Zona Del Silencio – A Smart System to Reduce Traffic Noise

Mrs. S. S. Ambarkar, Sanket Munot, Rupam Pusdekar, Shravani Dasari, Utkarsha Kandale

Abstract: *"Silent Zones" we often see this sign passing by the roads ever wondered what they are? The areas such as Hospitals, libraries, schools, court come normally under silence zones. It is done so that the people in hospitals, readers in the library, Students and court martial have no disturbance in the surrounding and they can concentrate on the work being done. According to the standards, the noise level in silence zone should not exceed 50 dB during the daylight and 40 dB after dusk. But there is seen a large variation on how much the sound levels vary from 56 dB to even as high as 77 dB for the daytime and from 51 dB to 75 dB after the dawn. The solution to this increasing problem, "Zona Del Silencio" is a device which will be connected to the vehicle, upon entering the no-honking-zones the device will suppress honking of vehicles by drivers. Effective reduction of noise in surrounding silence zones can be observed.*
Keywords: Silent Zone, Noise pollution, Traffic, IOT.

I. INTRODUCTION

"Silence Zones were identified by the MCGM after a Bombay High Court Order directed them to identify and place Silence Zone boards within a week in 2009. In its Order and Judgment of August 2016, the Bombay High Court ruled that Silence Zones do not require any specific Notification by the Government, so long as an area fulfils required definitions. After a failed challenge to the Supreme Court of India, the State is bound to implement Silence Zones in Maharashtra in accordance with Noise Rules and Bombay High Court Orders" - Awaaz Foundation

The Silent Zones are facing a severe issue of noise pollution which is causing a humongous disturbance to the people. According to World Health Organization (WHO), the sound level of 60 dB can cause a person temporary deafness, while sound levels of 100 dB can lead to deafness permanently. In heavily urbanized cities it is becoming a serious issue.

"Zona Del Silencio" is a device connected to the vehicle which will act as a noise barrier upon such areas, this device will suppress honking of vehicles by drivers. In case of an emergency, the driver will be provided with an emergency switch.

The noise pollution levels will be decreased in the silence zones thus maintaining the integrity of the silence zone. A system to penalize the mischievous drivers would be obtained.

II. BACKGROUND

1. Library sound level meter [1]

The Library Noise Detector is a portable device that is used in detecting noise in the library with Short Information Provider. This device is used to control excessive noise inside the library.

2. Nirob a next generation green earth technology [2]

It is a device which detects overall sound level and displays it on the Digital Board using sound sensors. Thus, creating an awareness among the public.

3. Assessment of honking impact on traffic noise in urban traffic environment of Nagpur, India [3]

The noise assessment is done in Nagpur which comprises of three roads Wardha road, South Ambazari road and Neeri road. The assessment was done by the authors [3] in 2010. These roads were aliased as national highway, major and minor roads, as depicted in figure 2.3.1
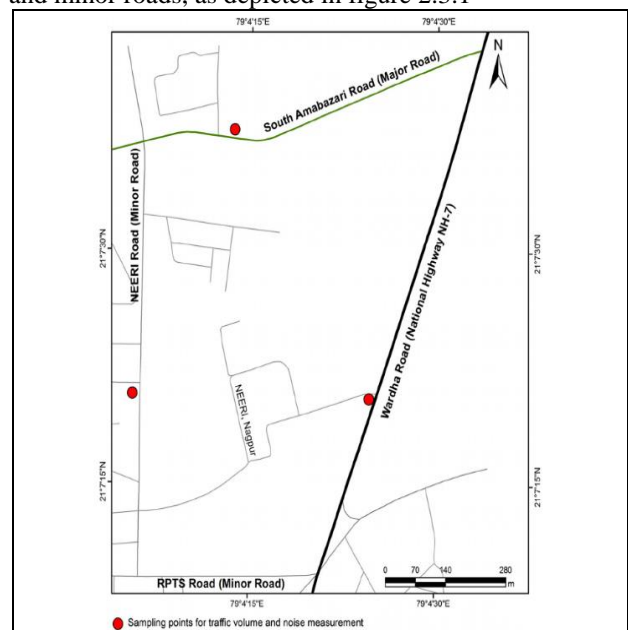

Figure 2.3.1 Study area of assesment [3]

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The vehicles were categorised into three type's namely heavy, medium and light vehicles. Heavy vehicles comprised of trucks, bulldozers, dumpers, etc. Medium vehicles are car, jeep, auto-rickshaws, loading rickshaw. Light vehicles are motorcycles, scooter.

