Design and Development of Smart Horn Automation System using GPS

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***Abstract*- Noise pollution is on the major issues in India. The pollution is majority caused by Road noise and city traffic. As per the statistics Car Horns are 90 decibels, bus horns are 100 decibels and two wheelers have horns ranging from 129-140 decibels. This causes a serious issue in the environment. Especially noise pollutions near public places like schools, colleges, residential areas and hospitals will affect the residents very seriously. The pollution cannot be totally eliminated, but it can be reduced. The paper aims to reduce noise pollution caused by the excessive vehicle honking in these areas. The proposed work develops a system that will reduce the extent of noise pollution byreducing the decibel of the horn depending on the location of the vehicles. The horn's decibel levels are automatically adjusted in these locations to keep the environment free from pollution by employing IOT devices: Arduino, GPS and sound sensors. The system is embedded in the vehicles and the results obtained proved reduction of the Nosie pollution by 72 percent.**

Keywords: **Noise Pollution, Acoustics, Decibel, Health effects, Vehicles.**

I.INTRODUCTION

Noise pollution refers to the presence of harmful or disruptive sounds in the environment that can have adverse effects on human health and well-being, as well as on wildlife and the ecosystem. It is an unwanted form of sound that can cause various physical, psychological, and environmental issues.

1.1 Noise pollution Disadvantage Advantages of Noise Pollution:

Some sounds can mask unwanted noise: In certain situations, controlled background noise or white noise can help mask or reduce the impact of more disturbing sounds, aiding in concentration or relaxation. Warning signals Noise can serve as a warning signal in various situations, such as alarms, sirens, or horns, alerting people to potential dangers and helping them take appropriate actions.

1.1.1 Disadvantages of Noise Pollution:

Health issue Prolonged exposure to high levels of noise can lead to stress, anxiety, hearing loss, hypertension, and sleep disturbances, negatively affecting physical and mental health. Reduced quality of life: Excessive noise can impact people's ability to concentrate, work, study, and communicate effectively, leading to a reduced overall quality of life. Noise pollution can disturb wildlife, disrupt animal communication, and lead to changes in animal behavior, affecting ecosystems and biodiversity. Noise pollution can cause conflicts between neighbors and communities due to disruptions and irritations caused by loud activities or events. Excess noise in certain situations, such as construction sites or traffic-heavy areas, can mask important auditory cues and compromise safety. Economic implications: Noise pollution can have economic consequences due to increased healthcare costs, reduced productivity, and decreased property values in noisy areas.

1.2 Causes Noise Pollution: -

The majority of the world's manufacturing firms and industries employ enormous machinery that can make a lot of noise. In addition, a variety of machinery, including exhaust fans, compressors, grinding mills, and many others, contribute to the production of loud noise. The workers' hearing abilities may be harmed by their extensive exposure to loud noise.
Traffic is one of the main sources of noise pollution since there are so many vehicles on the road at once, which makes a lot of noise. Apart from that, individuals find it difficult to adjust to excessive sound from underground trains, flying over residences and other kinds of transportation. Building, station, road, dam, flyover and mining construction all generate a great deal of noise. An individual exposed to the sound may possibly experience hearing impairment as a result of the sound.

Whether at a club, place of worship, wedding, or any other gathering place, people frequently make noise that ends up being the main source of noise pollution. Songs played at maximum volume can impair a person's hearing capacity if they are repeatedly exposed to such noises.

1.3 Impact of Noise Pollution

1.Traffic noise: - The majority of noisy pollution in cities comes from traffic. For instance, a bus horn makes 100 dB, while a car horn makes 90 db.
2.Air traffic noise: - A single aero plane produces 130 dB, which has a higher impact than the number of cars on the highways despite there being less aircraft flying over cities.

3. Construction sites: - Construction of buildings, parking lots, and resurfacing of roads and pavement make a lot of noise. A pneumatic drill, for instance, generates 110 db.
4.Catering and night life: - When the weather is nice, bars, restaurants, and terraces that flow outside can generate noise than 100 db. Pub and club noise is included in this.
5.Animals: - Noise made by animals can go unnoticed, but a howling or barking dog, for example, can produce around 60-80 db.

1.4 Sources of Noise Pollution
A major byproduct of industrialization, urbanization, and contemporary civilization is noise pollution. Both industrial and non-industrial activities can cause noise pollution. Large machinery operating at very high speeds and with a lot of noise are included in the list of industrial sources of noise. Vehicle usage in the year 2021-2022, there were approximately 1,78,21,111 two-wheelers in use in India. Honking regulation using a horn is now against the law in various places, including central cities, areas close to hospitals, schools, and zoos. Traffic signs in India often warn drivers not to use their horns. Municipal governments impose limits on horn usage, either permanently or temporarily
Non-industrial sources of noise include those produced by vehicles and transportation, as well as local noise from a variety of noise pollution that can be classified as either natural or man-made. The sounds produced by vehicles and roadways are the most polluting. Car horns are 90 dB, two-wheeler 140 dB, and bus horns 100 dB loud.

- **Noise From Aircraft: -**

Aircraft are a significant cause of noise pollution, and the legislation sets noise restrictions for airports based on the movement of the aircraft and the location of the aircraft, such as an industrial or commercial area.

- **Noise from Rail Road**

Noise pollution is caused by things like switching and shunting activities in rail yards, locomotive engines, horns, and whistles. For instance, rail car retarders, a mechanism that slows down a freight train or a railway coach, can generate high-frequency noise with peak levels of 120 dB at a distance of 100 feet.

- **Construction Noise**

The noise and air pollution in cities are significantly influenced by the noise produced during the construction of roads, city streets, and building.

- **Noise From industrial Activity**

People who live close to noisy manufacturing plants may be bothered by fans, motors, and compressors located on the exterior of industrial buildings. Industrial employees are particularly affected by noise from equipment and industries, and unpleasant hearing loss caused by noise is widespread among them.

- **Noise in Building**

Plumbing, boilers, generators, air conditioners and fans all produce bothersome internal building noise. Walls and ceilings that have been improperly insulated may allow the sound of neighbors' loud noises, voices, and footsteps to be heard. Urban inhabitants may experience issues with outside noise from emergency vehicles, traffic, garbage collection, and other city noises. particularly with the windows open.

