

Design of a Smart Real-time Excessive Honking Control System

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Abstract : — Indian Roads are very noisy due to various road users and congestion factors. It's a custom in India to paint Truck Rear with message "BLOW HORN". The ever-increasing noise pollution affects both physical and mental ability and presents the significant need for a sustainable and an economically viable solution. The aggressive honking of the horn from the vehicles treading on a road is a major source of noise pollution and is highly undesirable and irritating. The residential areas, schools, hospitals and other workplaces nearby are adversely affected. Honking is a habit and usually people uses various types of horn to generate discrete audible noise. Horn blowing leads to noise pollution and creates a chaotic environment. Horn is a device to be used in emergency and if it is used repeatedly in very short succession then there should be system having the following features: - recording the no. of times a horn is pressed by the driver & this should be further linked with driving capability which in turn should be used to calculate insurance premium / permit charges for taxi, etc. An attempt has been made to develop a low-cost smart honking system for which enables the users to calculate the number of horns at a certain period. In addition to this a technological solution has been made to generate an alarm system to the user if the no. of horns goes above the limit. Once the user has registered to this system will receive a bill taxed on the honking made in monthly basis. If the counting of horn exceeds the pre-set limit the user needs to pay the excess tax. The system found to be simple, easy for installation and user friendly.

Keywords: Honking System, Internet of things, Smart City, Noise Pollution

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I. Introduction

Noise can be defined as sound levels that are loud and unpleasant to our ears. Noise pollution is defined as quotidian exposure to higher levels of sound that lead to severe effects to human health as well as other living organisms. World Health Organization (WHO) has recognized sound levels lower than 70 dB are not harmful to living organisms. However, exposure to higher levels for prolonged periods can cause health hazards. Again, decibels follow an interval scale so 80 dB is not twice as loud as 40 dB instead it is exactly twice of what 70 dB is.

Noise can be created from various sources. In India some of the main culprits are 1. Road Traffic Noise, 2. Air Craft Noise, 3. Noise from Railroads, 4. Noise in Industry, 5. Construction Noise, 6. Noise from Households, 7. Noise from Consumer products.

India's Central Pollution Control Board (CPCB) states that traffic sound reaches levels of 100 dB in the streets with bus stops or places prone to more traffic can reach 125 dB The Centers for Disease Control have set a max of 15 minutes as exposure limit to 100 dB of sound, over which possible damage may occur [1]. Noise pollution due to honking is one of most pressing problems that not only India but many countries are hostage to. Drivers on roads often are found to have the tendency of using horns recklessly. This is a result of impatience, strong braking in busy road, in jam packed situations and often in crossings also while overtaking and speeding. Honking creates impulsiveness and poses threat to the life of pedestrians, cyclists and passengers in vehicles as well. Studies have shown that continuous honking is a common expression of growing impatience, rage, anxiety, stress and a truculent attitude. Also seen as a signature move of dominance on other fellow drivers [2]. Often jaywalking pedestrians and inefficient traffic controlling also results in excessive use of horns but it is not due to the excessive number of vehicles on road or population. To a great extent honking depends on mentality of the person using it.

Throughout the world various studies have been done in order to find the main sources of vehicular noise and most of all show honking to have the biggest credit in doing so. Noise level has different effects on the time period to which a person is exposed to it or even on the height difference between the source and the receiver. In India the government has taken various steps to control noise pollution in Delhi city [3].

An area closer to a zone with higher levels of noise is not fit for being a workplace as it decreases the efficiency of the people and also affect their physiological and mental health conditions. Traffic noise owes to various parameters which include traffic flow, weather conditions, density of vehicles, road surface condition.

II. Literary Review

A. Automatic Vehicle Horn Control System Using Proximity Sensor

Proximity sensors have been implemented to develop a system that can automatically trigger the horn without the interference of the driver. Proximity sensors are interfaced with Arduino which are programmed to response whenever objects are detected nearby [1].