From the literature survey we found that honking adds up to 2-5 decibels to overall vehicle noise.

III. TECHNOLOGIES REQUIRED

Node MCU Microcontroller
The Node MCU is an open source Microcontroller equipped with ESP8266. It contains almost all crucial elements of the modern computer like CPU, RAM, and Wi-Fi. Node MCU is used instead of Arduino or Raspberry Pi because Node MCU comes with built in Wi-Fi module and the microcontroller is affordable.

Arduino IDE (software)
The Arduino Integrated Development Environment written in java which is used for development of microcontroller programs and upload them.

Wi-Fi Router
For development a Tenda home Wi-Fi router is used which acts as an access point for NodeMCU and replicates the silent zone.

Buzzer
A buzzer is an audio device which can be used as an alarm or a horn to provide audio signal audible by human.

IR Sensor
An infrared sensor is an electronic device that emits infrared rays to sense any obstacle in the surrounding. On aspects of project, IR sensor is used to detect if there exist an obstacle in front of the vehicle.

XAMPP
XAMPP provides a local server with phpMyAdmin and MySQL Database which is used for development of the project, further the project is deployed on online server at https://delsilentzone.000webhostapp.com.

Python
Python is interpreted programming language which is used for daily report generation, provided to authorities.

IV. OBJECTIVES

Initially the main objective is to identify and list out the silence zones in the city, so that Wi-Fi router devices can be installed throughout the listed places.

Implement an IoT based prototype which will interact with the Wi-Fi routers installed in the silent zones and suppressing the honking of vehicle to maintain the integrity of the zones.

Additionally, maintaining the records i.e the count for which the emergency switch has been used since there will be a limit for this switch in order to identify the mischievous drivers from the normal one.

To ensure the rightful use of emergency switch, device will be integrated with sensors such as IR sensor to check the existence of vehicle which is in front of the honking vehicle.

V. PROPOSED WORK

Zona Del Silencio is an IoT based device that works solely on Node MCU which is integrated with ESP 8266 module. As the project idea describes that the horn is suppress once the vehicle enters the silent zone. In the silent zone if driver comes across an emergency he/she can use the emergency switch but, if used this switch mischievously a count is incremented in the database for which he/she would be penalized. The mischievous use of emergency switch is detected with the help of obstacle detection IR sensor.

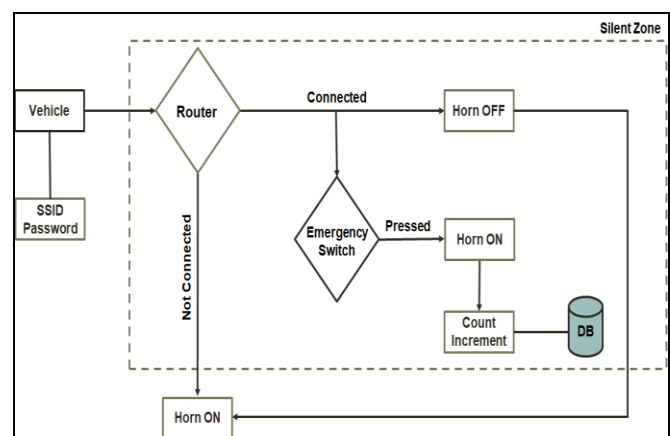The basic work flow of the model can be understood from figure 5.1.