- **Noise from Consumer Products**

Vacuum cleaners and several kitchen appliances are examples of popular household items that produce noise, however they often do not make a significant difference to everyday noise levels.

1.5 Noise Pollution in India
Noise pollution is a major problem in India, especially in heavily populated urban areas. Rapid industrialization, transportation, construction, and urbanization have all contributed to higher noise levels in numerous cities and villages around the country. Here are some main factors of noise pollution consumption and impact in India.

Restrictions The Indian government has identified noise pollution as a severe issue and has enacted a number of restrictions to solve it. The Environment (Protection) Act of 1986, which authorizes the central government to take steps to control and abate environmental pollution, including noise pollution, is the fundamental legislation governing noise pollution in India. Furthermore, numerous state governments have developed their own policies and standards to combat noise pollution. Vehicle traffic, industrial activity, construction sites, public gatherings, religious festivals, and loudspeakers are the major sources of noise pollution in India. Vehicle honking is a common cause of noise pollution in cities, particularly in congested regions. Health effects Exposure to excessive amounts of noise pollution can be harmful to human health. It can cause stress, sleep problems, hearing loss, cardiovascular problems, and poor cognitive performance. Construction workers and traffic police officers, for example, are particularly prone to noise-induced health problems.

Noise regulations to regulate noise levels in various places, India's Central Pollution Control Board (CPCB) has created ambient noise standards. The recommended daytime noise level for residential areas is 55 decibels (dB), which drops to 45 dB at night. However, these guidelines are not often followed, and noise levels in many Indian cities frequently exceed the allowable limits. that automatically decreases the decibel levels of the horn based on the vehicle's location. This is accomplished by the use of IoT devices such as Arduino, GPS, and sound sensors. The goal of incorporating this technology into autos is to reduce noise pollution in specified places. The data acquired from implementing this technology showed a reduction in noise pollution. Awareness and enforcement the general people in India are becoming more aware of the adverse impacts of noise pollution. Non-governmental organizations (NGOs), citizen groups, and environmental campaigners are raising awareness about noise rules and lobbying for stronger enforcement.

However, compliance remains difficult due to issues such as insufficient funding, a lack of people, and the prominence of cultural events and gatherings, where noise levels frequently exceed allowable limits. Technology to prevent noise pollution is being used to prevent the impacts of over honking and maintain a peaceful environment. This includes automatically adjusting the horn's decibel levels based on the vehicle's location. Sound sensors detect the location, and the horn's decibel level is adjusted accordingly.

Noise pollution levels During peak hours, noise pollution levels on numerous roadways in cities such as Bangalore, Mumbai, and Delhi can reach 80 to 90 db. Road noise and city traffic are significant polluters. Two-wheeler horns have a decibel rating of 129 to 140, whereas bus horns have a decibel rating of 100, and automobile horns have a decibel rating of 90. Excessive noise pollution from vehicle horns has a negative impact on the environment. Noise pollution has a tremendous influence on residents, particularly those who live near public places such as hospitals, schools, and universities.

1.6 Vehicle in Bangalore During Peak Hours.

Bangalore faces severe traffic congestion during peak times, which causes a large increase in the number of vehicles on the road. Travel times are frequently lengthened, noise levels are raised, and pollution levels are intensified as a result of this rise in vehicle traffic. As a result of the increased traffic, the streets fill up with automobiles, motorbikes, buses, and other types of vehicles.

Bangalore commuters have a number of difficulties during peak hours. The overcrowding on the highways causes slower mobility and frequent traffic bottlenecks. In addition to making drivers more frustrated, this congestion also ups the risk of accidents and causes delays in getting to destinations.

Increased noise pollution is also a result of the excessive number of vehicles on the roads during rush hour. The frequent blowing of horns, especially when there is traffic, makes the already noisy urban atmosphere worse. Stress, irritation, and a general decline in quality of life are all possible negative effects of this noise pollution on people's health.

Additionally, the large number of automobiles during peak hours causes more emissions and air pollution. Vehicles' emissions of pollutants into the atmosphere caused by the burning of fossil fuels put locals' health at risk and contributed to poor air quality. The pollutants that cars release, like carbon monoxide, nitrogen oxides, and particulate matter, have a negative impact on respiratory health and worsen the environment.

Bangalore has put in place a number of steps to solve the problems caused by traffic congestion during rush hour. The expansion of the metro rail system, expanded bus service, and promotion of cycling and walking are a few examples of programs to support public transportation. Additionally, in an effort to minimize the number of automobiles on the road, ride-sharing and carpooling programs have grown in popularity as alternatives to single-occupancy vehicles.

There are ongoing efforts to enhance infrastructure and traffic management, including building flyovers, enlarging roadways, and putting sophisticated traffic technologies in place. With these solutions, traffic congestion during peak hours will be decreased and vehicle flow will be improved.

A spike in vehicle volume during peak hours in Bangalore causes traffic jams, noise pollution, and worsened air pollution. In order to overcome these obstacles and lessen the strain on the city's road networks and the detrimental effects on the environment and the well-being of its residents, a combination of measures, including improved public transportation, traffic management techniques, and promoting sustainable modes of commuting, must be implemented.

1.7 Noise Pollution Regulation:

Standards for noise emissions for cars with smart horns, regulations may establish particular noise emission limitations. These restrictions outline the highest sound pressure level (dB) that is permitted at particular distances. These requirements must be met by smart horns in order to prevent them from creating an excessive amount of noise pollution.

Intelligent algorithms and sensors that modify the sound output based on the context and environment may be required by regulations for smart horns. As a result, needless noise is reduced as the smart horn can produce the right sound levels based on the situation.

Regulations may specify smart horn compatibility specifications so they work flawlessly with the electrical system and other installed safety systems of the vehicle. By doing this, the smart horn is guaranteed to perform dependably and effectively without affecting the rest of the vehicle's operation.

Testing and certification to make sure that their products fulfill the appropriate performance and safety standards, smart horn manufacturers may need to submit to testing or receive certifications. The functioning, dependability, and conformance of the smart horn technology with noise emission rules may be evaluated as part of these certifications.

Certification of compliance Those in charge of enforcing vehicle laws may ask vehicle makers or owners to submit documentation, test results, or certification from accredited testing organizations as proof that they have complied with noise pollution reduction laws.

