

Soundless Overtaking Vehicle Alarm System

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Abstract: Most Road accidents are as a result of improper driving behaviors. Past studies have shown that the main cause of road accidents is dangerous overtaking. The main confusion in overtaking is the communication between the drivers. It, therefore, brings the need for an effective vehicle horn system that can help reduce the danger during overtaking. The alarm system in most vehicles uses different horn sounds. However, other studies indicate that these horn systems are ineffective while overtaking and they have a lot of drawbacks. In crowded countries like India, these horns create a lot of sound pollution and frustration among people. Therefore, in this project, it is shown that radio wave transmissions can be used to replace the horn system. The findings of this study from practical driver situations show that radio wave signals are far much better than other sound signals. This project might form the basis for consequent design of any vehicle alarm system.

Keywords: Road accidents, Soundless Overtaking Vehicle Alarm System.

1. INTRODUCTION

Overtaking was chosen as the focus of this study, after careful consideration of a number of alternatives. Mainly because it is a kind of dynamic driving behavior which drivers engage in frequently and yet also rated as one of the most dangerous maneuvers to perform. With economic development, there exists convenient traffic and better roads, but road accidents are also constantly increasing. The specific behaviors that may lead to driving errors also include tailgating, maneuvering within traffic, and improper driving (e.g. vehicles passing closer during overtaking). Lack of signals when changing lanes, passing on the road shoulder, and refusing to give way to other motorists may also lead to driving errors. Others include blocking other drivers from overtaking, lack of cooperation with other road users, inability to change lanes and merge because of road situations, over speeding that result in abrupt lane changes, rampant tailgating, hitting stop signals and disobeying traffic lights. But one of the frequent one is miscommunication, where the driver remains unaware that the following vehicle is trying to overtake it.

According to the data from the Ministry traffic of Delhi, the main reason for car accidents is brought about by the driver's negligence (96.07%). The primary causes of a driver's negligence are (20.1%) drunk drivers, (19.5%) lack of attention to the horns, and (13.8%) driver carelessness. Furthermore, the elementary cause of the accident indicated by the data is careless driving, including improper switching of lanes and careless overtaking, (18.8%).

The approximate statistics of injuries (both minor and major) and deaths for the period 2005 and 2015 are given in Table below. The consequent figure indicates the changes in road accident casualties in India in a time span of 45 years. It shows both the fatalities per 100,000 persons and an absolute number of fatalities (bold line).

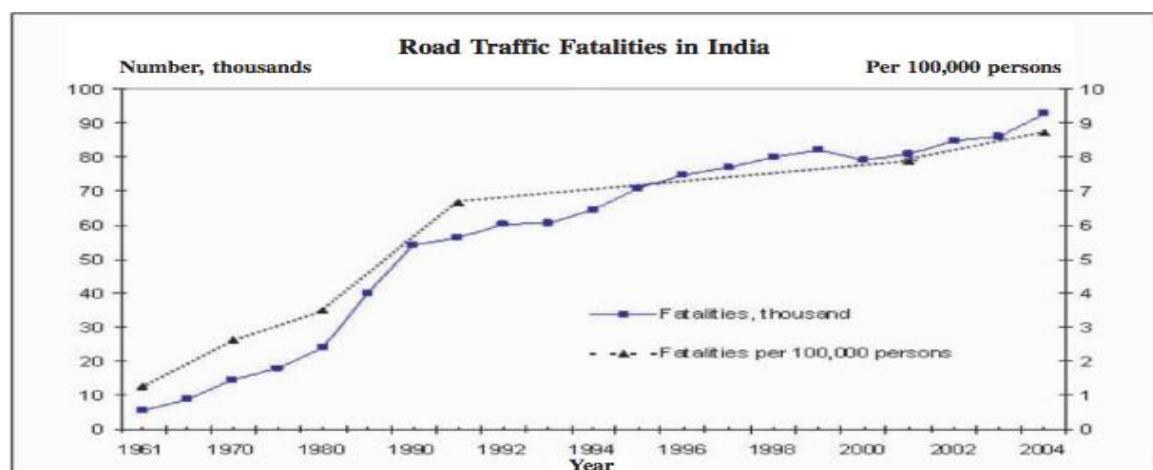


Table 1: Road accident statistics

Year	All roads			National Highways		
	Accidents	Persons killed	Persons injured	Accidents	Persons killed	Persons injured
1999	3,86,456	81,966	3,75,051	1,03,839	28,713	98,427 (P)
2000	3,91,449	78,911	3,99,265	1,10,508	30,216	1,24,600
2001	4,05,637	80,888	4,05,216	1,15,824	32,108	1,19,592(P)
2002	4,07,497	84,674	4,08,711	1,31,738	33,621	1,32,307
2003	4,06,726	85,998	4,35,122	1,27,834	33,153	1,31,102
2004(P)	4,29,910	92,618	4,64,521	1,30,265	34,723	1,43,140

Table 2: Estimated road accident statistics for the years 2005 and 2015

Year	No. of deaths	No. of serious injuries	No. of minor injuries
2005	1,10,300	22,06,000	77,21,000
2015	1,54,600	30,92,000	1,08,22,000

From the information provided by the ministry, it reveals that car accidents usually occur when a driver want to overtake other vehicles. The reason for this situation is that drivers sometimes can't see the following car from the side mirror or review mirror. The existing communication systems (i.e. sound signals) are not sufficient to provide drivers enough information to avoid these accidents. It, therefore, creates a need to provide efficient driver alarm signals that might help to prevent these accidents. Radio wave alarm transmission system provides an alternative to the sound system.

