

VEHICLE TO VEHICLE COMMUNICATION FOR NOT REACHABLE AREAS

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Abstract

Vehicle to vehicle communication for not reachable areas is a protocol that enables communication between vehicles wirelessly, in areas having no connectivity. The wireless communication between two vehicles is achieved using RF communication having range of 100 metres in areas having no connectivity of internet or GSM. The two connected vehicles can exchange data information about the various parameters like gas level, accident occurrence, fuel level or other warnings. The NRF module is used to establish communication among the vehicles using RF technology. For accident occurrence monitoring and for gas level monitoring, various sensors are used. The data information or the status of one vehicle is transmitted over a wireless medium and is displayed on the LCD module present in another vehicle. Arduino nano microcontroller is used for the overall interfacing and programming of the connected system. So using this technology the parameters of one vehicle can be monitored by another vehicle wirelessly. The wireless technology used for vehicle to vehicle communication greatly reduces the various fatal roadway accidents by giving initial warnings to the connected vehicles. The two connected vehicles provide smooth means of transportation based on the principles of reliability and safety. However, because of human error, circumstantial error, negligence, accidents occur. In such a situation, the affected vehicle warns the connected vehicle via an emergency warning message. Hence further accidents can be prevented.

Keywords: - Vehicle-to-Vehicle (V2V), RF Transceiver, Area Coverage, Information Propagation

1. INTRODUCTION

1.1 Intervehicle Communication

Vehicle to vehicle communication is a wireless network in which the connected vehicles send alert messages to each other. These messages include speed, location, direction of braking, loss of stability, obstacles in the path, occurrence of an accident etc. It is a mesh network, in which all the connected vehicles can send, receive and retransmit the message signals. Warnings are given the drivers to alert them about the circumstances and allow them to respond accordingly. Thus, it is a way to 'talk' to each other (automobiles) and is a way to overcome blind spots, avoid accidents and travel safe.

Smooth means of transportation can be provided and road safety can be improved by intervehicle communication, wherein the driver would come to know about the conditions down the road. All the traffic information, including the information regarding collision or accident, is provided to the connected vehicles. This makes travelling on roads safer and efficient. Annually, about 1.2 deaths occur worldwide due to road accidents. If this intervehicle communication technology

is efficiently utilized and other preventive measures are taken, then this number is greatly reduced.

1.2 Wireless Transmission

Wireless communication is the transfer of information between two or more points over a distance without the help of any electrical conductor or wires. Air is used as a medium of transmission and the range of communication varies from few metres to 1000's of kms. Most commonly used wireless technology is radio waves. In radio communication, information is carried across space using radio waves. The information to be sent is applied to a radio transmitter that converts it into RF signal and transmits it in the space medium. At receiver end, the antenna picks up the signal and regenerates back the original signal. Radio waves from many transmitters pass the information through air simultaneously without interfering with each other because each transmitter has a different frequency.

2. GENERAL BLOCK DIAGRAM

The receiver and the transmitter sections are both identical, so these can be represented using a single block diagram.

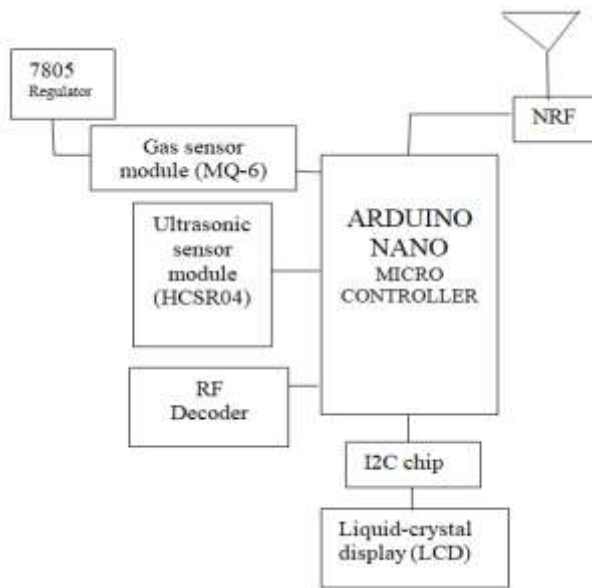


Fig 1: Block diagram

- Ultrasonic sensor module HCSR04
- LCD with I2C chip
- RF decoder (433MHz and 315MHz)
- 7805 regulator