It's crucial to remember that different jurisdictions may still be developing rules relating to smart horns and their role in reducing noise pollution. The most accurate information on the rules that apply specifically to the use of smart horns and their contribution to noise reduction can be found from local transportation authorities or regulatory bodies.

One of the main risks that lowers people's quality of life globally is recognized as noise pollution. In recent years, noise pollution has risen to an alarming level as a result of the rapid advancement of technology, industrialization, urbanization, and other communication and transportation systems. This level of noise pollution needs to be studied and controlled in order to prevent adverse health effects like high blood pressure, insomnia, nausea, heart attacks, depression, dizziness, and induced hearing loss.

1.8 Some specific problems caused by noise pollution in Bangalore include:
Long-term exposure to loud noises can cause a number of health concerns, including hearing loss, tinnitus (ear ringing), stress, sleep disorders, cardiovascular problems, and reduced cognitive function. The physical and mental health of those who are exposed to loud noise on a regular basis may suffer. Noise pollution during the night and early hours of the morning can disturb sleep cycles, resulting in insomnia and poor sleep quality. Lack of sleep can lead to weariness, decreased productivity, and a decline in general wellbeing.

Location / Vehicle Type	2 wheelers	Autos	Cars/Vans/Jeeps/SUVs	Buses/Trucks	Total
Richmond Circle	2,090	460	1,401	164	4,115
Langford and Hosur Rd. Jn.	1,603	312	1,408	63	3,386
Thimayya Rd and Hosur Rd. Jn.	2,285	554	1,872	112	4,823
ITC Gardenia	2,238	628	1,303	290	4,459
Kasturba and Vittal Mallya Rd. Jn.	2,754	281	780	35	3,850

Table 1:- **Traffic volume for Peak Hours**

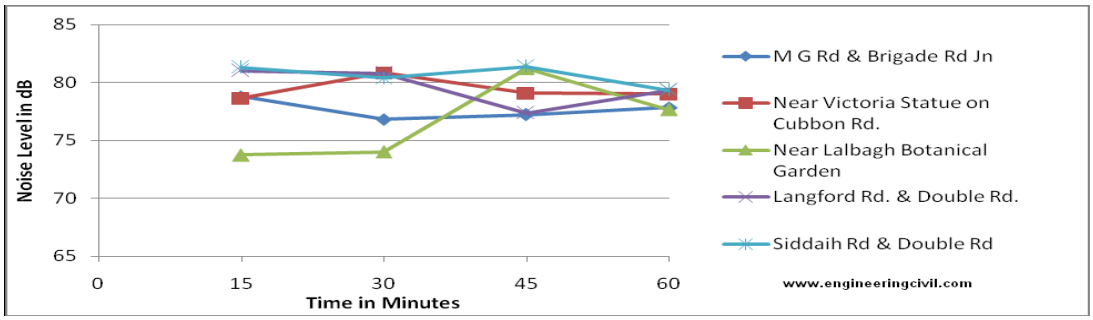

Figure 1: Noise Level during Peak Hour

The noise levels (dB) and traffic volume measured over a 1-hour period during peak and off-peak hours are displayed in Tables 1through 2. Figures 5 to 8 display the noise levels (in dB) for each location over a period of time (60 minutes), during peak and off-peak hours. With the exception of the ITC Gardenia junction, the traffic volume on the anticipated lines was larger during peak hours than during non-peak hours. The following is a discussion of the outcomes for each site

Location /Vehicle Type ?	2 wheelers	Autos	Cars/Vans/Jeeps/SUVs	Buses/Trucks	Total
Richmond Circle	1,642	503	851	249	3,245
Langford and Hosur Rd. Jn.	1,251	295	981	59	2,586
Thimayya Rd and Hosur Rd. Jn.	1,870	676	1,208	160	3,914
ITC Gardenia	2,346	701	2,246	277	5,570
Kasturba and Vittal Mallya Rd. Jn.	1,109	506	675	118	2,408

Tab2: **Traffic volume for Non-Peak Hours**

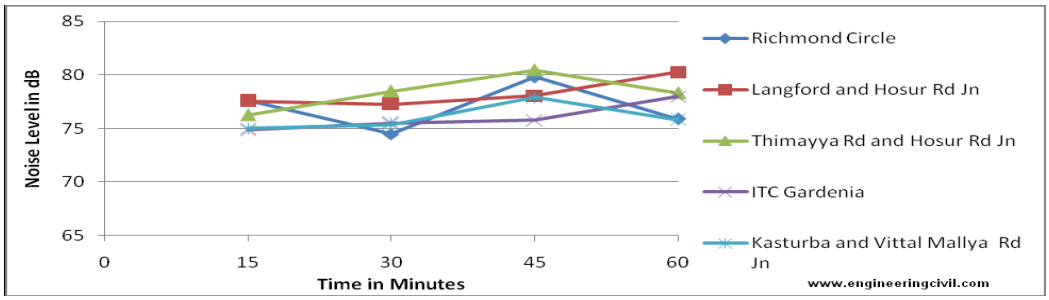

Figure 2: Noise Level during Non-Peak Hours

1.Richmond Circle

During both peak and off-peak hours, Richmond Circle, which is a convergence of five main highways (including a flyover), is a hotspot of traffic congestion. This might be as a result of the fact that all of these highway's lead to significant urban areas. The junction is formed by Residency Road (which runs northeast of the college), General KS Thimayya Road (running east), Raja Rammohan Road (running west), Lalbagh Main Road (running south of Residency Road) and Mission Road to Residency Road Flyover. There is no vegetation in the area. The maximum noise level can so easily approach 80dB. The average noise level for an hour during peak hours was 77 dB, whereas it was 82.3 dB during off-peak hours. Although the number of people is lower during non-peak hours, the noise level.

2.Junction between Langford Road and Hosur Road.

There is a moderate to high volume of traffic at the three-way junction of Hosur Road and Langford Road during peak hours. A few trees line the sides of the building, which lowers the noise by a few decibels. Peak hour noise levels were 78.3 dB on average, while non-peak hour noise levels were 77.4 dB on average.

3.General K S Thimayya Road-Hosur Road Junction.

At this four-way intersection, traffic flow is roughly equal during peak and off-peak periods. In peak and off-peak hours, respectively, the average noise level for one hour was 78.4 dB and 77.4 db.

