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# Soundless Horn using Radio Communication and Accident Monitoring using IoT

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## Abstract

One of the major jeopardies that affect the quality of life in metropolitan cities is noise pollution caused by vehicles. The vibration of the vehicle's body along with the sound of its engine running produces a vehicular noise. In addition to this vehicular noise, the noise produced by the horns mainly contributes to the noise pollution. The fundamental idea of this proposed system is to develop a soundless horn system and accident monitoring system. Soundless horn system can be developed by using a radio communication module to transmit and receive horn in the form of messages between the vehicles. This effectively reduces the sound of the horn, thereby reducing noise pollution. In addition to the soundless horn system, an IoT system is developed to detect the occurrence of accidents. An emergency vehicle awareness system is also developed to notify the driver about the arrival of emergency vehicles in a high traffic area. By this proposed system, the traffic can be cleared for the emergency vehicle.

**Keywords:** Radio communication module, IoT system, Emergency vehicle awareness system.

## 1. Introduction

India has a cohesive and well-organized transportation network. Numerous difficulties with road safety exist in India, including traffic congestion, emergency vehicle delays, noise pollution from horns, and road accidents. It has been reported that around 70% of noise pollution in the cities is caused by just pointless honking. A normal car releases around 85 dB of noise and a bike releases around 90 dB of noise. Also, noise pollution leads to serious health threats like hearing loss, increased stress levels, insomnia, hypertension and many more.


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According to official statistics from The Transport Research Wing, 1,31,714 persons were killed and 3,48,279 injured in road traffic crashes in India in 2020. In some cases, these victims get deceased due to failing patients transferring to hospital on time. These may be due to delay of ambulance service and traffic. Therefore, as a solution for the above cases soundless horn system is introduced in this research. This proposed system introduces a simple radio communication system that incorporates functions that aim to reduce noise pollution in traffic while providing features that aid in smooth traffic and traffic monitoring. A simple radio communication between vehicles and the control unit is implemented. The objective is to design an efficient soundless horn and accident monitoring system for the vehicles in order to reduce the noise pollution caused by vehicular horns and to prevent patient fatalities due to an emergency vehicle's late arrival at the hospital.

## 2. Literature Review

### 2.1 Soundless horn using Ad-hoc network

Vikas Sharma et al., used an ad-hoc network to transfer wireless data that will notify the drivers about signals which they use to convey each other just like the way the horn works. Cluster based routing protocol was used in the work because it provides effective communication for vehicular ad-hoc networks. The protocol helps to reduce the overhead involved in the network and delay of the network thereby increasing the safety of the vehicles, which ensures the highest packet delivery ratio [7].

### 2.2 Greenhorn novel design of honking to reduce the effect of noise pollution

Nikhil Nerkar et al., replaced the inherited honking method with the combination of transceivers and the low-intensity horn that produces low level of sound and signal to the vehicle receivers that are within range, and the direction was provided to the driver using the visual dashboard [8].

### 2.3 Solution for noise pollution and pothole detection

Priya Bhandare et al., control the horn of a vehicle in restricted areas (such as schools, parks, hospitals, old age homes, college, government offices) automatically using the current location of the vehicle. GPS offers the location information and the software helps in identifying the no honk zones and intimates the Arduino to adjust the honking sound; the adjustment returns to normal once the vehicle is out of the no horn zone. Along with this, an

additional feature, Pothole Detection was implemented using ultrasonic sensors for minimizing accidents [9].

### 2.4 Soundless horn system

Swapnali et al., designed a kit for vehicular honking to produce a soundless horn and avoid collision in the hilly areas. The intelligent transport system offered a base station to vehicle, and the vehicle to vehicle communication utilized an embedded transceiver [10].

## 3. Basic Working Methodology

A soundless horn using radio communication consists of four units namely Vehicle Unit 1, Vehicle Unit 2, Control Unit and Emergency Unit. The working of the vehicle unit 1 and 2 represent the general traffic in the road. The communication between vehicle to vehicle takes place. Whenever the driver presses the horn from vehicle unit 1, the signal is sent to the other vehicles within the range of 100 meters. The radio communication module has 125 channels. Each channel has 6 different addresses and it can be able to communicate with the vehicles, and it acts as both transmitter and receiver. In case of any accident, if the value is above the threshold value, the message is sent to the registered mobile number through IoT along with the details of the vehicles. The function of the control unit is to transfer and receive the signal to and from the adjacent control unit which is installed in the road side and also the vehicles. The function of the emergency unit is represented in high traffic and when the ambulance driver presses the horn instead of siren, the signal is sent to the control unit and that control unit sends the signal to the adjacent control unit and also to the nearby vehicles. Hence, it takes less time to get out of the traffic.