The various components i.e., gas sensor, ultrasonic sensor and RF decoder (433MHz) are interfaced to arduino nano (microcontroller 1) of vehicle 1. The supply is given to the system via a 7805 regulator which ensures that each component gets a supply of +5V. A LCD module is also interfaced to arduino nano via I2C chip which is used to display the received data information as a message to another vehicle. A +5v supply is given to the LCD through 7805 regulator. Vehicle 2 is identical to vehicle 1 except for the fact that the RF decoder used in this vehicle operates on 315MHz so that the two RF signals for controlling the two vehicles won't interfere with each other. Since a full duplex mode of communication is used both the vehicles (vehicle 1 and vehicle 2) are transceivers and can be regarded as a transmitter or as a receiver depending upon the situation.

The above figures show the general block diagram of V2V communication. The main components of the system are:

- NRF 24L01+PA+LNA with antenna
- Arduino nano microcontroller
- Gas sensor module MQ-6

3. FUNCTIONALITY

3.1 Schematic Diagram

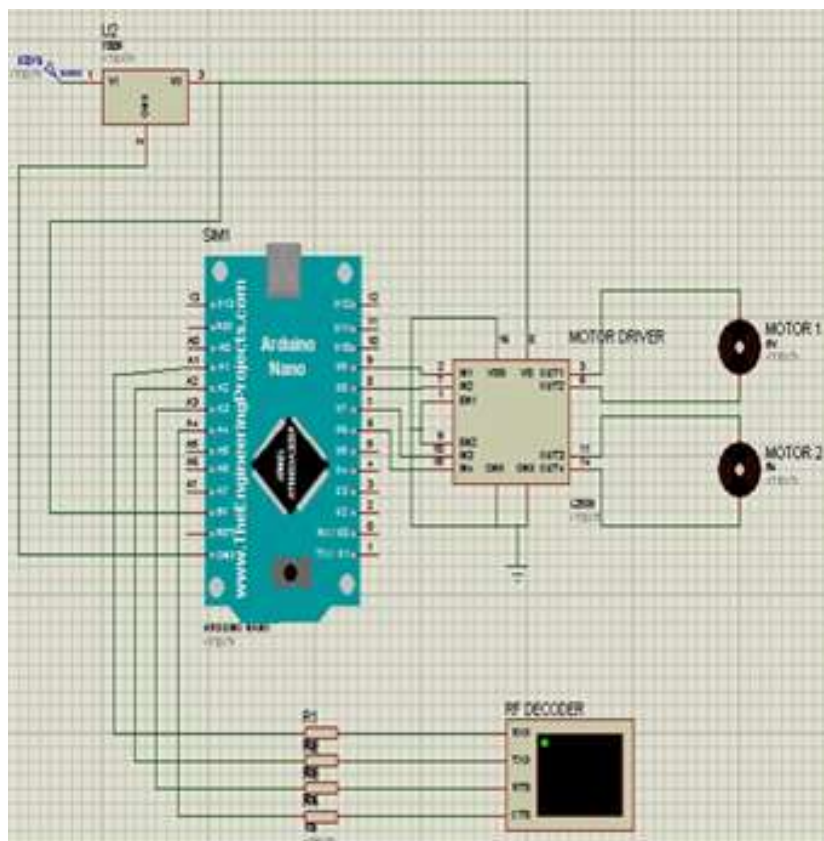


Fig 2: Interfacing Of Motor Driving Circuit

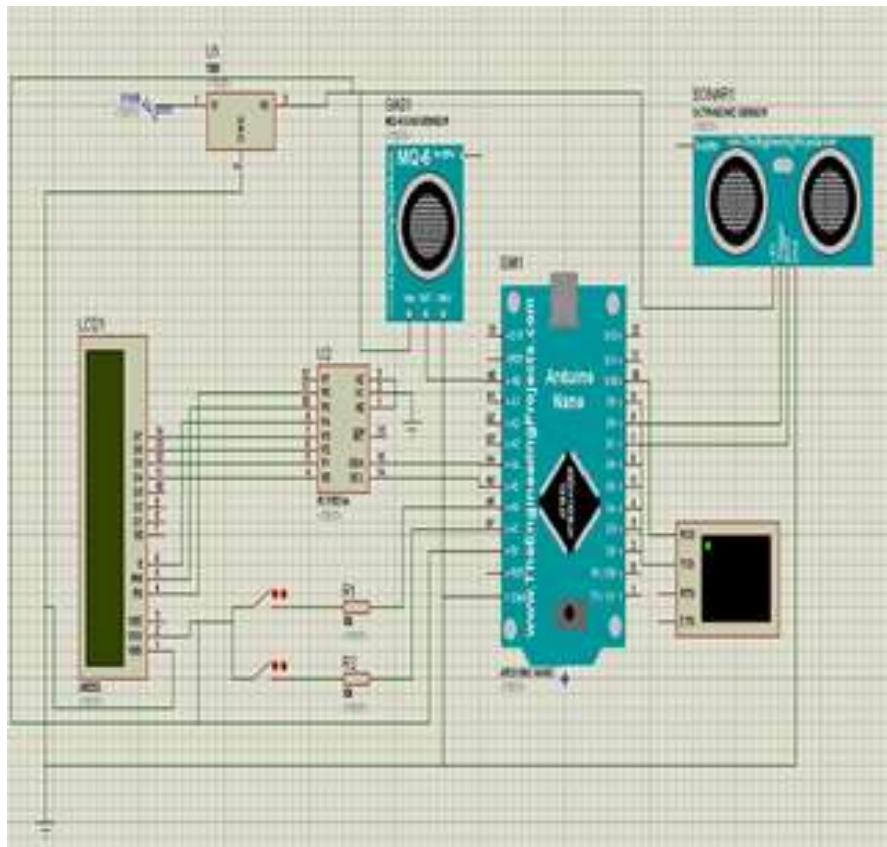


Fig 3: Interfacing Of Wireless Communication Circuit

3.2 Description

Vehicle to vehicle communication for not reachable areas is a wireless data communication based project that enables communication among vehicles travelling in areas where there is no internet or GSM connectivity using RF technology. It is a prototype for wireless transmission of data in which two vehicles are connected using NRF modules so that important information like gas level and accident occurrence of one car can be monitored by another car wirelessly without any GSM or internet connectivity.

It has two broad sections:

- **Wireless Motor Driving and Controlling:**

In this prototype the two vehicles are driven using two separate L293D motor driver ICs. Each L293D IC is interfaced to arduino nano via digital pins D6 D7 D8 D9. The arduino nano is connected to the RF decoder via analog pins A1 A2 A3 A4. The RF decoder is used to control the motion of the vehicle wirelessly. Its counterpart, the RF encoder works as a wireless remote having four buttons for