4. Near ITC Gardenia

There is a lot of traffic flow at this intersection, which is close to several significant monuments in Bangalore, such as the ITC Gardenia, the Kanteerva Stadium, and the Vittal Mallya Hospital. It is a complicated intersection with two major roads entering the intersection: Raja Rammohan Road and Vittal Mallya Road. A smaller 1st Main Road from Double Road also joins Raja Rammohan Road, and two short lanes connect its two bifurcations. There is a good deal of vegetation in the area. Peak hour noise levels were 76.6 dB on average, while non-peak hour noise levels were 76.1 dB on average. The noise level during non-peak hours is a little bit greater than during peak hours, and the number. is also higher during non-peak hours for cars.

5. Kasturba Road- Vittal Mallya Road Junction.

This intersection is intricate and has a lot of vegetation surrounding it. The noise level has not much decreased as of yet. Regular daytime traffic results in noise levels that are comparable to or higher during non-peak hours than during peak hours. Peak hour noise levels were on average 76 dB, whereas off-peak levels were 77.2 db. Although there are more vehicles during peak hours, the noise level is slightly higher during non-peak hours.

6. M G Road-Brigade Road Junction

Given that this is one of Bengaluru's major retail districts and there is heavy traffic during the day. There are no trees to muffle noise. This intersection is close to the metro train. In peak and off-peak hours, respectively, the average noise level for one hour was 77.7 dB and 78.2 db. Although there are more vehicles during peak hours, the noise level is slightly higher during non-peak hours.

7. Near Victoria Statue, Cubbon Park

At this intersection, where Kasturba Road, Queen's Rod, M.G. Road, and Lavelle Road converge, there is heavy traffic during rush hour. Peak hour noise levels were 79.4 dB on average, while non-peak hour noise levels were 75.4 db.

8. Near Lalbagh Botanical Garden

Lalbagh, a famous feature of the city situated in Central Bengaluru, is one of the two significant green spaces that make up the city (the other being Cubbon Park). The Siddapur circle, which is in the center, is connected to the Lalbagh botanical gardens' main entrance by the K.H. Rd, Hosur Main Rd, and the Siddapura Road. In comparison, the noise level is lower here. Peak hour noise levels were 76.7 dB on average, while non-peak hour noise levels were 72.2 db.

Communication problems It can be difficult to converse clearly when there is excessive noise on the streets and in public areas. Communication in a variety of situations, including schools, workplaces, and public transportation, may become challenging, making it difficult to hear and understand conversations, instructions, and announcements.

Noise pollution in educational settings can have a negative impact on the learning environment. It can undermine concentration, divert pupils' attention, and worsen academic achievement. In noisy classrooms, teachers may struggle to deliver courses effectively, and students may have a harder time understanding what is being taught. Stress levels can rise Constantly being around loud noises can make people feel more stressed. The persistent state of awareness brought on by noise pollution can cause irritation, anxiety, and a general decline in mental health.

Noise pollution can have a negative effect on outdoor places by reducing their appeal and limiting recreational activities. Due to traffic and other noise sources, parks, gardens, and other public spaces that are meant to provide peace and respite might actually become noisier and less pleasant. sound pollution can disturb natural environments and have an impact on wildlife. It may interfere with an animal's natural behavior, communication, and mating cycles, and it may cause ecological imbalances.

Reduced quality of life Overall, Bangalore's people can experience a significant decline in their quality of life due to noise pollution. Constant noise exposure can undermine tranquility, make it difficult to unwind, and have a negative effect on both people's and communities' general pleasure and well-being. Stricter legislation, public awareness campaigns, smarter urban planning, traffic management techniques, and encouraging the use of quieter technologies and cars are just a few of the many solutions needed to address noise pollution in Bangalore.

1.9 Road Traffic Noise Pollution

The World Health Organization has found links between traffic noise and issues with sleep, fatigue, headaches, high blood pressure, hormonal changes, stress, and a higher risk of heart disease. Approximately 5% of strokes may be related to the impacts of traffic noise, according to a recent Danish study. Premature death is brought on by this cardiac disease's long-term effects. Although it is well known that traffic noise has negative health impacts, there is little data on how many people are affected.

Thousands of people are believed to die young each year as a result of exposure to traffic noise, according to research conducted in Europe. More than 100 million people in Europe are impacted by health-damaging noise levels. For a more thorough understanding of the social and economic consequences country by country, National Committees are encouraged to map out traffic noise exposure. Additional research is needed to determine the impact of traffic noise on all member states.

In Bangalore, as in other metropolitan areas, locations with a large concentration of people and active transportation tend to have greater levels of noise pollution. Due to the concentration of traffic and human activity, major highways, junctions, and commercial areas frequently encounter elevated noise levels. Historically more congested and noisy areas in Bangalore include the following in September 2021.

Majestic (Kempe Gowda Bus Station): As one of the city's major transportation hubs, the area around Majestic, including Kempe Gowda Bus Station, sees heavy traffic and is prone to higher noise levels.

MG Road and Brigade Road: These commercial and shopping districts in central Bangalore attract a significant number of vehicles and pedestrians, leading to increased noise pollution.

Silk Board Junction: Being a critical traffic intersection in Bangalore, Silk Board Junction often experiences heavy traffic congestion and associated noise pollution.

Koramangala: A popular residential and commercial area, Koramangala's major roads can be noisy due to high traffic flow.

K**R Puram:** This area in the eastern part of Bangalore is known for its traffic-heavy Outer Ring Road and railway station, which can contribute to higher noise levels.

Indiranagar: Another well-known residential and commercial area, Indiranagar, experiences noise pollution due to its busy streets and commercial establishments.

1.9.1 Road traffic reducing noise Pollution: -

Compatible Zoning and Urban Design By ensuring that noise-sensitive land uses, such as residential areas, schools, and hospitals, are located away from busy roads, planners can minimize the exposure of communities to traffic noise. Increasing the distance between roads and residential areas (e.g., from 20m to 100m) can significantly reduce noise levels, providing a quieter environment for nearby residents.

Ground Design and Earth Mounds Utilizing earth mounds, loose soil, and protective vegetation can act as natural sound barriers, absorbing and scattering sound waves, thereby reducing noise propagation. Road Gradient and Pavement Designing roads with minimal gradients and using low noise pavements can contribute to quieter traffic operations.