### 3.1 Flow chart

The flowchart of the proposed soundless horn using radio communication and accident monitoring using IoT is shown in figure 1.

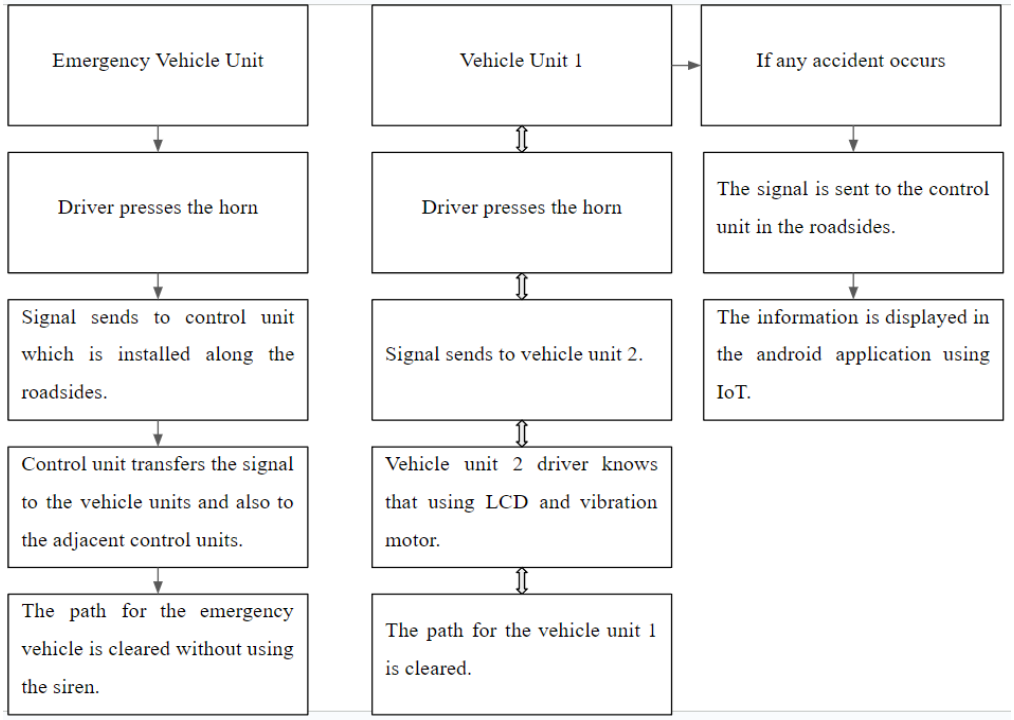


**Figure 1.** Flowchart of the proposed system

### 3.2 Components Used

The proposed system uses Arduino UNO, LCD with $I^2C$, NRF24L01 module, vibration sensor, push button, vibration motor and Wi-Fi module.

#### A. ARDUINO UNO

Arduino UNO is one of the microcontroller-based boards where the USB is present in the Arduino in order to connect it to the computer. The microcontroller-based board used is ATmega328P. It has 14 input output pins, 6 analog input pins, extra power jack port and also a reset button. In order to interface the computer to the Arduino, a software is used which is called Arduino IDE. The software supports programming languages like C, C++ etc.

#### B. LCD WITH $I^2C$

LCD is used along with the integrated circuit in order to reduce the number of pins connected to the Arduino. The LCD used is 16x2 display; the backlight is green and the character color is black. The integrated circuit has the interfacing address of 0x20 to 0x27. The integrated circuit is interfaced at the back of the LCD. The information is displayed using the LCD.

### C. NRF24L01 MODULE

NRF24L01 is one of the radio communication modules which is used in this proposed system. It has features like 125 channels; each channel has 6 different addresses and can communicate within the range of 100 meters. The frequency range is 2.4 to 2.5 GHz. It acts as both transmitter and receiver, and so it is called a transceiver.

