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Research Article

"Development Of An IoT-Enabled Noise Monitoring And Controlling Device With Advanced Alert Mechanism For Silent Zone Areas In India: Overcoming IoT Challenges And Enhancing Quality Of Life"

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ABSTRACT

This invention describes an innovative IoT-Based Noise Detection & Alert System designed to monitor noise levels and enhance security in diverse environments. Deploying noise detection sensors and integrating them with the central processing unit, the Raspberry Pi, the system continuously monitors ambient noise levels in real-time. By comparing noise data against predefined thresholds, the system detects noise disturbances and triggers automated alert notifications to designated. recipients. Additionally, the system's integration with image capture and processing capabilities provides visual context for noise level incidents, facilitating targeted interventions and documentation. The versatility and adaptability of the system make it suitable for various applications, including educational environments, commercial settings, and residential neighborhoods. By enabling proactive management of noise pollution, detection of intruders, and real-time response to security incidents, the IoT-Based Noise Detection & Alert System offers a comprehensive solution for creating healthier, safer, and more secure environments.

Noise pollution or sound pollution is the propagation of noise with ranging impact on activity of humans & animal life. Most of which are very harmful to humans. Source of outdoor noise worldwide is mainly caused by machines, transport, and propagation systems. Noise pollution also impact the health and well-being of wildlife. To control the noise pollution various systems models are present. Hence to overcome all problems and help our society we propose a IoT based systemnoise detection system using raspberry Pi and with high end noise detection sensor. This model is used in school area as well as any other places where noise is required in less amount. After one lecture second lecture is starting. In this gap teacher may came late between these students make noise. It will effect on nearby classes or office. That's why for controlling this noise we develop IoT based noise detection system is proposal which will help to control the noise. With the help of this model teacher or authority will take a preventive action. This model is helpful in various noise pollution area like in city, hospital, school, court area silent zone areas.

Keywords*-** Noise Monitoring; Smart Classroom; Noise Awareness:*** IoT, Raspberry Pi, Sensors

INTRODUCTION

In school days or when we taking education in polytechnic we see that, after completing current lecture next lecturer has to come for take his lecture. But teacher may be busy in other work so they will be come late on lecture. Between that time spam noise is created by students. Then we decided to find out the solution for

control the noise creates in a classroom. In this project we can intimate noise of students from the classroom automatically to class coordinator. For that, voice sensor will be used in this project and it will be controlled by the Raspberry Pi. Voice will be recognized by an IC (lm 324) which is connected to the Raspberry Pi. In this we must set the fixed/threshold value of noise decimal. When the noise exceeds the limit of fixed/threshold value of decimal, then message will be sent to the class coordinator of that classroom and HOD of department. Through this project respective authority of particular class can take necessary action to reduce noise while class is making noise because of staff is not available to engage that class. Using this project, we can control the noisy situation of classroom. For this we can intimate to class coordinator and HOD through text message on mobile phone or through email.