the movement of the vehicle to right, left, forward and reverse directions. For two vehicles two sets of RF encoder and decoder are used, working on two different frequencies i.e. 315 MHz and 433 MHz for two vehicles respectively. The supply is given to the system via a 7805 regulator which ensures that all the components i.e. arduino nano, RF decoder and L293D IC get a supply of +5V each. The RF encoder is operated using a 12V dc battery.

- **Wireless Communication:**

In this prototype two vehicles communicate with each other wirelessly using NRF 24L01 module. This module is interfaced with the arduino nano via digital pins D9 D10 D11 D12 D13. The connections are made as the digital pins of arduino i.e. D9 D10 D11 D12 D13 are connected to CE,SCN, MOSI, MISO, SCK pins respectively of NRF module. Apart from this a 3.3V supply from the arduino is given to the VCC pin of the NRF module.

Two types of data information's are exchanged between the two vehicles using full duplex mode of communication. The two data information's are Gas level monitoring and Accident occurrence monitoring. Each vehicle has a MQ-6 gas sensor interfaced to the arduino nano via analog pin A0 and a HCSR04 ultrasonic sensor module interfaced to the arduino nano via digital pins D7 and D8. D8 pin of arduino nano is connected to TRIGGER pin and D7 pin of arduino nano is connected to ECHO pin of the ultrasonic sensor respectively. The gas sensor can sense gases like CO, CO₂, Propane and ultrasonic sensor can sense any obstacle within a desired range. If the gas level exceeds beyond normal range or the vehicle strikes any obstacle in its way, another vehicle connected to this vehicle can monitor this information. Both the sensors are provided with a +5V supply via a 7805 regulator.

In order to display the received information from another vehicle, a LCD is used that is connected to the arduino nano using I2C chip. The LCD is interfaced to the arduino nano via I2C chip at two analog pins A4 and A5. A4 pin of arduino nano is connected to SDA pin of the chip and A5 pin of arduino nano is connected to SCL pin of the chip. So the LCD occupies only two analog pins of the arduino nano to display the received data information. A +5V supply is given to the LCD through the 7805 regulator.