### D. VIBRATION SENSOR

Vibration sensor used is SW-420. It is used to detect collisions that take place within the vehicles in the road. It has a comparator and a potentiometer. The comparator is used for detecting the collision over a threshold level and the potentiometer is used to set and control the threshold value in the sensor.

### E. PUSH BUTTON

Push button is used in this proposed system as a horn in the vehicles. It is one of the types of switches which is used to short or complete the circuit once it is pressed. It allows the signals to pass.

### F. VIBRATION MOTOR

Vibration motor used here is a coin type motor which is excited by a DC source voltage of 3V. It is placed in the steering of the vehicles and if any signal is received, the steering will vibrate.

### G. WI-FI MODULE

The Wi-Fi module used is ESP8266. It is one of the standalone wireless transceivers used to connect to the internet. It is mainly utilized for the IoT applications. It primarily uses the TCP/UDP communication protocol for connecting to the server.

## 3.3 Working

The proposed system of soundless horn using radio communication has four units, they are vehicle unit 1, vehicle unit 2, emergency vehicle unit and control unit.

### A. VEHICLE UNIT

Vehicle unit 1&2 represent the vehicles in the road. Vehicle unit consists of Arduino uno, NRF24l01 module, vibration sensor, LCD, push button, vibration motor, and ESP8266 Wi-Fi module. Whenever a horn from vehicle unit 1 is pressed, it uses radio

frequency to transmit it to vehicle unit 2 and other vehicles within its range. And the message “horn detected” is displayed in the LCD. Once the message is received, the vibration motor vibrates which alerts the driver. In case of any accident, if the value is above the threshold value, the message “accident detected” is sent to the control unit and to an application through IoT along with the details of the vehicle.

### B. CONTROL UNIT

Control units are installed along the roadside at an interval of 100m. Control unit consists of Arduino uno, NRF24l01 module and LCD display. This unit helps to collect the information of the vehicles involved in accidents and it also helps to clear the pathway for emergency vehicles.

### C. EMERGENCY VEHICLE UNIT

Emergency vehicle units are installed in emergency vehicles like ambulances. Whenever an emergency vehicle approaches a traffic area, the horn from the vehicle is passed to the control unit and from the control unit the information is passed to the vehicles of its range and to the next control unit, so that the path for the ambulance is cleared.

## 4. Results and Discussion

### A. VEHICLE UNIT 1

Fig.2 shows the output of vehicle unit 1. Vehicle unit 1 uses radio communication to display the message in the LCD when it gets signal from Vehicle unit 2 or the Control unit. Vehicle unit 1 LCD shows "HORN DETECTED" when it gets a signal from Vehicle unit 2.

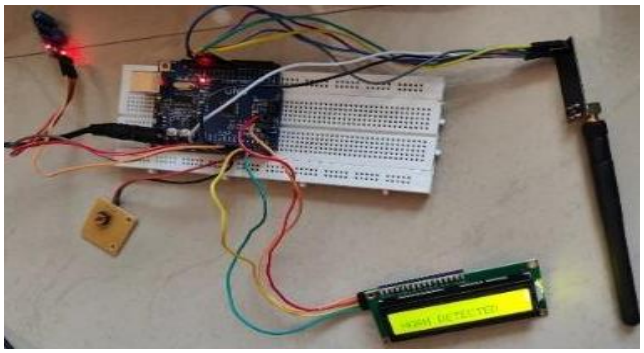

**Figure 2.** Vehicle Unit 1 Output

## B. VEHICLE UNIT 2

Vehicle unit 2 uses radio communication to display the message in the LCD when it gets a signal from Vehicle unit 1 or the Control unit. Vehicle unit 2 displays "HORN DETECTED" in the LCD when it gets a signal from vehicle unit 1.