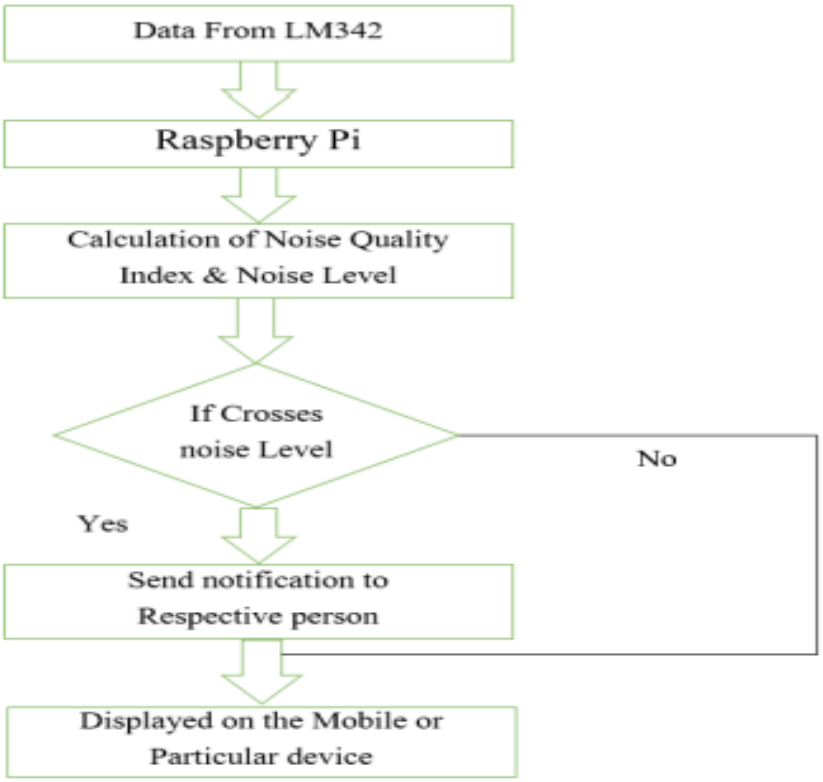
Literature Survey

The paper [1] mainly deals with the feature engineering of the ECG signals in building robust systems with better detection rates, and uses the human visual perception paradigm as the image analysis method for the extraction of new features from the signals. After acquisition of new clinical electrocardiogram (ECG) signals the first step is often to pre-processed and have a signal quality assessment to uncover noise.
The aim of the paper [2] is to implement portable internet based sound detective prototype by using internet of things technology. The approach of this paper [2] is to make use of low prices components and sensors and single chip microcomputer like raspberry Pi with Wi-Fi connection ability to design a sound detective device to offer a better solution to noise pollution. The article [3] devised a system which can automatically detect and recognize whether an environment is noisy or not The main aim of this paper [3] is the detection and recognition of the impulsive sounds caused by gunshots and the proposed gunshot recognition algorithm recognizes the gunshot among the same. The author presents in [4] recent progress on portable Doppler, frequency-shift keying (FSK) and frequency modulated continuous-wave (FMCW) radar systems for life activity sensing and human localization, and machine learning is presented as an efficient approach to make the radar system smart for automatic classification and decision making. Also the paper [4] addresses noise and sensitivity issues in remote sensing and detection of vital signs based on a continuous wave biomedical radar operating at multiple harmonic carrier frequencies.

