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Design of a Noise Detection System Using Arduino

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Abstract: Growing levels of noise pollution in our busy urban environment causes various health issues. Traffic lights manages the chaos at traffic but unfortunately it fails to alert about the increasing noise pollution in traffic and especially in squares. The increasing noise pollution reduces productivity, causes stress and inhibits focus. The severity of health issues, such as heart problems, hearing loss and sleep disorders reminding us how urgent it is to address this matter. We suggest an Arduino-based device that can be used in offices, libraries and school to reduce noise. This clever technology analyses data from several microphones and, when noise levels are exceeded, it sounds a buzzer. It's controlled by an Arduino controller. By raising awareness and encouraging people to highlight this issue and turn down their noise level, the system provides an automatic and innovative way to detect and reduce noise pollution, which is good for the environment and the people.

***Keyword*-- Noise detection, Noise pollution, Noise Level, Health issues, Buzzer alert.**

1. Introduction:

In the fast-paced environments of libraries, schools, and offices, maintaining a conducive atmosphere for productivity and learning is paramount important. But in between that if noise levels get excessively high all the time, disruption of concentration, hinder effective communication, and ultimately lead to reduced performance. It impacts millions of individuals on a daily basis and can result in various health issues such as hearing loss, high blood pressure, heart diseases, sleep disturbances, stress, headaches, and more. Identifying noise pollution manually is a challenging task, as it requires locating and mitigating the source of the noise each time it occurs. In order to tackle this issue, we propose an Automatic system that detects noise pollution. C. N. Vanitha, K. L. Sridhar and R. Dhivakar in this research project present an affordable, dependable, and adaptable automation solution for noise pollution in urban areas. It uses an IoT paradigm to detect human speech and sends personalized alarm messages via Arduino. The system can be used in workplaces, schools, and libraries to identify loud individuals and take appropriate action. [1]. P. M. B. Mansingh, T. J. Titus, G. Sekar and A. Shankar in this research discusses how workplace machine noise, particularly in industrial settings, can reduce productivity and lead to distractions. This problem can be resolved with the use of a noise detector and an automatic recording device. For industrial workers, this gadget offers substantial advantages since it warns the user of the noise level and records sound and time when it surpasses a predefined threshold.[2]. Q. Lian et al. An acoustic triboelectric nano-generator (TENG) and an electrical bilayer synaptic transistor (EDLT) make up the

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suggested noise detection system (INDS) in this paper. TENG serves as a stand-alone sound sensor, and EDLT mimics biological synapses. The goal of this humanized system is to build a fundamentally sound, intelligent framework for noise detection. [3]. P. S. Palkar in this paper presents a prototype for a DJ system that automatically shuts off when a silent zone is detected, alerting authorities if sound levels exceed predetermined limits. The system uses an RF module and a GSM device to detect and manage noise pollution. [4].

2. Literature Review:

A. Dufaux, L. Besacier, M. Ansorge and F. Pellandini in this study presents a system for detecting impulsive noises using a sound database with over 800 signals. The system, based on a median filter, performs well in noisy environments. It compares two statistical classifiers, Hidden Markov Models (HMM) and Gaussian Mixture Models (GMM), with a recognition rate of 98% at 70dB. [5]. K. Kondo, M. Haseyama and H. Kitajima in this study propose a new method for noise detection in images distorted by sudden noise. It involves two stages: identifying impulsive noise sources using a new flag picture and using two median filters. The method is effective in locating noise sources and working as a preprocessor for noise reduction filtering. Experiments show that even in severely degraded noisy images, the technique successfully detects impulsive noises. [6]. D. Eridani, A. F. Rochim and A. Z. Firdananta in this project aims to develop a system to monitor disruptive noise in libraries, particularly for students. It uses an Arduino Nano 33 BLE microcontroller, ESP32-WROOM32U, and DFROBOT Analogue Sound Level Metre Sense sensor, and uses feature extraction and Convolutional Neural Network techniques. The system integrates with websites and Wi-Fi, with an average accuracy of 82.78%, and stores monitoring data in MySQL databases. [7]. Noise pollution is a significant environmental concern. O. Meshkov and A. Naumoski in this paper uses a Raspberry Pi 3 model B+ computer for a noise measurement and monitoring system. The system stores data on Heroku, but power supply and internet issues limit its installation location. Future plans involve a notification system, SIM cards for internet access, and batteries for power supply, as these constraints make deployment difficult. [8]. G. Marques and R. Pitarma in this research aim to improve health and well-being through mobile computing and the Internet of Things. It proposes a modular, scalable approach for improved acoustic comfort, including real-time monitoring. The system was tested in a laboratory setting with average sound levels, highlighting the importance of real-time monitoring for improved living conditions. Advancements in wireless communications technology also improve installation and configuration. [9]. H. Nachtnebel and T. Sauter in this study investigates noise assessment algorithms in a closed-loop measurement channel, assuming no stimulus changes. The authors develop a simple method using

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addition and shift operations and suggest standard deviation adjustments. The approach's viability is confirmed through numerical studies and has been successfully applied in an automotive capacitive angular speed sensor system. [10].