Intelligent Transportation Systems (ITS) Implementing ITS technologies to manage traffic flow efficiently can help reduce the noise from constant starting and braking, leading to smoother traffic movement. Maintenance and Quality of Roads Well-maintained roads with smooth surfaces can help minimize noise due to potholes, loose service covers, and uneven seal and expansion joints.

Low Noise is Encouraging the use of low noise tires, and supporting regulations mandating their usage, can significantly reduce road traffic noise levels. Noise Barriers and Building Upgrades Installing noise barriers along roads and upgrading homes with features like "silent" façades can further limit noise transmission to nearby residential areas.

Building Design for Noise Reduction Collaborating with building regulators to design housing that reduces noise entry and strategically places noise-sensitive areas away from the road can enhance living conditions for residents. By adopting a combination of these strategies and integrating noise reduction measures into road planning and design, authorities can create a healthier and more peaceful living environment for communities impacted by road traffic noise. At 20 decibels (dB), a typical human should be able to hear a normal tone. Most people's hearing ranges from 45 to 55 dB, with the right and left ears perhaps picking up decibel levels that are different.

The horns and engines of moving vehicles make up a large portion of the noise produced by vehicular traffic. At congested traffic intersections, the decibel level soars. People honk even when passing through "No Honking" zones, near schools and hospitals, etc., because nobody follows the laws anyhow, and there is a great deal of ambiguity about what the automobile in front is allowed to do. The maximum decibel level for horns used in cars and commercial vehicles in India is 125 db. The human body is stressed out by just 60 to 65 db, which makes drivers hostile and prone to road rage.

1.10 EFFECTS OF NOISE POLLUTION:

Constant loud noise can harm human health in numerous ways, notably in the very young and the very elderly, in addition to impairing our hearing by creating tinnitus or deafness. Here are some of the principals:

Physical symptoms include disturbance of the respiratory system, a rapid heartbeat, high blood pressure, headaches, and, in cases of excessively loud, continuous noise, gastritis, colitis, and even heart attacks.

In both people and animals, psychological noise can trigger episodes of stress, exhaustion, sadness, anxiety, and hysteria.
Behavior and sleep difficulties You can't fall asleep or get a good night's sleep if the noise level is over 45 db. Keep in mind that the World Health Organization recommends a maximum noise level of 30 d. Loud noise can have undetectable consequences on our conduct, such as making us irritable and angry.

Recollection and focus Over time, poor performance may result from people's inability to concentrate due to noise. Additionally, it affects memory, making it challenging to study. It's interesting to note that two hours of exposure to 100 dB requires our ears to rest for longer than 16 hours.

1.11 Noise Pollution Problem Statement

Noise pollution from traffic is a significant problem in Bangalore (Bengaluru), like many other major cities in India. The rapid growth of urbanization and an increasing number of vehicles on the roads have contributed to elevated noise levels in the city.
Bangalore faces significant traffic congestion, especially during peak hours. The slow-moving or stationary traffic leads to prolonged exposure to noise, including vehicle engine noise and honking. Horn usage is prevalent among drivers in Bangalore, and unnecessary and continuous honking adds to the overall noise pollution on the streets.

Poor road conditions, including potholes and uneven surfaces, can amplify noise from vehicles as they pass over these road defects. Busy commercial districts in Bangalore generate significant traffic noise, especially during business hours when commercial activities are at their peak. Many residential areas are located close to major roads and highways, making them more susceptible to traffic noise intrusion. Noise from buses, especially when they stop or start, as well as noise from public announcements at bus stops and railway stations, contributes to traffic-related noise pollution.

Ongoing road construction and infrastructure projects can lead to additional noise pollution during their execution.
The impacts of traffic-related noise pollution in Bangalore are similar to those experienced in other urban areas and include health issues, sleep disturbances, stress, reduced quality of life, and negative effects on overall well-being.

1.12 Noise Pollution solution traffic Zone: -

Noise pollution from traffic honking in Bangalore (Bengaluru) requires a combination of regulatory measures, public awareness campaigns, and infrastructure improvements. Here are some specific solutions to tackle the honking problem:

Designate and enforce specific "No Honking Zones" in sensitive areas such as hospitals, schools, and residential areas. Implement fines and penalties for violators to discourage unnecessary honking. Install prominent traffic signs and boards in key areas to remind drivers to avoid honking unnecessarily. Conduct public awareness campaigns to educate drivers about the adverse effects of honking on noise pollution and public health.

Implement intelligent traffic management systems with real-time monitoring and traffic signal synchronization to reduce congestion and prevent traffic bottlenecks that lead to honking. Enforce noise pollution standards for vehicles, including the maximum permissible noise levels for horns. Regularly inspect and fine vehicles that exceed noise limits.

Encourage a non-honking culture among drivers through media campaigns, public service announcements, and community engagement programs. Promote the use of visual signals, such as hand signals or indicators, to communicate with other drivers instead of using horns. Improve public transportation options and services to reduce the number of private vehicles on the roads, which can lead to reduced honking.

Increase traffic police presence in busy areas to monitor and control traffic, discourage unnecessary honking, and enforce no-honking zones. Explore the use of technology to monitor and control noise pollution, such as noise sensors and automatic identification of honking violators. Involve citizens and local communities in campaigns against honking, encouraging them to report excessive honking and contribute to noise pollution reduction efforts.

Include traffic education programs in school curriculums to educate children about the importance of responsible driving and the impact of noise pollution. Implement traffic calming measures such as speed breakers, roundabouts, and raised pedestrian crossings to reduce speeding and unnecessary honking. Promote the use of electric vehicles (EVs) or hybrid vehicles, which tend to be quieter than conventional vehicles with internal combustion engines. By adopting these solutions and implementing a comprehensive approach, Bangalore can work towards reducing noise pollution caused by excessive honking, creating a more peaceful and livable environment for its residents.

1.13 Statistics Bengaluru of Noise pollution

According to the United Nations Environment Programmer's (Unep) most recent "Annual Frontier Report, 2022," Moradabad, Uttar Pradesh, is the second-most noisy city in the world. According to the paper, the area experienced noise pollution that peaked at an ear-splitting 114 decibels (db) in 2021. With a noise pollution index of 119 dB, Dhaka tops the list of the 61 cities ranked in the survey. With a maximum noise pollution level of 105 dB, Islamabad comes in third. The list includes thirteen South Asian cities. Of the seven, five are from India. The other four are Delhi (83 db), Jaipur (84 db), Asansol (89 db), and Kolkata (89 db).