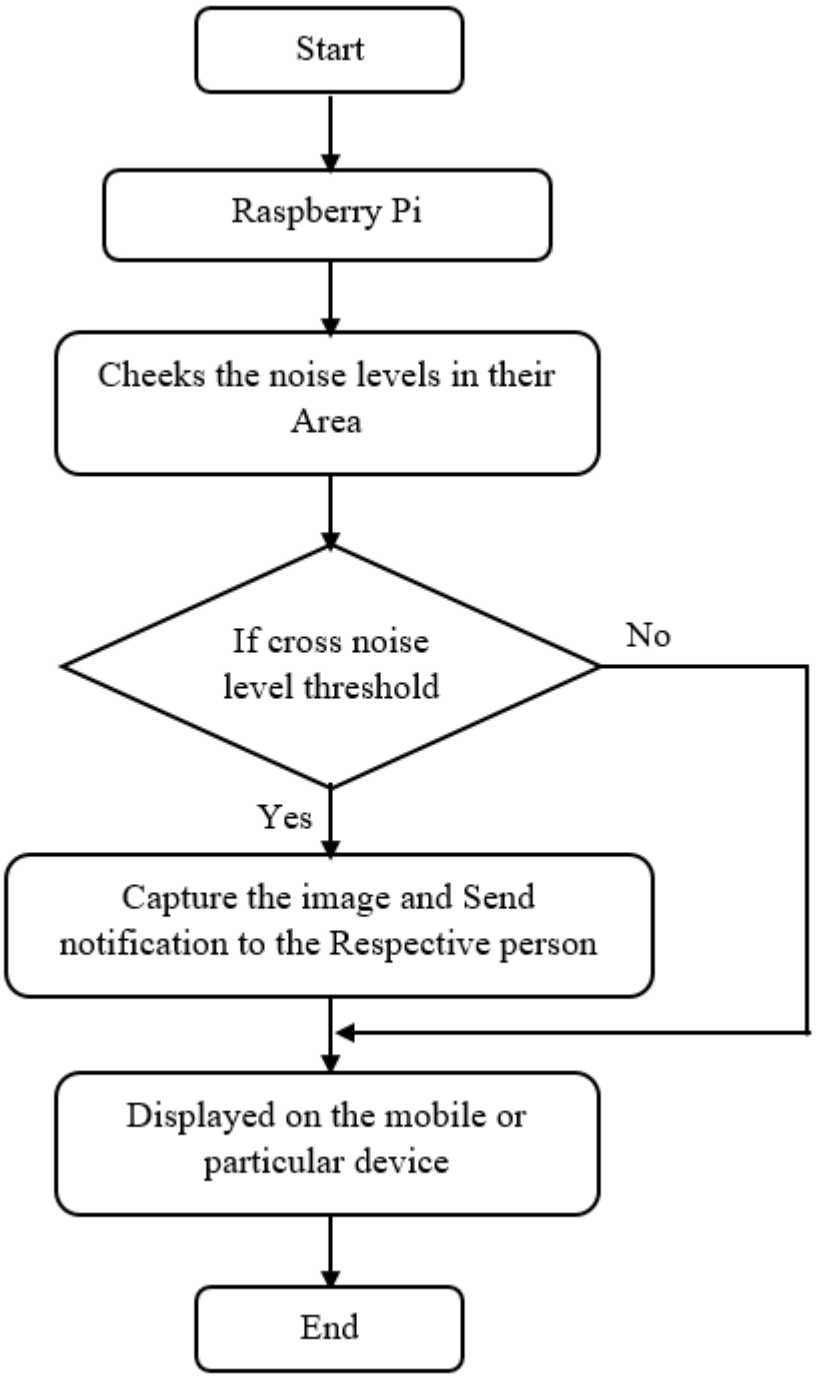
The Proposed Work And Research

Objective 1: Detect the noise and if it is greater than threshold then give the signal to the Raspberry Pi.
Objective 2: capture the image process the image and identify the image save the image.
Objective 3: Send that this image to the higher authority.

PROPOSED WORK –



a) FIGURE 1. ***Flowchart of Hardware processing***



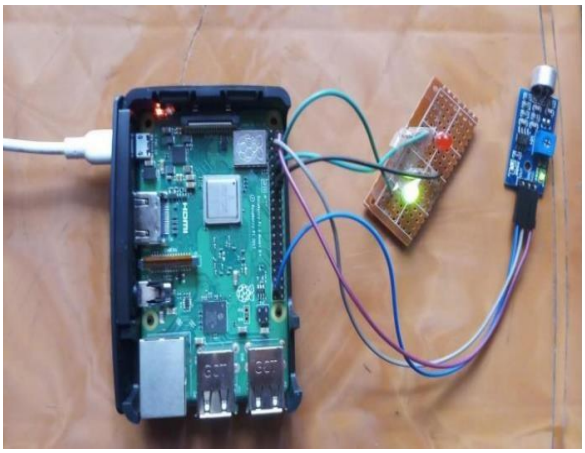
b)

FIGURE 2. ***Flowchart of Hardware processing***

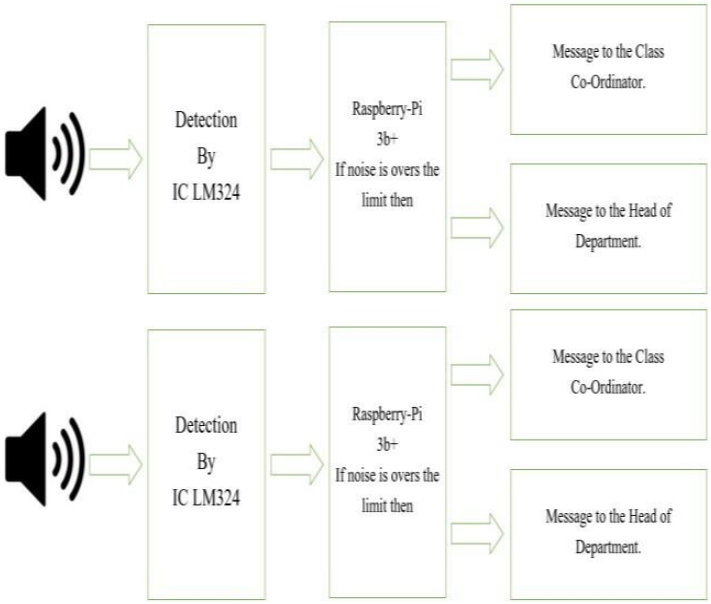
The figure 1 is flowchart of hardware processing. It is our flow chart of our proposed system. It consists of following models noise quality index, noise intensity detection model. LM 324 noise detection sensor is utilized to measure the noise level with motive to monitor noise pollution in an area. When sensor detect the noise, it processes the output signal voltage which is sent to Raspberry Pi which again performs the necessary processing required for monitoring the parameters. When the noise level is crosses the limit at that time this system sends the notification and its image (figure 2) to respective person to perform necessary action.

Hardware Connection

In today's world many pollution monitoring systems are designed by considering different parameters. Existing system model is presented in figure 3 uses Raspberry-pi based wireless sensor model to monitor noisy conditions with thousands of applications in different fields. With the help of this kind of project it is easy for the Police to identify the noisy zones. For Ganapati Festival or any festivals to control noise by Police Station. This project is useful for the control to a noisy in silent zone and any other places. To determine a frequency level of the noisy by using this "Voice Recognition Device" and solve the problem to creation of the noisy.



