

# Real Time Full Duplex Message Service with Adaptive Vehicle Lighting System

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**Abstract:** Real time full duplex message service with adaptive vehicle lighting system is a wireless data communication based project that enables communication between two or multiple devices in areas where there is no internet or GSM connectivity using RF technology plus it prevents day by day increasing accidents by providing smart adaptive lighting and alcohol detection for modern vehicular systems. It is a prototype for wireless transmission of data in which two devices are connected using nRF modules having a range of approximately 600 meters so that important information can be transferred among them without any GSM or internet connectivity. Since non availability of existing systems leads to social isolation thus the main aim of this prototype is to enhance, design, examine real time Bluetooth based full duplexed communication. The data or message from one device is transmitted via wireless medium and is exposed to view on LCD of another device. So microcontroller like Arduino NANO is used for the general interfacing and coding of the connected devices. In addition to this there is adaptive lighting system which is an inventive technology that controls the focusing direction and lighting distribution of the low beams as per the turn while driving on curves. This feature also over powers the glaring of incoming lights during night driving thereby reducing the number of accidents that occur. Alcohol detection sensor automatically detects the alcohol content via buzzer if the driver is drunk and the car is stopped manually thereby reducing the chances of accidents.

**Keywords:** Real time full duplex, wireless communication. Bluetooth. nrf, Arduino NANO

## I. INTRODUCTION

### A. Full Duplex Bluetooth Messaging

Real time full duplex communication is a wireless network in which the connected devices send messages to each other. It is a two way communication that can occur without any support of the network. Full duplex message service is an non invasive network which does not require GSM or internet for connectivity. This non invasive network is based on Bluetooth which can be used for long range communication upto the range of 600 meters approximately. Its range can be extended with the use of multiple repeaters which will have some threshold standards in order to amplify the signal. Bluetooth provides communication on low cost and on low power basis. Bluetooth is integrated into android which is a recognized smart phone platform as a means of mobile communication.

### B. Adaptive Vehicle Lighting System

Adaptive Vehicle Lighting System is an innovative technology where headlights turn according to the steering wheel adjustments. Standard headlights react to speed, elevation of the car and automatically adjust to illuminate the roads ahead. This feature also controls glaring of incoming lights during night driving thereby reducing the number of accidents. [2] Adaptive lighting system is a safety technology which are designed to make driving at night or in low light conditions safer by increasing visibility around curves and over hills.

Adaptive headlights are made up of various components that are examined and controlled by a microcontroller.

### C. Alcohol Detection System

Alcohol detection system is a system with vehicle controlling technique. In this system, a sensor is fixed near the driver's seat and the sensor automatically detects the alcohol content if the driver is drunk. Sensor connected to the microcontroller gives a high pulse to the buzzer circuit which generates an alarm. [3] Initial warnings are given to alert the driver and the other members in the car. It provides automatic safety system for vehicles and reduces many accidents that happen due to alcohol consumption of driver.

## II. GENERAL BLOCK DIAGRAM

The overall system is divided into two parts:



Figure1: Sender or transceiver 1

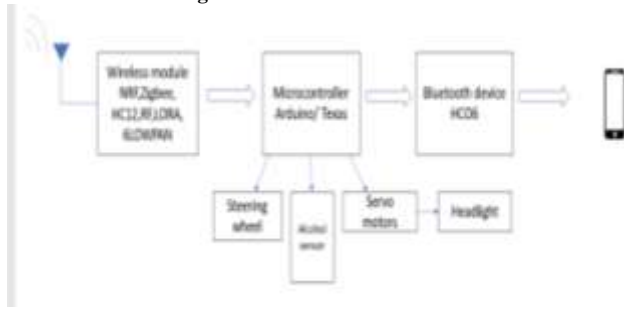


Figure 2: Receiver or transceiver 2

The above diagram is a general block diagram of Real time full duplex message service with adaptive vehicle lighting system. The main components of this system are:

- HC05 Bluetooth Module.
- Arduino NANO microcontroller.
- NRF 24L01.
- MQ-3 Sensor.
- Potentiometer.
- Servo Motors.
- Light Emitting Diodes (LED)
- Liquid Crystal Display (LCD)
- Piezo Buzzer.

### III. FUNCTIONALITY

#### A. Description

Real time full duplex message service with adaptive vehicle lighting system is a wireless data communication based project that enables communication between two or multiple devices in areas where there is no internet or GSM connectivity using RF technology plus it prevents day by day increasing accidents by providing smart adaptive lighting and alcohol detection for modern vehicular systems.

It has three broad sections:

1. Real time full duplex message service using Bluetooth:

In this prototype, HC05 Bluetooth module is interfaced with Arduino NANO on both transmitter and receiver side. HC05 has six pins, out of which only four pins are connected to Arduino via digital pins D3, D4, Vcc and Gnd. Arduino NANO is also interfaced with NRF24L01 via digital pins D9, D10, D11, D12 and D13. The NRF module helps in the long range wireless transmission of data or message with the help of SPI communication. The message is displayed on LCD JHD204A via analog pins A1, A4, A5.

