International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue X, Oct 2018- Available at www.ijraset.com

Green Horn: Novel Design of Honking to Reduce the Effect of Noise Pollution

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Abstract: ***The increasing levels of noise pollution are a major cause of concern for the environment and human health. One of the more prominent causes of the same is the harsh and loud sound created by the vehicular honks. In this paper, we propose a new honking mechanism, would considerably reduce noise pollution caused due to the blowing of horns. This new system does not compromise on the safety of people in and around the vehicle. The proposed system does not suggest the elimination of the current horn system, instead, it operates in coexistence. We will discuss the various ways of implementing the proposed system, its effectiveness, and feasibility.***
Keywords: Honking, silent horn, GreenHorn, noise pollution, horn, vehicular traffic

I. INTRODUCTION

The world is advancing at a rapid pace with the advent of technology and it becoming a part of our day to day lives. We are a massively growing generation and this massive growth comes with a hefty price tag. We pay in terms of three grave problems, namely: population, poverty, and pollution. If these problems persist, pollution will be the one that will adversely affect the present generation and many more to come, including us. Due to industrialization and extreme urbanization, the levels of noise pollution have been soaring. As a result, noise pollution is now a major concern in urban areas, unsurprisingly having numerous hazards.

The crux of noise pollution lies in the trinity of vehicular, railway and air traffic noises. Starting off with vehicular traffic, honking happens to be an integral part of it. Notably, vehicular traffic and honking noises contribute to 55% of the total urban noise. Due to the sizable increase in the number of vehicles (public as well as private), the widespread expansion of road network, along with urbanization and industrialization majority of the cities in India have been battling noise pollution [1].

Honking is a common occurrence in urban as well as semi-urban areas, irrespective of traffic, road types and conditions [2]. The intention behind using a horn is to alert the vehicles or people in the vicinity of the vehicle. However, an unwarranted use of the horn creates a high-intensity noise signal. This sound may shake up or negatively affect active drivers and passengers of surrounding vehicles, pedestrians and people living in that area. If the sound level is greater than 120 dB, it has been found out that it may result in undesirable diseases like Hypertension and Insomnia. Certain aspects of the driving mindset such as impatience, anxiety, over accelerating, sudden braking, abiding traffic rules may also aggravate unnecessary honking. The objective of the study is to assess and quantify traffic noise, and the impact of honking on the urban environment. Further on, we will evaluate the available methods and identify their efficiency in reducing noise pollution through honking. [3]

II. EXISTING SOLUTIONS TO REDUCE NOISE POLLUTION

To curb the extreme effects of noise pollution, there are a few existing policies in place. To name a couple, there are established Silence Zones and the usage of High Beam Headlights. Both of these methodologies are briefly discussed below.

A. Existing method 1: High Beam Headlights

To increase road safety at night time, RTO has proposed the use of dipper lights. Drivers can briefly flash their headlights immediately before starting an overtaking maneuver to warn the driver ahead they will be overtaking. This solution also reduces noise pollution through honking as only lights are used. The limiting implementation of this solution is the constraint of night time, thereby reducing its efficiency considerably. Also, when the headlights of oncoming vehicles are flashed directly into the eye, it will cause the pupils to contract and may impact the vision of the driver.

B. Existing method 2: Silence Zones

The Government has laid down Silence Zones with a radius of up to 100m near hospitals, educational institutions, and courts in the city [4]. This pre-existing rule aims to reduce the disturbance caused in the aforementioned places as it completely bans the

vehicular honks, loudspeakers, and burning of firecrackers in these zones. It ensures that the noise levels are up to 50dB during daytime and 40dB during night time. Hence, it has also reduced the levels of noise pollution for the residents in the vicinity of the Silent Zones too. However, the lack of awareness about road signs may result in the lower impact of silent zones.

