Our aim in this work is on designing a Zigbee protocol that is capable of delivering correct transmission signals.Thus an automatic safety system is in working condition if it can be able to identify a fatal situation before the driver of a vehicle does. Till the time a driver attempts to take the reaction, i.e., the time duration between the moment and the application of the decision, is between 500ms to 1.2s, depending on how the consequences the event would take is [5]. Noting that a warning message alerting a driver, itself needs to be processed, communication delay must not exceed 100-200ms.

III. RELATED WORK

The curiosity in vehicular networks research has been increasing rapidly over the last few years. Farnoud et al. in [6] used a positive orthogonal coding to contribute a transmission pattern for broadcasting messages. The performance in terms of the success ratio and the average delay time in message transmission was noted. In [7], a vehicle for deriving the packet delivery delay between adjacent vehicles, the re-handling time, was designed. It was shown that this time can be gradually increased to values more than 120 seconds in multihop disconnected communications, which is unacceptable for vehicular networks. Thus, many researching institutions proposed the vehicle-to-infrastructure (V2I) communication where roadside units (RSUs) with better equipment are acquainted to increase network establishment. DV-CAST protocol was proposed in [8], which is a distributed vehicular multihop broadcast protocol that is applicable only on local information for handling transmitting messages in VANETs. DV-CAST can operate in all traffic situations, including extreme cases such as dense and rare traffic regimes. In [9], mathematical models [10] was developed to determine the average delay of a packet between long distance transmitter and receiver in the presence of RSUs as relays. In order to improve VANET connectivity, [11] proposed to implant a limited number of RSUs.

IV.SYSTEM MODEL AND SPECIFICATIONS

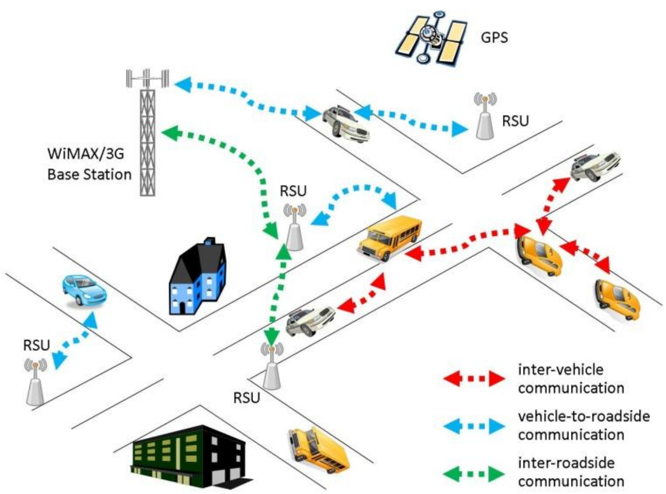


Fig. 1 VANET Architecture

V. OUR CONTRIBUTION

We have designed zigbee based ad hoc network by creating a two way communication via transmitter and receiver.

A. Zigbee Module(X-BEE 24B):-It helps to establish communication between vehicles.

Fig. 2 Zigbee module

B. The circuit is divided into two parts:-
1. Transmitter
2. Receiver

For transmitter section,different command signals are transmitted via RF transmitter module of 433 MHz. it has four pins of Antenna, Vcc, Gnd, & serial data input.
On receiver side the data is received by RF receiver module of 433 MHz .

C. Ultrsonic sensor:-It is used for measuring the critical distance between the two vehicles.

Fig. 3 Ultra Sonic sensor

VI.DEVELOPMENT STAGES & PROCESS

The complete development of this system can be divided into the following stages:

1.Problem definition stage
2 .Designing block diagram
3 .Implementing circuits and components
4 .Developing algorithm for software
5 .Writing actual code for Microcontroller
6 .Compiling the code
7 .Burning of the hex file into microcontroller with programmer
8. Testing and Running

5.1.1.Problem definition stage

It is the very first stage to develop the base of any project. It actually defines the aim and the concept of the project.

5.1.2.Designing block diagram

At this stage we have categorized the entire system into different zigbee modules. These modules will help in understanding the concept and working of this integrated system. It also simplifies the entire debugging and testing process.

5.1.3.Implementing circuits and components

This is the actual implementation of circuit of each block. We design each block separately and finally integrated them into the complete working system.