While driving, the driver's actions are influenced by various aspects of the traffic environment such as motion of other road users, width of the road, and road encroachment. It is assumed that driver's actions are influenced by two main factors: safety during travel and need to reach destination on time. The driver achieves this through acceleration or deceleration and steering thus maneuvers the vehicle effectively. Most of the time drivers focus on either steering or acceleration, so this is the point where fellow vehicles attack to gain the attention of the driver making them aware that they are going to overtake. Radio wave transmission alarm system allows a driver to driver communication thus there is no chance of miscommunication. Drivers cannot ignore this message because there will be a mild vibration in their hand when they receive the message and they could also reply by glowing LEDs, situated at the back of the vehicle.

2. METHOD

How this works:

The concept of this project is that during overtaking rather than making sound signals vehicle will use radio waves to communicate among themselves. If a car wants to overtake a truck or wants to change a lane, then the oscillator (transceiver) present in car's front part will produce radio waves with the help of transmitter, and then these waves will be collected by the receiver present in truck's rear part. Then the receiver of the truck will send these signals to the steering (handle) of the truck through electric means. Consequently, the vibrator present in steering will work and will produce a mild vibration in driver's hand. And when the driver stops this vibration the LED lights will glow in the rear part of the truck that signifies that driver got the message that the car wants to overtake.



Transceiver and Antenna:

In this project transceiver is used, A transceiver is a device made of both a receiver and a transmitter, and they are combined to have common circuitry. LED circuit and a vibrator are also attached to this circuitry.

An antenna’s physical properties, for example, the orientation, type, shape, size, and design might have a big influence on the effectiveness of an alarm system. One of the major constraints in ISM applications is form factor. It can, therefore, dictate which radio to use or the frequency band chosen. There are many forms of antennas, from simple $\frac{1}{2}\lambda$ dipoles and $\frac{1}{4}\lambda$ monopoles, to loop, F and many more. They can also be sampled as M-field or E-field depending on the type of current they use. Antenna design is an art of its own. The initial step in choosing an antenna is to find the longest dimensional length allowed concerning the limiting factors of the system and how to use a physically attached antenna and a “trace.”

TABLE 1 : ANTENNA GEOMETRIES VERSUS FREQUENCY						
f (MHz)	λ (m)	$\lambda/4$ (cm)	$\lambda/4$ on FR4 (cm)	Aperture size (cm ²)	Reactive near field (cm)	Far field (m)
260	1.153	28.83	16.72	1058	18.35	2.31
300	0.9993	24.98	14.49	795	15.90	2.00
315	0.9517	23.79	13.80	721	15.15	1.90
330	0.9085	22.71	13.17	657	14.46	1.82
434	0.6907	17.27	10.02	380	10.99	1.38
435	0.6892	17.23	9.99	378	10.97	1.38
470	0.6379	15.95	9.25	324	10.15	1.28
[868]	0.3454	8.63	5.01	95	5.50	0.691
902	0.3324	8.31	4.82	88	5.29	0.665
915	0.3276	8.19	4.75	85	5.21	0.655
928	0.3231	8.08	4.68	83	5.14	0.646

Higher frequency bands work efficiently with smaller antennas. The process, however, has an upper limit. The aperture of the antenna shrinks simultaneously with the shrinking in the physical size of the antenna. The smaller the aperture, the less the amount of energy transferred to the environment by the antenna.

Range:

Many factors determine the predicted range of the system, particularly receiver sensitivity, antenna efficiencies, operating frequency, and transmitter output power. The operating distance can be determined by conditions such as atmospheric conditions, obstacles, and motion, the system designer, however, has no control over these variables. Therefore, TX power, RX sensitivity and antenna selection are the best options when planning for the worst environments.

Future advancements:

Piezoelectricity for more efficiency because this type of horn system is very sophisticated, it can be easily misused. This process can be made more reliable by adding a piezoelectric material in vehicle's tires that will provide the energy required to this horn system and will save fuel and energy. By doing this, it helps to avoid the misuse of this type of horn signal because this system will only work when the vehicle is moving. It means that when the vehicle is static, the system would temporarily stop because it will have no use when the vehicle is not moving.

Most vehicles have a limited battery range system which makes it appropriate for short distance transportation only. It gets a solution in plug-in hybrid vehicles or extended-range vehicles where an engine that uses fuels in internal combustion recharges a battery and hence extends the range. The above approach however goes against the main aim of having an electrical driveline which is to improve the environment through the use of renewable energy. there is therefore need to come up with a new system that extends range maximally with minimal environmental impact.

3. SUMMARY

The present society has experienced the number of vehicles increase frequently, but what follows are more traffic accidents. According to the investigations, overtaking, improper change of lanes and lack of attention to the front state while driving may be the main causes of a car accident. The reason all these happen must be miscommunications among drivers (sometimes they neglect the horn signals, or other times they fail to use the review or side mirror.). Therefore, in this project improved technologies are represented to assist vehicle drivers prevent the accidents. It is radio wave communication system in which, while overtaking, fellow vehicle transmits the signal and the other driver receive it. This transmission can also help avoid sound pollution especially in a crowded country like India.

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