Furthermore two buttons are also connected to the arduino nano via analog pins A6 and A7 through two 10k resistors. This buttons are kept for future development of the project so that using these buttons, messages like "STOP" and "WAIT" can be exchanged between the two vehicles.

3.3 Working

This project is a prototype that enables communication between two connected vehicles wirelessly, in areas having no internet or GSM connectivity. Here the type of communication used is a full duplex communication. Both the vehicles act as transceivers i.e. both can transmit and receive data information wirelessly.

Each robotic vehicle is driven using a L293D motor driver IC that gets its supply of +5V from the 7805 regulator and the motion is controlled using a wireless RF encoder that acts as a wireless remote. The vehicle can move forward, left, right or reverse depending upon the button we press on the wireless remote. The two vehicles are controlled using two wireless remotes working at two different frequencies viz 315MHZ and 433 MHZ.

When the vehicles are given a +12V supply via a dc 12V battery or a 12V ac adapter connected to ac mains supply, the whole network becomes functional. Each component gets as +5V supply from the regulator and is turned ON. Whenever gas level in one vehicle exceeds beyond normal, the gas sensor senses this input information and passes this information to the arduino nano of that very vehicle. The microcontroller (arduino nano) sends a signal to the NRF module which transmits this information via air medium using the RF waves. The antenna of NRF module of the other vehicle receives this information or we can say it detects the RF signal and then passes it to the arduino nano of that vehicle. The microcontroller processes this information and sends a signal to the LCD display module and the message "GAS LEVEL EXCEEDED" is displayed on the LCD module of this vehicle. The vice versa is also true. So whenever the gas level exceeds in one vehicle, another vehicle connected to it gets the information and can go to rescue the travelers in that vehicle.

Similarly, whenever one vehicle encounters an obstacle, the ultrasonic sensor of that very vehicle senses the distance of the obstacle which the vehicle has encountered and based upon the measurement of the distance, it senses whether an accident has occurred or not. If the obstacle is present at a distance less than 10 cm (for this prototype), the ultrasonic sensor sends a signal to the arduino nano of that vehicle about the occurrence of the accident. The arduino nano passes this information to the NRF module which sends this data information as a RF signal via the air medium. Another vehicle connected to this system receives the RF signal via the antenna of the NRF module and the module passes the signal to the microcontroller of that vehicle. Then the microcontroller upon receiving this data information, passes a signal to the LCD module and a message "ACCIDENT OCCURRED" is display on the LCD of that very vehicle. Since it is a duplex mode of communication, so vice versa is also true. So we can conclude that if accident occurs in one vehicle, the vehicle connected to it can get the information about the occurrence of accident and can come to rescue the travelers of the said vehicle.

Furthermore, two buttons are also attached to the system that could be used in future to send data messages like "WAIT FOR ME" or "HELP" or "STOP AT A FUEL STATION" etc. When one vehicle presses a button, a particular type of message would be displayed on the LCD of another vehicle. So that in areas of no connectivity, the two vehicles can remain connected.

3.4 Result

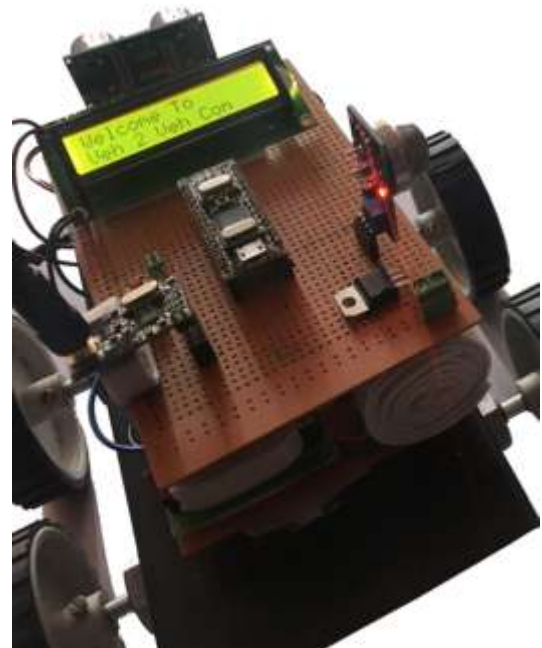


Fig 4: LCD Display When Power Supply Is On



Fig 5: Information Of Accident Occurrence Of One Vehicle On The Second Vehicle.