Fig 3: - In India Noise Pollution Statistics.

One of the biggest environmental risks in expanding cities is noise pollution. According to Inger Andersen, executive director of Unep, "high levels of noise harm human health and well-being by interfering with sleep or obliterating the helpful and positive auditory communications of many animal species that live in these places. Health experts believe sounds with a frequency of over 70 db to be dangerous. In its 1999 standards, the World Health Organization proposed a 55-dB threshold for residential settings. This maximum is 70 dB for the business and traffic sectors. Irbid, with a noise level of 60 dB, is the world's quietest city. Belgrade at 70 db, Stockholm at 70 db, Madrid at 70 db, and Lyon at 69 db.

Mitigating noise pollution While pollution cannot be completely eliminated, it can be reduced. Reducing excessive horn blowing in sensitive regions can aid in noise pollution reduction. The proposed effort includes developing a system. system that automatically decreases the decibel levels of the horn based on the vehicle's location. This is accomplished by the use of IoT devices such as Arduino, GPS, and sound sensors. The goal of incorporating this technology into vehicles is to reduce noise pollution in specified places.

II. LITERATURE SURVEY

Martin Ma, Tariro Ma, Gonzalez A, Macchiarini M. Exposure–effect relationships between road traffic noise annoyance and noise cost valuations in Valladolid, Spain. In [1] Paper the authors has used Traffic noise parameters such as the equivalent continuous sound level and the Noise Pollution Level have all been used in noise impact assessment studies in India so far and has built up an automatic beams control system. The amount of light will be detected by it. value of opposite vehicles and automatically switches the high beam into low beam and it will reduce the glare effect.

Shivaji Karhale Paper A study on autonomous horn intensity regulation for vehicles (2019). [2] vehicle is within a predetermined radius or a predetermined distance. Here, the suggested system is that the horn won't sound unless a vehicle is sufficiently close, or else it won't sound at all. This project ensures that there will be less noise produced by horns and we can avoid the needless honking where it is not at all necessary. In this way, it can prevent all noise pollution and provide a noise-free environment. A disadvantage

Horn only functions in certain locations. There are no safety precautions for reducing vehicle speed. The honking area's range is constrained by Bluetooth use.

Sai krishna prasad P Paper Automatic vehicle horn control using proximity sensors. (2018). in [3] paper the authors have automated horn system that is being proposed. The horn won't sound unless a car is sufficiently close; else, it won't sound at all. This project assures that there will be less noise produced by horns and we can eliminate the unneeded honking where it is absolutely unnecessary so that we can avoid all noise pollution and provide a noise-free environment. Instead of using Wi-Fi to determine the location of the vehicle, this method employed GPS. shortcomings are There are no provisions for speed in it. There is no external power supply available.

Sodo, R., Sharma, S., & Yadav, V. K. (2016). Real Time Smart Honking System. In [4] paper this system has measures to reduce collisions on the road due to driver hearing impairment and the inability of the driver to hear the horn due to loud music playing inside the car. The authors anticipate that with the development of this kind of smart system, transportation will become more effective and sustainable.

Mrs. Bhawana A Aire, Assistant Professors 1846- 168. in [5] paper The quantity of pollution produced by these cars has dramatically increased as a result of the increase in vehicle production. Honking (using a horn to make noise) is forbidden in various places, including central cities, locations close to hospitals, schools, child care facilities, etc. There is no device to measure and regulate sound in real time, however sound that is measured in decibels can be controlled in accordance with governance. creating an embedded module to lower noise levels in order to reduce noise pollution.

P. Patil, “Smart IoT Based System for Vehicle Noise and According to this publication, "Pollution Mentoring, in [6] paper noise is defined as sound levels that are excessive and uncomfortable for Listening in humans. "Noise pollution" refers to the daily exposure to louder sounds that have a serious negative impact on both human health and the health of other living things. Sound pressure levels under 70 dB are not detrimental to According to the World Health Organization, living beings (WHO). The risks to your health come from sustained exposure to higher amounts. As mentioned before, decibels are measured on an interval scale, therefore 80 dB is not twice as loud as 40 dB but rather is equal to 70 db. A number of things can produce noise.

Vijay, R., Sharma, A., Chakrabarti, T. & Gupta, R. (2015). honking impact on traffic noise in urban traffic environment of Nagpur, India. in [7] paper the authors have considered various factors like various factors— honking, road layout, and vehicle speed—the initial analysis indicated no association between traffic volume and comparable noise. Also, a frequency analysis of the traffic noise revealed that honking added 2 to 5 dB of additional noise, which is extremely noticeable. Traffic noise was also observed to increase with vehicle speed. nova, a statistical technique, indicates that, in addition to traffic volume and road type, frequent honking (p 0.01) and vehicle speed (p 0.05) have a significant impact on traffic noise.

T.K. Roy, A.R. Mukhopadhay, S.K. Ghosh and G. Majumdar “Honking- Its Influence on Noise Pollution” In [8] paper authors has taken into consideration about the traffic issue in which it has been noted that the volume of traffic affects the extent of honking, which affects Lea, the noise measurement used in this study. The correlations were discovered using regression analysis. By advising the drivers, honking might be reduced. During the counselling process, drivers should be made aware of the harmful effects of noise on humans as well as the laws surrounding honking and the corresponding penalties. Administration must simultaneously maintain and regulate the autonomous signaling system and reroute traffic to less crowded highways.

Syed Ali Fathima Bhuvaneshneshwar, Arunsunai, S, and Ajith Kumar Mr. Bala Kumaresan The "IoT Based Horn Detection System for Safety vechicle Driving". in [9] paper the purpose of this study is to introduce a horn recognition system that can identify horn sounds and their directions for safe four-wheel driving. This strategy can be useful for both hearing-impaired people and those who have trouble determining which side of the road their car is approaching from when they are driving. While driving, Deaf persons pay attention to the flashing lights, but blowing horns have no effect on any senses.

Karhale Shivraj Narayan, Chaudhari Vishal Shivaji, Bhalerao Akshay Uttam Prashant S. Bibave, A survey paper titled "a survey paper on automatic vehicle horn intensity control system". In [10] paper this system, intelligent devices are used in all facets of our existence. We soon realise that the majority of our tasks are carried out by technology. They will soon undertake one of the most difficult jobs a person does each day, driving a car, as we shall see. This is a good thing. The days of manned driving are rapidly coming to an end, as are those of gridlock, bad, reckless, and aggressive drivers, and most significantly, accidents. Every second, a person perishes in an automobile accident. One of the most important needs is the automation of the car's driving controls.