III.PROPOSED SOLUTION

Our solution proposes the traditional honking mechanism be replaced with a combination of a low-intensity horn along with trans-receivers fitted into vehicles. The honking noise will be broadcasted as a signal which will be caught on by surrounding vehicles. The moment a driver needs to honk in order to alert vehicles ahead, instead of producing a loud noise honk, our proposed system will produce a low-intensity sound, just enough to alert pedestrians and two-wheelers. Along with this sound, the transmitter will simultaneously send a signal which will be caught on by the receivers in other vehicles within a specified range, adapting to the surroundings and traffic intensity. The range will be lower when the vehicle is moving in a city in a slow traffic, whereas it would be much higher on highways or speedy roads. Processing the signal caught by the receivers in the vehicle, the system can indicate the driver that some car is trying to overtake or is honking from a deduced direction. Also, a visual indicator on the dashboard or in the line of sight of the driver which will provide the indication of direction[5].

The proposed solution can be implemented in various ways. These options, as well as their respective advantages and disadvantages, are discussed below:

A. Option 1: Infrared communication

Installing infrared trans-receiver to communicate the horn between the two vehicles.

1) Pros: Low-cost installation

2) Cons: Sensors are to be installed all around the vehicle to cover different driving scenarios. The variation in sizes of vehicles may not allow sensors to be aligned in the same plane. Infrared sensors work in the line of sight and in sync with the transmitter in order to catch the signal to process it further. The limitation being a different scenario every time, as the vehicles on the road might not be always traveling in a straight line for desired sensor communication.

B. Option 2: Bluetooth communication

Installing a Bluetooth module to transfer the data signal between two vehicles for communicating the horn.

1) Pros: Low-cost installation, no major changes in hardware.

2) Cons: Limited range of Bluetooth module makes it useful for transmitting data over short distances, it will have limitations when the distance between the vehicles is beyond 100 meters, such as on highways or speedy roads.

C. Option 3: Radio Waves to communicate

Installing Radio frequency trans-receiver to communicate the horn between the two vehicles [6].

1) Pros: No short-range limit and it can pass through obstacles as the waves are broadcasted in the surrounding.

2) Cons: It is difficult to sense the direction of signal transmission as the radio waves are ubiquitous. Hence, to guess the direction of transmission, the vehicle should be equipped with multiple trans-receivers. On comparing the intensity of the signal received, the system can decide the direction of the incoming transmission from another vehicle. This method has limitations due to its inefficiency when the vehicles are on slopes, like bridges.

D. Option 4: IoT Solution (A combination of GPS and Radio Waves)

Installing a Global Positioning System (GPS) module in synchronization with Radio Frequency (RF) trans-receiver.

The GPS module updates the location of the vehicle in real time. Every time the driver presses the horn, the RF transmitter will transmit the location of the vehicle in surroundings. Other vehicles fitted with the receivers can receive the signal and compare it with the current location of their vehicle, along with the intensity of the signal. Using this comparison, the module will indicate the driver with the location and direction of the transmitter, along with the predicted approximate distance between the two vehicles [7].

1) Pros: No range limit, can pass through obstacles, high accuracy, improved performance with sloppy terrains.

2) Cons: Cost consuming installation compared to others, some changes in car hardware required for implementation.

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IV. PROPOSED TECHNIQUE

Our proposed system would require all automobiles to have an adaptive horn button. This button will act as the regular horn and can be heard by all people in the surrounding with reduced intensity. The other button will activate the proposed GreenHorn. This new system uses radio frequencies (RF) to communicate the horn signal between automobiles. It involves fitting all vehicles with RF trans-receivers for a GreenHorn ready ecosystem. These trans-receivers are to be mounted on the exterior body of the car.

Now let us consider various possible scenarios, wherein a driver would require blowing a horn. The idea is to identify how many sensors are needed and where are they need to be mounted.

Figures 1.1 to 1.5 below depict the various scenarios where the driver of the grey car would require blowing a horn against the yellow car.