5.1.4.Developing algorithm for software

In order to get the logical flow of the software, the development of algorithm is having a prominent role.

5.1.5.writing actual code for Microcontroller

After the development of the algorithm and flowchart we have actually translated them in C language for ATmega328 Microcontroller so that it can understand the instructions and run as per our requirement. The instructions are in ANSI C language.

5.1.6. Compiling the code

The code is implemented on the computer for which we have used Keil software which was pre-installed on PC.

5.1.7. Burning the hex file into microcontroller with programmer

In this stage the compiled version of hex format was downloaded or burned into Atmel ATmega328 flash Microcontroller.

5.1.8.Testing and Running

Any errors which were detected were removed successfully. This is the last and final stage of development of this project.

VI. SPECIFICATIONS OF CONTROLLER

Fig.4 Arduino Uno R3 (Atmega328)

SPECIFICATIONS

Microcontroller	ATmega328
Operating Voltage	5Volts
Input Voltage	7-12Volts
Input Voltage	6-20Volts
Digital Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current per 3.3Volt Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

LM7805 Series Voltage Regulators:- The LM78XX series regulators is available with various fixed output voltages making them useful in a wide range of applications.

Power Supply Design:-

Power supply is the first and the most important part of our project. For this project we require 5 Volts regulated power supply with maximum current rating 500mA.

Following are the basic building blocks that are required to generate regulated power supply.

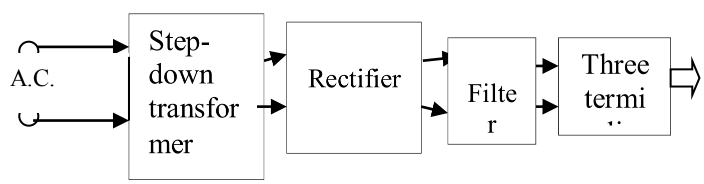


Fig.6 Block Diagram of Power Supply

VI.FUTURE RECOMMENDATIONS

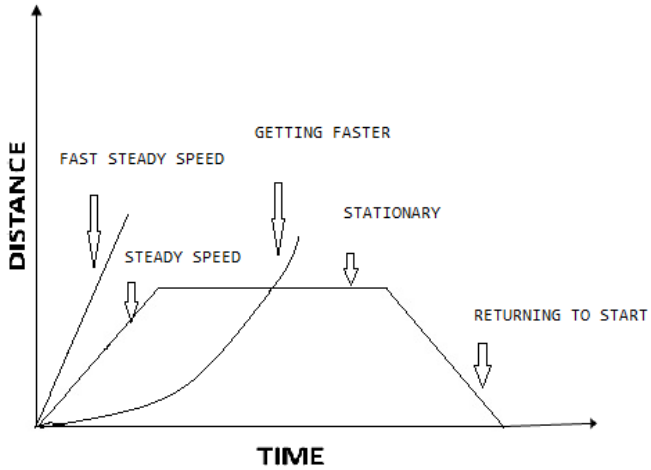
Zigbee pro module can be used instead of zigbee module which cover the distance up to one kilometre.Thus more number of vehicles will be able to communicate through zigbee pro which indirectly helps in dropping down accident rates.

VII.CONCLUSIONS

There are still various issues to be resolved and implemented before vehicular networks are deployed. The standards for Zigbee are still a work in progress.Also, 52 the Crash Avoidance Metrics Partnership (CAMP) is a group of automobile manufacturers, including both GM and Ford, which is currently working on the realization of the collision avoidance techniques of Zigbee. The CAMP Intelligent Vehicle Initiative (IVI) is a research system that brings together a number of automobile outlets and suppliers to work in coordination with the US Department of Transportation (US DOT) [11].

VIII.RESULTS

There are various inferences that are observed when certain cases are considered while listing out the daily traffic conditions,one of which is described as shown below



IX.ADVANTAGES

1. Traffic Management Applications
2. Traffic Coordination and Assistance

X.DISADVANTAGES

1. In VANET the extensive usage of GPS may be distrupting and time consuming situations.
2. VANET applications such as the internet, video streaming during driving may lead to accidents.

XI.APPLICATIONS

1. Safety oriented
2. Commercial oriented

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