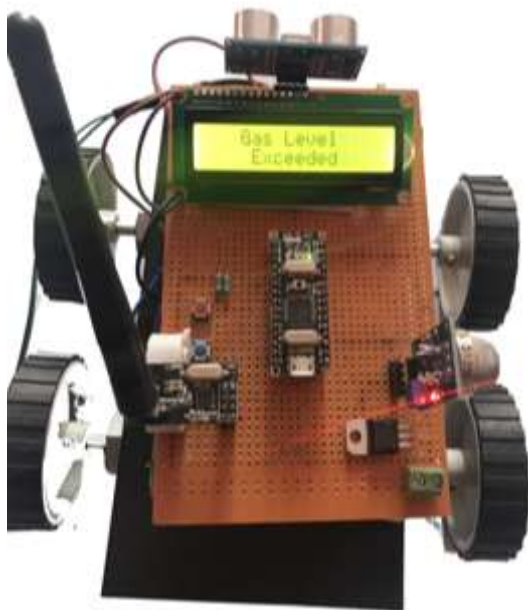


Fig 6: Information Of Exceeded Gas Level Of One Vehicle On The Second Vehicle

4. CONCLUSION

This project sums up the performance of V2V communication based on wireless transmission in realistic urban areas. It evaluates the capability of the connected vehicles using wireless communication and almost 87% of the time valid status of information is communicated. The distance of incident information propagation and speed estimation are used to measure the performance of the connected vehicles in both peak and non-peak hours. The information for each level is pre-determined. Thus, this project will be useful for any emergency assistance and decision making to improve the current transportation system, wholly based on sufficient wireless communication established between connected vehicles.

FUTURE SCOPE

Future research in this area would analyze some more factors affecting the performance of connected vehicles. The work can be extended to monitor the traffic pattern, road networks and include real-time traffic information to make the travelers' journey easy. The wireless communication signal interference can become one major work of research with focus on packet loss and delay to represent the real-time connected vehicles.

ACKNOWLEDGMENT

In the present world of competition there is a race of existence in which those having a will to do so will come forward and succeed. A project is like a bridge between theoretical and practical working and with this will, we joined this project. The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without mentioning the people who make it possible, whose constant guidance and encouragement crown the effort with success. We ought to pay regards to this institution which provided us a platform and opportunity to display our skills through medium of Projects and Research. We express our deep gratitude to our guide and Head of the Department, Er. Manzoor Ahmad Mir for providing a medium to pursue this Project Work accompanied with time to time guidance and constant support.

The statements made herein are solely the responsibility of the authors and we would like to thank all the authors who made their contributions in writing this paper.

REFERENCES

- [1] Hughes, JM, "Arduino", Arduino: A Technical Reference
- [2] Suthaputchakun.Chakkaphong, Sun.Zhili, "Routing protocol in intervehicle communication system", IEEE communication magazine, Volume: 49, Issue:12, December 2011
- [3] Dresslere.Falko, Hartensein. Hannes, Altintas.Onur, Tonguz. Ozan, "Intervehicle communication", IEEE communication magazine, Volume: 52, Issue: 6, June 2014
- [4] Agarwal,Tarun, "Different types of resistors and its applications", Kits And Solutions, September 14, 2016
- [5] S Biswas, "Vehicle-to-Vehicle Wireless communication protocol for enhancing highway traffic safety", Communication magazine, IEEE publication Date: Jan 2006 Vol: 44, Issue 1
- [6] MD Dikaiakos, S.Iqbal, T.Nadeem, L.Iftode, "VITP: An Information Transfer Protocol for Vehicular Computing"
- [7] Ron, Rakesh Mondal, " L293D Motor Driver", Ron Robotics, August 16,2013
- [8] Bin Hu and Hamid Gharavi, "A Joint Vehicle-Vehicle/Vehicle-Roadside Communication for highway traffic safety", Hindawi Publishing

Corporation, International Journal of Vehicular Technology, Volume: 2011

- [9] X. Yang et al., "A Vehicle to Vehicle Communication Protocol for cooperative collision warning," Proc. 1st Annual International Conference Mobile and Ubiquitous System Networking and Services, 2004

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