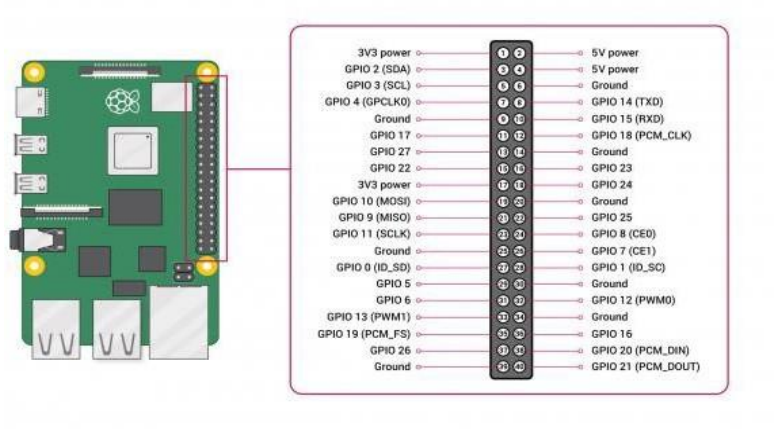
b) FIGURE 1.b) Connection of Hardware



It may use in the schools, colleges, court area, hospital and any silent zone areas to control the noise. A noise detector with instinctive recording device is proposed, which provides frequent warning information to the user if the noise limit exceeds, and finds wide advantage for labours in industry. Talking loudly is an infuriating habit in an office environment as well as in industry the machine noise is quiet annoying. The office environment with loud co-workers can distract the work and reduce the work efficiency. The machine noise in an industry environment above 85dBA affects the hearing capacity. To help and solve this issue, a noise detector with instinctive recording device is proposed. This device informs the user about the noise level and whenever the noise level exceeds the limit, it automatically records the sound and its duration. This system finds wide advantage for labours in industry, which provides frequent warning information to the user if the noise limit exceeds.

Pin Connection

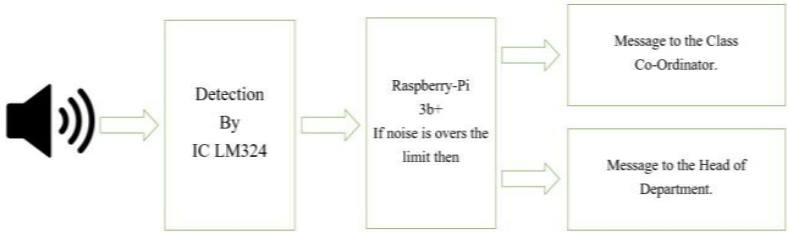
Take raspberry pi and LM 324 sensor for connection. Connect sensor to raspberry pi using pins. Sensor has three pins like VCC, Ground, general input output pin. Connect raspberry pi VCC to sensor VCC and ground to ground Connect sensor output pin to pi 14 pin (pi having 40 pin are present out of that 27 pin are available for GPIO (general purpose input output pin) after that take memory card . In that memory Card install one operating system that name is Raspbian version 5.2 (Stretch OS). This OS is Linux like type. In this OS all operation performs on command prompt. After this process connect monitor, mouse and keyboard to raspberry Pi using HDMI cable. Supply power to pi and monitor in between 2 to 5 volts.



c) FIGURE 1.c) Pin Connection

Model Description-

Initially, the system verifies if all the components that are being connected are in the position to work or not. A working model connection is established between Raspberry pi3b+ device and IC LM 342. This is one way connection is used to detect the sensitivity of noise and send message to class co-ordinator and Head of Department. Noise detection messagewill be send through mobile.



d) FIGURE 1.d) Model description

TECHNICAL DETAILS:

1. Average cost.
2. to 5V power and I/O.
3. 2.5mA max current use during conversion (while requesting data).
4. No more than 1 Hz sampling rate (once every second).
5. Body size 15.5mm x 12mm x 5.5mm.
6. pins with 0.1" spacing.

SOFTWARE REQUIREMENTS:

1. RaspBian Buster OS
2. Python IDLE3
3. Language: -: Python
4. Database: -: MySQL server

HARDWARE REQUIREMENTS:

1. Raspberry pi 3b+
2. Laptop
3. SD card
4. HDMI cable
5. ICLM342 sensor
6. Mobile
7. Camera

ADVANTAGES AND LIMITATIONS

Advantages-

1. Classroom Management:

The system can assist teachers in managing noise levels in the classroom, ensuring a quieter environment for effective teaching and learning. By providing real-time alerts when noise levels exceed the defined threshold, teachers can address noise issues promptly and maintain a focused learning atmosphere.