III. Methodology: -

The smart horn system, fig 3.consisting of Arduino Uno, GPS, buzzer, and LCD display, aims to reduce noise pollution in restricted areas while maintaining normal horn sound in unrestricted areas.

- Arduino Uno: Serves as the central processing unit, controlling the entire system's operation.
- GPS: Provides accurate location data of the vehicle.
- Buzzer: Emits sound based on control signals from Arduino.
- LCD Display: Shows real-time information and system status.

The system operates as follows:

- GPS provides vehicle location data. Arduino compares the location with predefined restricted area boundaries.
- In restricted areas (e.g., schools, hospitals), the buzzer's sound is automatically reduced to minimize noise pollution. In unrestricted areas, the horn operates normally with its original volume and sound characteristics. smart horn system ensures a quieter environment in sensitive locations, promoting a safer and more peaceful driving experience.

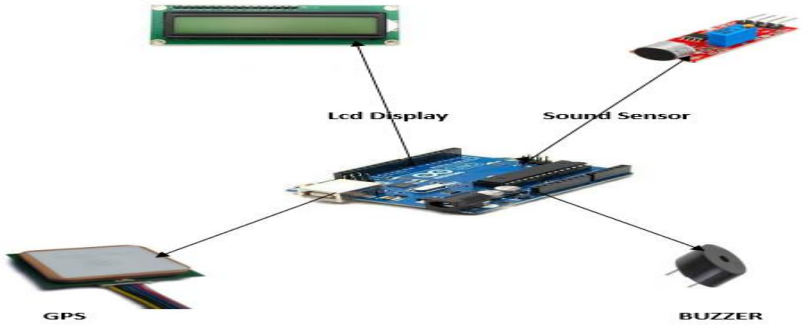

Figure 3:-Smart Horn Block Diagram.

IV. Smart Honking Flow chart

As Shon Fig 4. The smart horn is an innovative solution supported by administrations and transport authorities to address noise pollution and improve road safety. It introduces a controlled and less intrusive approach to horn usage, replacing the conventional loud and harsh honking. The smart horn incorporates a buzzer-like sound that significantly reduces noise disturbances for pedestrians and other road users, making it ideal for both restricted and unrestricted areas.

In restricted areas, such as near schools, hospitals, and residential neighborhoods, the smart horn's integration with GPS technology allows it to automatically adjust its volume, emitting a quieter sound to comply with local noise regulations. This feature ensures that noise pollution is minimized in noise-sensitive zones, contributing to a more peaceful and harmonious environment for residents and pedestrians.

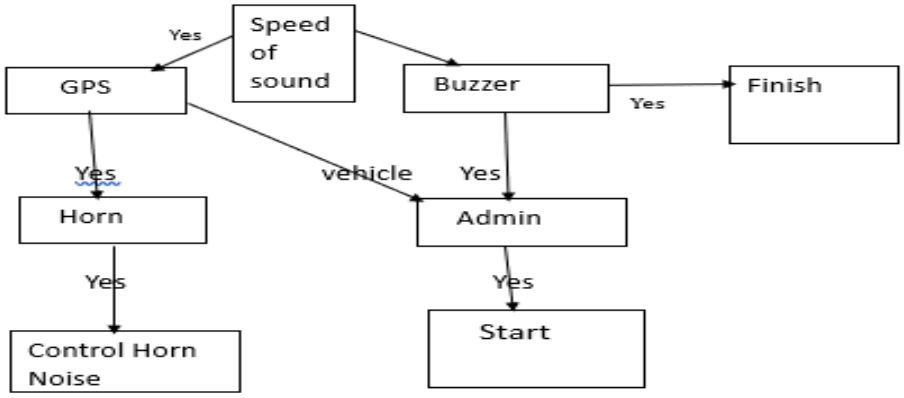

Figure 4 : Smart Honking chart

In unrestricted areas, such as highways and open roads, the smart horn's speed-sensitive technology comes into play. As the vehicle's speed increases, the horn's volume adjusts accordingly, ensuring it remains audible and effective during highway driving. This feature enhances road safety by allowing drivers to communicate effectively with other motorists in high-speed scenarios while still maintaining noise control.

Overall, the smart horn promotes responsible horn usage, discourages unnecessary honking, and provides a customizable and adaptable solution to reduce noise pollution in various urban settings. By incorporating technology and a more thoughtful approach to horn communication, the smart horn plays a vital role in creating a safer and more pleasant road environment for everyone, both in restricted and unrestricted areas.

V. RESULTS AND DISCUSSIONS

The results of implementing a Figure 5. smart horn system can vary depending on the specific design and implementation of the device. However, the general aim of a smart horn is to address noise pollution and enhance safety on the road. By incorporating advanced technologies such as sound sensors, GPS, and signal processing algorithms, the smart horn system can effectively reduce the overall noise generated by vehicle horns. Through location-based control, the system can automatically lower the horn volume in restricted or prohibited areas like hospitals, schools, and residential zones, where excessive noise can be disruptive or harmful. This helps to create a more peaceful environment for residents and minimizes the impact of noise pollution. Furthermore, some

smart horn systems may offer additional safety features like collision detection sensors, ensuring that the horn is only activated in situations where there is an imminent danger. Overall, the results of a smart horn system are aimed at reducing noise pollution, improving road safety, and enhancing the overall driving experience by providing customizable options and alerts to drivers. It is important to evaluate specific implementations and conduct thorough testing to assess the effectiveness and impact of a particular smart horn system.