Figure 5.1: Data Flow Diagram

1. Set up routers - All the Wi-Fi routers are set with a common SSID and PASSWORD.

2. Installation – Device is installed in the vehicle. From the research done, it is found that light two-wheeler vehicles are ought to make more noise.

3. The Setup – Node MCU is programmed to establish a connection eternally with the common SSID and PASSWORD by continuously trying to connect to Wi-Fi. It is configured here to set up the input and output modes on the required pins.

4. Infinite Loop – There are two condition for NodeMCU to take an action
i. Connected to Wi-Fi – When the device is connected with Wi-Fi emergency switch is checked for activation, upon use of this switch a reading from IR sensor is taken to detect some obstacle in front of the vehicle. If IR sensor provides a low output i.e. no obstacle found, an API is called with devices mac address as a parameter to register, increment the count of the vehicle. The buzzer is turned ON to make a honk.

ii. Not connected – When the device is not connected to Wi-Fi, the normal switch is checked for activation. Upon use of this switch buzzer is turned ON to make a honk.

5. Web – Register a user. – A user must be registered with the device while installation, Automobile Company is provided with web interface to register the user's vehicle number with device's mac address.

6. Web – Get My Challan – User is provided with a web interface to get his/ her monthly dues in the form of a receipt by entering the vehicle number in the online website.

7. Daily Record – A standalone application is provided to authorities to generate daily reports or custom reports by entering dates.

VI. COSTING

Sr. NO	Component	Price (INR)
1	Node MCU Microcontroller	370
2	IR Obstacle Detection Sensor	50
3	Breadboard	60
4	Buzzer and LED	20
5	Wires	20
6	Tactical Switch and 10 Ω resistor	15
	Overall Cost	535

Table 6.1: Prototype Estimation Cost

The overall cost for development of the device is 535₹ in production the cost to build the device can be reduced up to INR 215. Which is affordable for a greater cause.

VII. DIAGRAMS

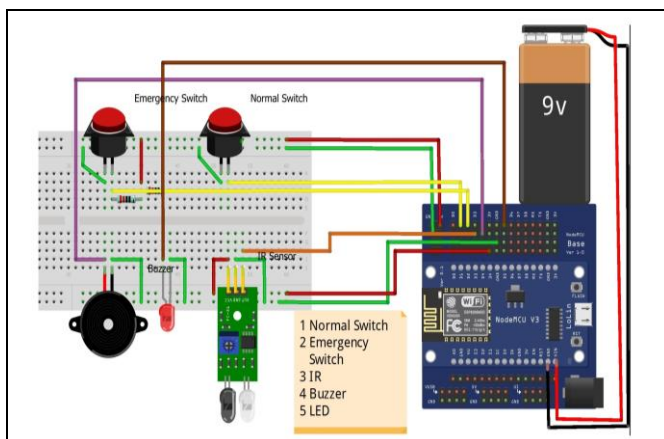**1. Circuit Diagram:** Implementation of Zona Del Silencio device using NodeMCU as in figure 7.1.

Figure 7.1: Circuit Diagram

Instead of using the switches as a bypass circuit, the inputs of switch is read at the microcontroller and based on the status of

Wi-Fi further actions are programmed. The total functionality of project is centrally controlled at the microcontroller.

2. *Schematic Diagram*

Three digital pins are used as shown in figure 7.2 to read status of 'Normal Switch', 'Emergency Switch' and 'IR Sensor' and two digital pins are used to output the action on buzzer and LED – to indicate mischievous use.
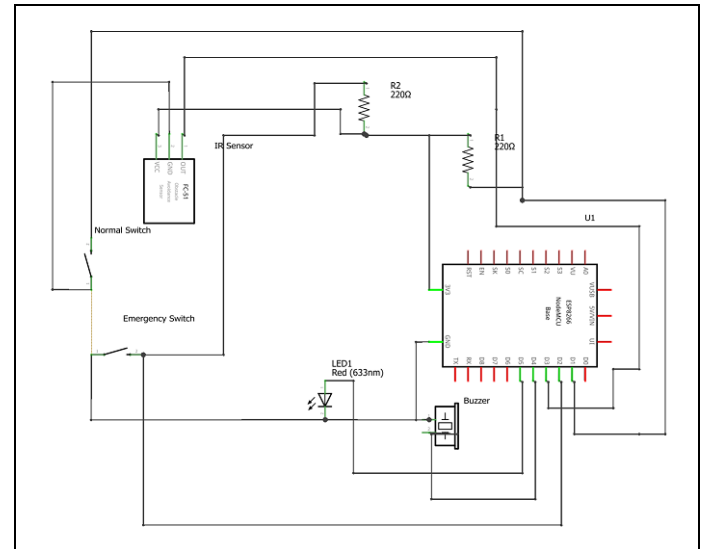