B. Honking with Reduced Effect on Noise Pollution

This system is intended to replace actual honking with virtual honking by implementing 1 of 4 exclusive methods namely using Bluetooth Transmitter and Receiver, Infrared Signal transmitter and receiver, using radio waves to communicate and finally the best fit using a Global Positioning System (GPS) and Radio Frequency (RF) transmitter. Two nearby cars when in close proximity will be informed about the condition. The same work done by a horn inside a car [4].

C. Smart IoT Based System for Vehicle Noise and Pollution Monitoring

The author has introduced a system that detects vehicles that cause noise pollution and air pollution as well using MQ-7, MQ-2 and SEN-12642. It is a low cost, simple to operate and portable device [5].

D. Noise Pollution Measurement System Using Wireless Sensor Network and BAN Sensors

They presented the design and build of a Noise pollution Measurement System which combines a Wireless Sensor Network (WSN) and a Body Access Network (BAN) that is capable of measuring Noise pollution level [6].

III. Methodology and Materials

Modern car horns are electric driven. They have a steel diaphragm and electromagnet-based mechanism which is opposed by a spring. The contact points that repeatedly interrupt current flow to the electromagnet is attached to the diaphragm. As the diaphragm springs back in the opposite direction the circuit is completed again. This close and opens numerous times resulting in buzzer or electric bell which is further amplified to finally produce the horn that is heard when the horn button is pressed. A sound level of car horns is usually within the range 107-109 decibels. Usually then require a current supply of average 6 amps.

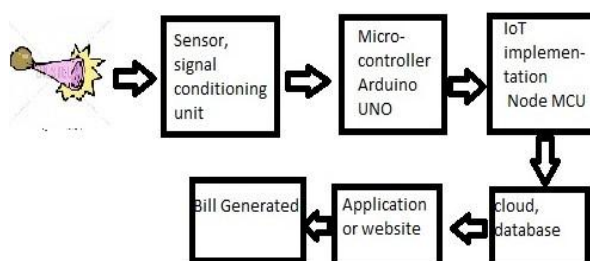


Figure 1: Block Diagram of Proposed System

So, we make a channel by building a connection between the electric supply interruption zone and the Arduino UNO board. Arduino is a microcontroller board in which we design a counter loop. Every time the horn circuit is triggered a pulse is sent to the Arduino Uno pre-set pin which takes the pulse of peak value above 4amps as 1 and below that as 0. Thus, every time a pulse is received the counter loop is incremented by 1 and the data is saved in variable. A timer of 24 hr. format is also set. For 24 hrs. the Arduino collects the data and after 1 cycle is completed it sends the final data to the Node MCU which is the W-Fi module-based microcontroller. The two devices pair with each other by serial connection. The Node MCU will be connected to the internet whose name and password can be programmed from the application. When connected it will push the necessary data to the application. The latter will process the data and present it in a table and graph format using graphics.