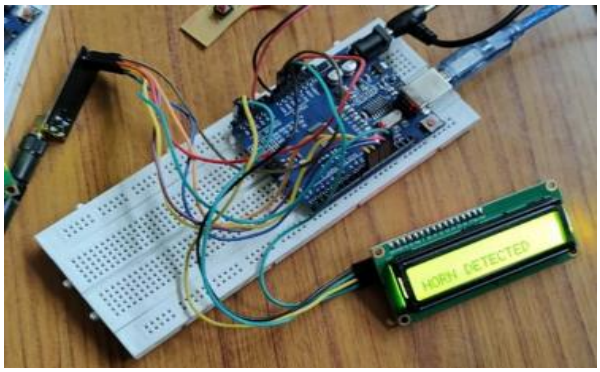


**Figure 3.** Vehicle Unit 2 Output

## C. CONTROL UNIT

When an accident happens in a vehicle, the vibration sensor in the vehicle uses the pre-set threshold level to detect the accident and sends the signal to the control unit that an accident has occurred.

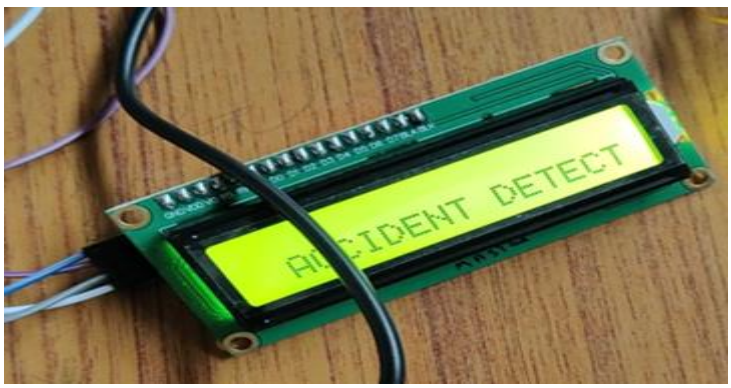


**Figure 4.** Control Unit Output

## D. EMERGENCY VEHICLE DETECTION

The control unit, which is installed along the roadsides, receives a signal from the ambulance when the ambulance approaches a high traffic area. The signal is sent from the control unit to all the vehicle units that are in its range.

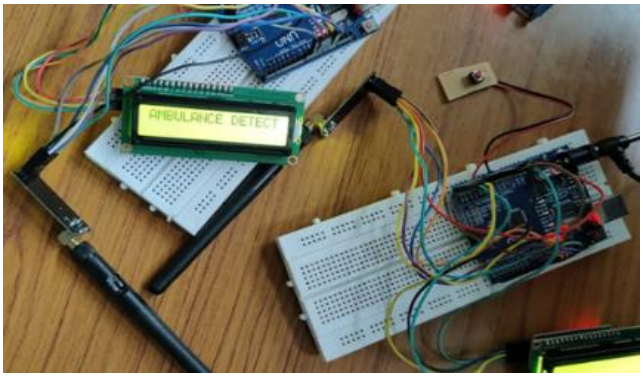


**Figure 5.** Emergency Vehicle Detection Output

## 5. Advantages

The advantages of soundless horn using radio communication and accident monitoring using IoT are given below.

i. This system reduces noise pollution.

ii. Alerts the driver without making loud noise.

iii. Monitors the accident and the system helps the victim immediately.

iv. People with hearing disabilities can use the system more efficiently.

v. Vibration motor used in the system alerts the driver more precisely.

vi. Improves the traffic condition.

vii. Clears the traffic for emergency vehicles.

viii. Cheap to construct and install.

ix. Robust and reliable.

x. Flexible and additional features can be easily added.

## 6. Conclusion

The development of a soundless horn using IoT has been a successful research. The proposed system warns the vehicle drivers without causing noise pollution. The system uses IoT technology, which helps to communicate effectively with other vehicles and for

monitoring accidents. This work has highlighted the potential of IoT technology in solving real-world problems faced by society today. It is evident that technology can help create a sustainable future by addressing environmental challenges. The soundless horn is a valuable addition to the automotive industry and has the potential to revolutionize the way of driving. It is crucial to prioritize sustainable solutions when developing new products and technologies, and this research is an example of that. The IoT technology will continue to play a vital role in developing environmentally friendly solutions. In summary, the design and development of a soundless horn using IoT is a significant step towards achieving this goal. When the smart horn system is created with the intention that it would improve the entire transportation system, the entire system will change once the system is fully implemented while interacting with the location. SOS signals can be sent to the nearby vehicles in case of an emergency. The proposed system can also be further developed to indicate the direction of the incoming horn signal.

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