2. Student Engagement and Concentration-
Excessive noise can hinder student engagement and concentration. The system helps create a conducive learning environment by promoting awareness of noise levels and encouraging students to be mindful of their noise output. This can lead to improved student focus, participation, and academic performance.

3. Special Needs Education-
The system can be particularly beneficial in classrooms with students who have special needs, such as those with hearing impairments or sensory processing disorders. By monitoring noise levels, the system can help ensure that the classroom environment is suitable for these students, minimizing distractions and providing optimal conditions for learning.

Research and Data Analysis-
The collected noise data can be used for research purposes and data analysis. Educational researchers can analyze noise patterns, correlations between noise levels and academic performance, and the impact of noise reduction strategies on learning outcomes. This research can contribute to evidence-based practices for noise management in educational settings.

Limitations -
1. Requires an active Wi-Fi connection.
2. This project can be used only Raspberry Pi by using python language.

FUTURE SCOPE-
The IOT-based noise detection and alert system for a classroom using Raspberry Pi has a promising future with several potential areas for further development and enhancement-

1. **Advanced Noise Analysis-**
The system can be expanded to include more sophisticated noise analysis algorithms and machine learning techniques. This would enable the system to not only detect excessive noise but also classify different types of noise, such as conversations, distractions, or specific sounds that may disrupt the learning environment. This additional analysis can provide deeper insights into noise patterns and help optimize noise reduction strategies.

2. **Integration with Smart Classroom Systems -**
The noise detection and alert system can be integrated with other smart classroom systems and technologies. For example, it can be synchronized with lighting systems to automatically adjust the brightness or color of the lights based on noise levels. Integration with smart whiteboards or interactive displays could enable the system to pause or mute presentations when noise exceeds acceptable levels.

3. Real-time Monitoring and Reporting-
Enhancements can be made to enable real-time monitoring and reporting of noise levels in the classroom. This would allow teachers and administrators to have instant visibility into noise conditions and take prompt action when needed. Real-time reporting can also help in identifying specific time periods or areas in the classroom where noise issues are more prevalent.

4. Data Analytics and Insights-
The collected noise data can be further analyzed to extract valuable insights. Statistical analysis and data visualization techniques can be applied to identify trends, patterns, and correlations between noise levels and academic performance. These insights can assist educators in making data-driven decisions to optimize classroom management and learning outcomes.

5. Integration with Smart Devices-
The system can be integrated with other smart devices or wearables, such as smart watches or noise-cancelling headphones. This integration can provide individuals with personal notifications or customized settings to help them manage their own noise output and create a personalized learning environment.

RESULT

Sr. No	Action	Idle Range	Low Noise	Medium Noise	High Noise	No Detection
1	Clapping	40DB			✓	
2	Dropping	55DB		✓		

	Duster					
3	School Bell	100DB				✓
4	Music	80DB			✓	
5	Drag Table	65DB			✓	
6	Communication	55DB		✓		
7	Snap the Finger	35DB	✓			
8	Shouting	70DB			✓	

TABLE 1. Actions and its noise level

our proposed system attempts to make practical model of noise detection based system which not only just detects noise but also is capable of distinguishing between normal sound and noise on the basis of intensity of sound and based on that comparison it makes decision to know about where the noise is high and it help to know where to put how much volume. in following result table 1, we used some range of noise level of various actions on the basis of google service. using this we calculate following results. using this we can control the noise level in school. the advantage of this project is help in reducing the noise in school but also help in controlling the noise in silence zone area, maintaining the noise in hospitals, control the noise in various festival and it also used for traffic and also to vehicle riders to not honk unnecessarily at traffic signals. in this system used noise sensor lm324 to detect noise.

CONCLUSION

The proposed model detects the noise detection which causes serious hearing capacity in humans. the device modeled with three cluster nodes is compatible with different environmental condition and finds application in the different field. the system provides frequent warning information if the cluster data exceeds the threshold limit of 85 db raspberry pi interfaced with think speak api provides iot platform combined with cloud storage location to record the noise levels at different cluster nodes. furthermore, the proposed model provides viability to fix cluster nodes based on the usage and also to vary the threshold value. advantage of the project is sensors are easily available. it is simple, compact and easy to handle. sensors have long life time & less cost. it's drive circuit is very simple & system is real time. It will help to all researchers who are doing research based on noise control.

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