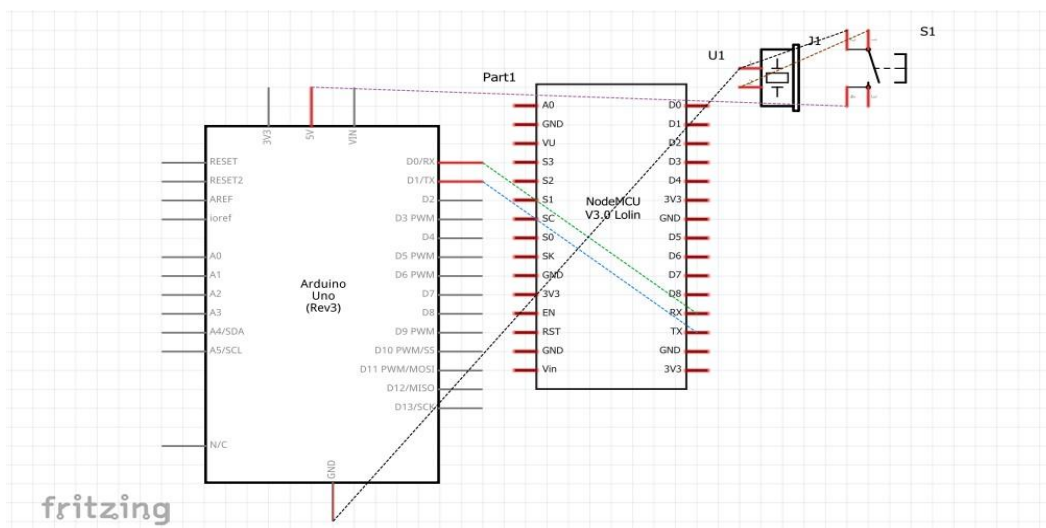


Figure 2: Schematic Diagram of the System

At first a long study is done over the zone where it is to be executed to collect huge data on this problem and correlating them, we can find a specific value of the number of horns. Thus, we specify our limit of horns per month. After 1 month of usage when the final data (FD) arrives on the application it subtracts the pre-set limit value (PSV) from it. If the result (R1) is positive then the systems refresh and starts cycle for new term. But if the result is negative it is modulated and charges a bill by multiplying the modulated value of the result with an Amount (Rs. X) which is tax per extra horn:

$$FD - PSV = R1 \dots\dots\dots (1)$$

$$R2 = R1, (R1 > 0)$$

$$= |R1|, (R1 < 0) \dots\dots\dots (2)$$

$$\text{Final Monthly Bill} = (R2 * X) \text{ rupees}$$

When a user is opening the application first time, he has to register with valid ID proof of himself and documents of the car that he is registering with this application. This profile can be viewed both by user and the concerned authority involved.

A. Arduino

Arduino is a microcontroller-based board with digital and analog pins that can be configured to behave as output or input pins depending on needs. It has 5v supply and analog to digital converter module. It has been used to detect and convert analog current signals into digital signals. 1 value represents a single horn strike. The microcontroller has been programmed to check this value and increment the counter by unity for every such digital horn pulse.

B. Node MCU

It is also a microcontroller-based Wi-Fi enabled board which can connect to the internet and the main part responsible to begin the process of exchange of data between the device and the cloud. It has the ESP8266 Wi-Fi module embedded in it. Like Arduino Uno it also has digital and analog pins but it gives out only 3.3 v of supply. The password and name of the Wi-fi is programmed in it which can also be changed at will using the application. Inside the Node MCU the URL of the cloud server is pre-set. Every time a data is to be send the Node hits the URL. The data then is processed and stored.

IV. Results and Discussions

For the experiment, a route was chosen from Bidhanagar Road to Narula Institute of Technology. 2-wheeler, a hash back cab and bus were chosen alternatively as mode of transportation.

Table 1: Details of parameters of the samples used

| Serial No. | Transport | Distance(km) | Average Time(min.) |
|------------|---------------|--------------|--------------------|
| 1 | 2-wheeler | 10 | 44 |
| 2 | Hash-back cab | 10 | 48 |
| 3 | Public Bus | 10 | 61 |

The experiment was performed over a sample of 20 random days with specially declared holidays, work days and weekends considered. The weather was also monitored on a daily basis especially rainy day.

Daily Horn counting Table

Type the date in the format of DD-MM-YY or type any values to find

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| Serial | Honking Value | Date | Time |
|--------|---------------|--------------|------------|
| 1 | 100 | 12-May-2019 | 12:00:43am |
| 2 | 102 | 14-May-2019 | 12:01:02am |
| 3 | 101 | 16-May-2019 | 12:01:09am |
| 4 | 102 | 20-May-2019 | 12:01:13am |
| 5 | 120 | 04-June-2019 | 12:01:16am |
| 6 | 120 | 05-June-2019 | 12:01:20am |
| 7 | 130 | 17-June-2019 | 12:01:24am |
| 8 | 140 | 21-June-2019 | 12:01:28am |
| 9 | 200 | 22-June-2019 | 12:01:32am |
| 10 | 210 | 23-June-2019 | 12:01:36am |
| 11 | 220 | 24-June-2019 | 12:01:40am |
| 12 | 230 | 25-June-2019 | 12:01:44pm |

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Figure 3: Data Table representing the number of horns used per day by vehicle

The data is uploaded to the user’s personal account in the application or website after 1 day. The same data can be presented in the form of a graph that helps the user to perceive it in a more comparable approach. Also, the graph can be downloaded in most globally accepted formats.