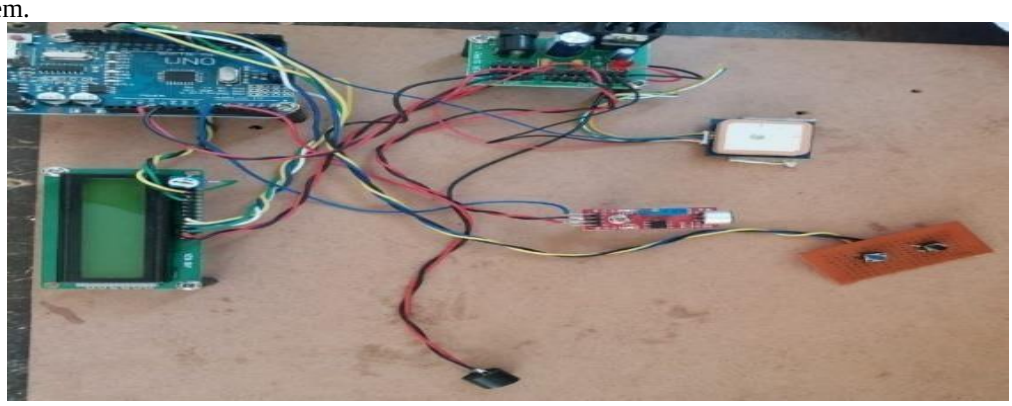

Fig 5: Smart Horn Using GPS

The smart horn in figure 6.automation system utilizes GPS technology, specifically the GPS-6m-0-001 module, to track the precise location of the vehicle. The system extracts the latitude and longitude coordinates of the vehicle's position, and these values are utilized within the Arduino-IDE (pulse width modulation) programming environment. By comparing the latitude and longitude with the supplied data, the system adjusts the decibel level of the horn accordingly. In areas where the decibel level of the horn should be restricted, such as specific locations near hospitals, schools, or residential areas, the system lowers the horn's decibel output. This ensures that the horn remains audible but at a reduced volume to minimize noise pollution and disturbance in those areas.

Fig 6: College Area GPS

The provided screenshot displays as shows fig 7 the range of the horn, which is adjusted and decreased in accordance with the specific areas where the decibel level should be limited. This visual representation helps to illustrate how the system dynamically modifies the horn's output based on the proximity to designated locations. The accompanying diagram illustrates the warning zone, as previously mentioned, within the smart horn system. When the vehicle approaches this particular location, an LCD display will actively indicate the presence of the warning zone to the user. This visual notification serves as an alert, notifying the driver that the horn's decibel level will be automatically adjusted to a reduced volume as the vehicle enters the restricted area.

Figure 7:-Control Horn Restricted Area

In this paper, the focus is on managing the sound level of the siren or horn in different areas. It has been observed that the siren sound tends to be louder in traffic areas but needs to be quieter in specific places such as hospitals, colleges, and schools. To address this, a device is proposed that can be installed in vehicles to effectively mute the horn sound in prohibited areas. The results obtained from measurements in these limited places indicate favorable outcomes. Specifically, the focus is on a university entrance location that is designated as a restricted area. The GPS value provided for this location is 12.940706, and the speed of sound is reported as 261. Comparatively, the speed of sound in the traffic area is higher. However, in the restricted university area, the sound level is considered normal and falls within acceptable limits, leading to satisfactory results. Additionally, the device incorporates a warning area feature, which automatically reduces the sound of the horn. This ensures that in designated warning areas, such as hospitals, the horn sound is appropriately reduced to minimize disturbance and maintain a peaceful environment.

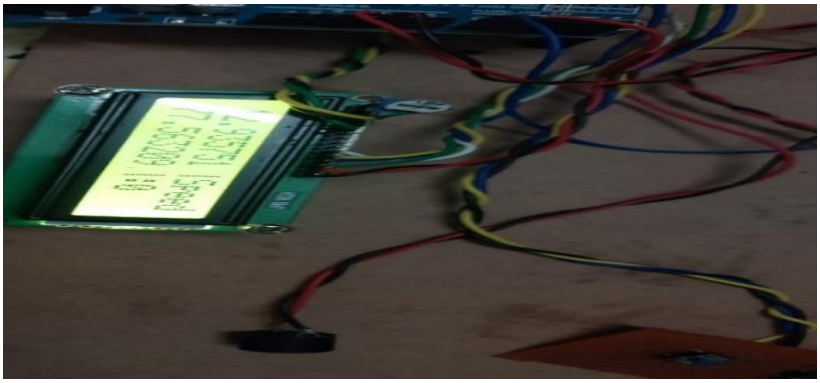

Figure 8:-Hospital Area GPS

To further illustrate, In figure 8. let's consider the example of a hospital area. The GPS value for this restricted area is given as 12.9357352, and the speed of sound is reported as 72 db. This suggests that the sound level in the hospital area is lower than in the traffic area, aligning with the objective of reducing noise pollution and maintaining a suitable environment for patients and staff. To summaries, the suggested technology is intended to regulate and eliminate horn noise in restricted places such as universities and hospitals. The noise level can be effectively managed by installing this device, resulting in a good conclusion and contributing to a quieter and more harmonious environment in these locations.

VI. CONCLUSIONS

This paper aims to address noise pollution caused by excessive vehicle honking in these areas. The proposed work focuses on developing a system that mitigates noise pollution by automatically adjusting the decibel level of the horn based on the vehicle's location. This is achieved by utilizing IoT devices, such as Arduino, GPS, and sound sensors. The system is embedded in vehicles and aims to reduce noise pollution by 72 percent. In this system, the siren sound is louder in traffic areas while being quieter in restricted locations like hospitals, colleges, and schools. By installing this device on vehicles, the horn sound can be muted in prohibited areas, resulting in better outcomes. The results obtained from measuring noise levels in limited places demonstrate favorable outcomes. For instance, in the restricted area of a university entrance with a GPS value of 12.940706, the measured sound level is 261, which is lower than that in traffic areas. This indicates that the device effectively reduces horn sound in restricted areas, leading to satisfactory results. Additionally, the system includes a warning area feature, automatically reducing the horn sound in specific locations. For example, near a hospital with a GPS value of 12.9357352, the sound level is measured at 72 db. This showcases the device's capability to reduce horn noise in restricted areas, ensuring a quieter environment where loud noises can be detrimental. the successfully addresses noise pollution caused by excessive vehicle honking. By implementing a system that adjusts the horn sound based on location, a substantial reduction in noise pollution can be achieved. The results obtained from measuring sound levels in restricted areas have shown positive outcomes, enhancing the overall environment and satisfaction of residents. Additionally, the system includes a warning area feature, automatically reducing the horn sound in specific locations. For example, near a hospital with a GPS value of 12.9357352, the sound level is measured at 72 db. This showcases the device's capability to reduce horn noise in restricted areas, ensuring a quieter environment where loud noises can be detrimental.

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