Fig 1.1

Fig 1.2

Fig 1.3

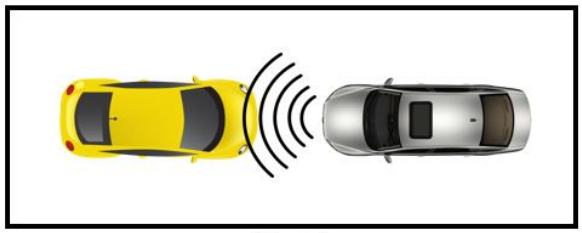

Fig 1.4

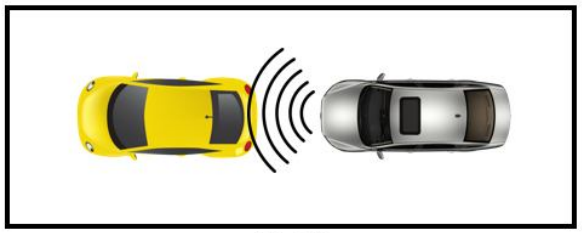

Fig 1.5

The first four cases are regular overtaking or cross junction scenarios, while the last one (Fig 1.5) occurs when the yellow car enters the wrong side of the road or in a narrow lane.

The design (Fig 2) consists of only two trans-receivers which are mounted on the rooftop of the vehicle. This design reduces the possibility of physical damage to the RF modules in case of accidents. Also, it optimizes the number of RF modules, so it is less costly. Only one trans-receiver will act as a transmitter at a time, while the other functions as particularly as a receiver. Normally, the trans-receiver mounted at the front will act as a transmitter unless, the vehicle is moving in the reverse direction, in which case the trans-receiver mounted at the rear end will function as a transmitter.

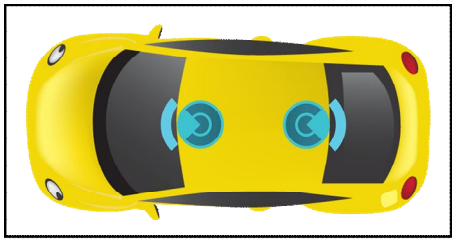

Fig 2

V. WORKING

The vehicle has required RF trans-receivers and GPS system installed. Whenever the GreenHorn is pressed, an RF signal and the GPS coordinates are transmitted by the transmitter. All receivers falling within its specified range will receive this signal along with the current GPS positioning. All receivers are connected to a special buzzer and LED indicator that is fitted inside the automobile to which the receiver is connected. On receiving this signal, the buzzer will blow and the sound will only be heard inside the vehicles, ensuring a reduction in noise pollution. Since a receiver is mounted right adjacent to the transmitter, the horn will also be heard inside the car blowing the horn. This will act as an acknowledgment to the driver, that the horn has been blown [8]. The GPS and RF frequency intensity calculations will result in the generation of an alert in all automobiles within the range of the transmitter. Parallelly, a low-intensity horn will be heard by all the pedestrians and two-wheelers, where this system is not installed.

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VI. APPLICATIONS

Revenue Source: Monetizing advantage of selling GreenHorn integrated with automotive services to manufacturers

E-wallets: Synchronising the car's GreenHorn to integrated IOT system with the user's e-wallet. Consider this, you visit a fuel station and after filling fuel, the attendant passes a message to your car using RFID and you only need to accept the money transfer message through a click on your phone or car dashboard and the payment is transferred through your e-wallet. Similarly, this can be implemented at toll plazas too.

Emergency services: A specialized system can be made for emergency services such as ambulances, firefighting truck and police jeeps where all cars in the lane of that emergency service vehicle will be signalled through GreenHorn to clear the lane without sounding harsh siren to all.

Insurance: There are various big data applications where a driver's behaviour and car statistics can be analysed and linked to insurance, so that safe drivers would receive perks such as paying a lower premium.

Driverless cars and autopilot mode: The driving behavioural analysis and statistics (acquired in earlier applications) can be used to improve the autopilot mode and self-driving cars and the ultimate goal is hornless cars wherein cars communicate with each other without honking to create a noise free road.

VII. CONCLUSION

We conclude that this proposed system, the GreenHorn will significantly help in reducing the levels of noise pollution. This is with regards to the unwarranted noise caused due to the honking of vehicles to a great extent without compromising the safety of people. Most importantly, the proposed system is practically feasible as well as implementable, and its cost will be reduced in mass production.

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