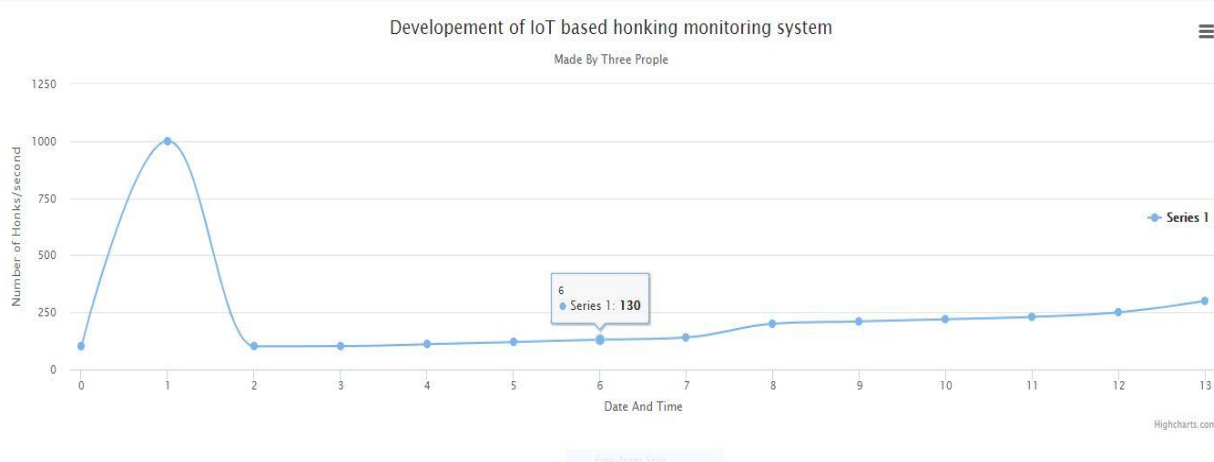


Figure 4: Data representation in the form of graph

From the experiment we have identified certain aspects that need immediate attention in order to lessen the noise pollution.

- In many places the divider in-between lanes do not have proper guard as a result often pedestrians tend to cross roads using such points. As a result, to avoid accidents drivers tend to use horns constantly.
- Lane changing is very common fact that attracts extreme honking specially 2-wheelers are the main culprits in such cases.
- Drivers at crossings have a tendency to honk although when 5-6 seconds are left for the signal to turn green.
- Drivers prefer to honk at irregular intervals without any reason just to make pressure on vehicles around.

V. Conclusion

The system so developed is very simple, cost effective and can be easily implemented to prevent the significant reason of noise pollution. Honking is a critical problem specially in India. The various effects related to this problem including stress, depression and other physical and mental ailments which needs at most attention from the society are directly tackled by uprooting their main cause. The system results in an embedded module which shall benefit the authority to provide a necessary check on unnecessary honking habit of people in India. This will definitely provide benefit to residents of societies located near the high traffic roads, students

studying in schools located in the vicinity of busy roads, patients admitted in the hospitals located on the roadsides and people of various professions/occupations.

VI. Future Scope

A device as this can be amalgamated with other present advanced similar applications to derive traffic conditions of different routes. Information like when a particular route is heavy with traffic. The time periods of heavy traffic can be noted so as to release the pressure by making necessary changes to road crossings and other parallel routes, to systematize the travelling experience. By this method various routes can be classified into classes with traffic density being the basic parameter. We can derive all this data using this device as more horns will be used in places that regularly experience such chaos. This will also help traffic police services as quality of their work will be enhanced if they can have a map of all the crossing presenting huge crowd so as to divert vehicles in order to smoothen the overall process.

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