2. Adaptive Vehicle Lighting System:

In this innovative technology, two servo motors are used and interfaced with another Arduino NANO via D2 and D3 respectively. Furthermore, to depict the adaptive headlights two light emitting diodes are used which are also connected to the same Arduino NANO through Vcc and Gnd. Rheostat is used which act as steering angle sensor for adaptive vehicle lighting system. It is also interfaced with the above mentioned Arduino NANO via analog pin A1.

3. Alcohol Detection System:

Alcohol detection system uses MQ-3 sensor for detection alcohol content. MQ-3 sensor is interfaced with Arduino NANO via four pins A0, D0, Gnd, Vcc. A piezo buzzer is an electronic device used to produce siren. It is also interfaced with Arduino NANO.

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#### B. Working

This project is a prototype in which communication is possible between any two devices wirelessly without the need of any cellular network connectivity. It is a real time full duplex communication. Both the devices act as transceivers that is both can transmit and receive data simultaneously. Also there is a feature of adaptive vehicle lighting which controls the movement of headlights with the help of steering wheel. The excess alcohol content is also governed by the buzzer.

The whole network becomes functional once the power supply is turned ON.

At TRX 1: First, smart phone will be used which will have a messaging application. Then the message is typed on a smartphone 1 and the smartphone is connected to Bluetooth device version 2.0 via Bluetooth connection. And in this way data is transmitted to Arduino NANO microcontroller serially. Then the wireless module is initialized and the wireless transmitter will transmit the message into free space.

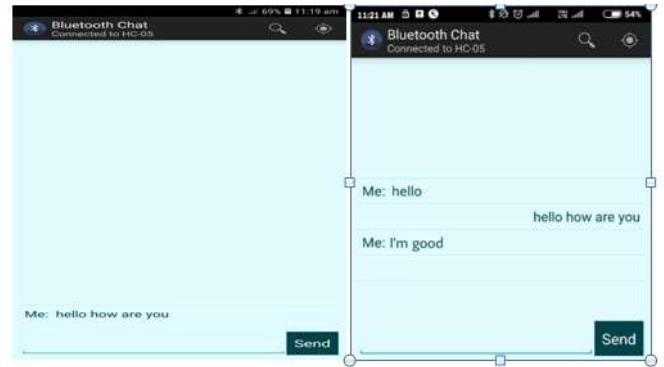
At TRX 2: The wireless module is initialized, then it waits for the incoming data from TRX 1 then the data is serially received. Bluetooth device is initialized and serial data is received through Bluetooth and then we can see the incoming data on smartphone 2.[1]

Meanwhile, microcontroller also controls adaptive headlights with the help of manual rotation of steering wheel. The rotation of servo motors are controlled by the potentiometers which acts as steering wheel. It includes a function called servo attach which is used to indicate that servomotors are attached to which pin of the ARDUINO. When the analog pin is read that is Pot= analog read(A1), the value present at potentiometer will be available at A1. Whenever some value is sent to the SIGNAL PIN of servo motor it will get deflected by that amount and will rotate. The headlights can turn left or right accordingly.

Microcontroller also monitors alcohol content of a driver and when the alcohol percentage crosses a threshold level, sensor awares the owner of the vehicle or to his/her family members via siren through buzzer. When the alcohol level sensed by the sensor is below the threshold level, then there will be no siren generated by the buzzer. And the message can be displayed when connected to serial PC monitor, 'NORMAL DRIVING DRIVER ALERT'

### I. RESULT





## V. CONCLUSION

This project sums up that a non invasive network can be used during the non availability of any mobile network. This feature of a two way establishment of communication enables Bluetooth chat between two devices. Further it can be integrated into smart phones as well as in vehicles. It also provides long range communication based on low power and low cost. The proposed project also incorporates an additional feature of rotating headlights near curves. Due to this the user is able to sufficiently illuminate the path and avoid many accidents and can be effectively utilized only if it is universally accepted and incorporated in all the vehicles.

The project also provides an effective solution to develop an intelligent system for vehicles for alcohol detection whose core is Arduino. Since sensor has fine sensitivity range around 2 meters, it can suit to any vehicle and can easily be hidden from the suspects. The whole system has also an advantage of small volume and more reliability. As the growing public perception is that vehicle safety is more important, advances in public safety is gaining acceptance than in the past.

## ACKNOWLEDGEMENT

Presentation, inspiration and motivation have always played a key role in the success of any venture. We joined this project with a will to fill the gap between theoretical and practical work. This project is our hard work, will and commitment towards our aim. We take this momentous opportunity to express our heartfelt gratitude, ineptness and regards to all the authors mentioned in this paper. All the authors that are listed in the paper have done an equal amount of work and have equally contributed in this paper. The success and final outcome of this project is due to the utmost dedication shown by all the authors. We pay regards to our institution for providing us an opportunity and platform to present our talent and skills through a medium of Projects and Researches.

We thank all the authors who made their contribution in writing this paper.



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