Figure 7.2: Schematic representation

VIII. SNAPSHOTS

1. Web Interface – Following web interface is provided for the user to check the status of dues at anytime, anywhere.

Apart from this same platform would be used to register a new vehicle with our device by connecting device's MAC address with user's vehicle number at automobile company.

Figure 8.1: User Interface.

An admin panel is provided for the authorities to check defaulters online.
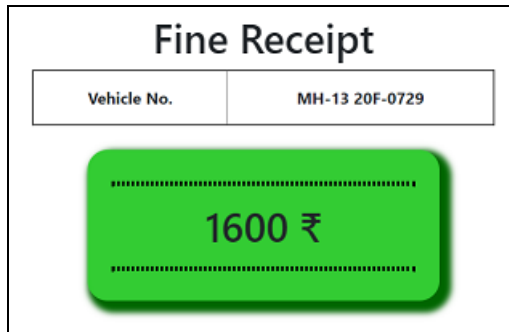
2. Web Receipt

Figure 8.2: Online fine receipt.

The above fine is generated for the owner of 'MH-13 20F-0729' who has used the emergency switch 16 times mischiviously. The unit for one wrog use is 100 INR.
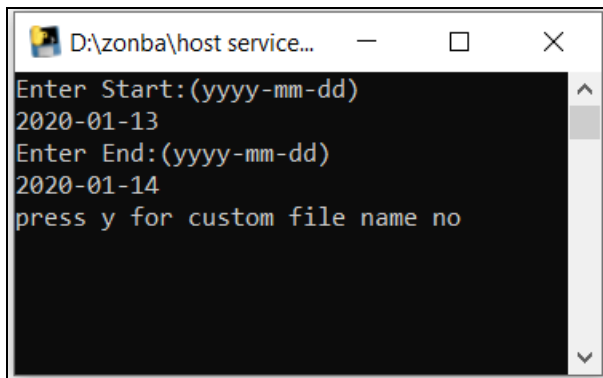
3. Report Generation

Figure 8.3: Application for custom report generation

The standalone application is provide to authorities to generate custom reports by mentioning the interval of days in form of dates.

IX. RESULT AND DISCUSSION

The results found were satisfactory as the device was working as planned with proper web interface and database connections. Device was able to call the API when it was not in silent zone and no obstacle was detected.

Implementation of Zona Del Silencio can reduce the traffic noise up to 3 – 5 decibels and the rules about silent zones can be followed strictly.

1. Report

Figure 9.1: Generated Report

The above csv file is generated for the time period provided by the admin user in the application. Figure 9.1 shows the report for dates 13-01-2020 to 14-01-2020, on dummy data.

2. Invoice

Figure 9.2: Invoice

The above invoice is generated for the user from the web interface as an acknowledgement.

X. CONCLUSION

"Zona Del Silencio" is an IoT based device which suppresses the unwanted honking of vehicles in the Silent Zones. The vehicle being installed with the device detects the silence zones by sensing the Wi-Fi routers present in the zones. The driver is given an emergency switch to use in such scenarios, each time this switch is used, it is recorded in the database to check any mischievous behavior. This way it can be easily made sure that notorious use of emergency switch is penalized.

Thus, achieving **The True Silent Zone!**

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