3. Design:

The block diagram of the design which is proposed is been delineated in Figure-1. The Microphone Sound Sensor Module KY-038 serves as a pivotal component in the auditory monitoring system designed for environments such as libraries, schools, and offices. Integrated with an Arduino microcontroller, this sensor captures ambient noises, allowing for real-time analysis and response. Upon detecting elevated noise, the Arduino swiftly transmits a signal to both the LCD display and a buzzer, initiating a predetermined algorithmic sequence. The buzzer persists in sounding until the noise level subsides, at which point it reverts to a quiescent state. Notably, the system is configured to intelligently discern the absence of noise, prompting the buzzer to return to its normal state when the Sound Sensor perceives a tranquil environment.

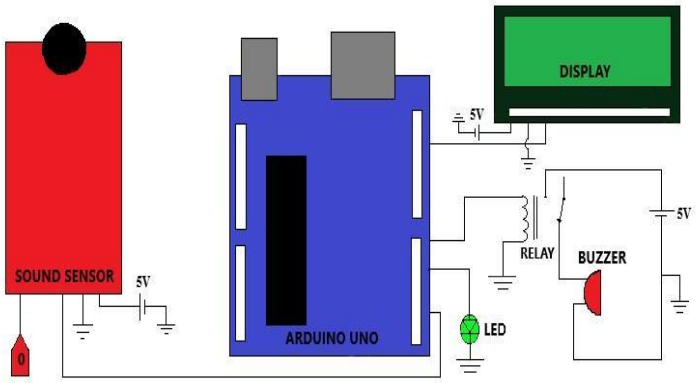

Figure-1: Block Diagram of Noise Detection System

This intricate interplay of components facilitates an efficient and automated mechanism for noise management in diverse settings. Figure-2 clearly illustrates the work flow of the suggested technique.

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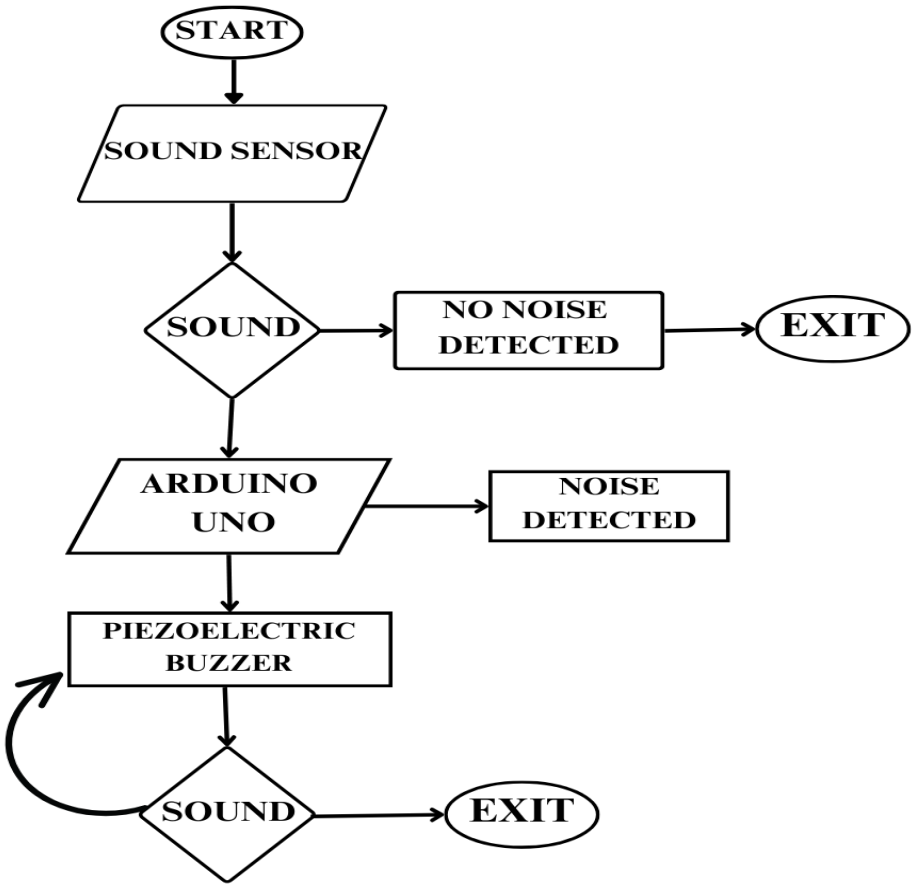

Figure-2: Flow chart of Noise Detection System

4. Simulation Parameter:

A. Hardware Components:

- SOUND SENSOR (KY-038): It is a microphone sensor used to detect noise.
- ARDUINO UNO: It is a software and hardware development environment used to program certain task.
- LCD DISPLAY: It is also a software and hardware development environment used to display content related to resolved task.
- BUZZER: It is a beeping device used mainly in alerting systems.

B. Software Components:

- PROTEUS 8 PROFESSIONAL: It is a circuit design and simulation app that is mostly used for designing electrical circuits and simulating without the use of hardware components.
- ARDUINO IDE 2.0: It is a programming software used to program various hardware Arduino boards and also used to program for software simulation purposes.

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5. Result Analysis:

When the sound sensor detects any auditory activity within designated areas such as the Library, Schools, and Offices, it promptly sends a signal to the Arduino microcontroller. In response, the Arduino executes a triggering command that activates both the Buzzer and the LCD Display simultaneously. The Buzzer emits a distinctive beep, while the LCD Display dynamically showcases the message "Sound Detected".

If the sound sensor does not detect any audio signals within its designated range, the Arduino responds differently. In this scenario, the LCD Display takes on the role of indicating the absence of sound by displaying the message "No Sound".

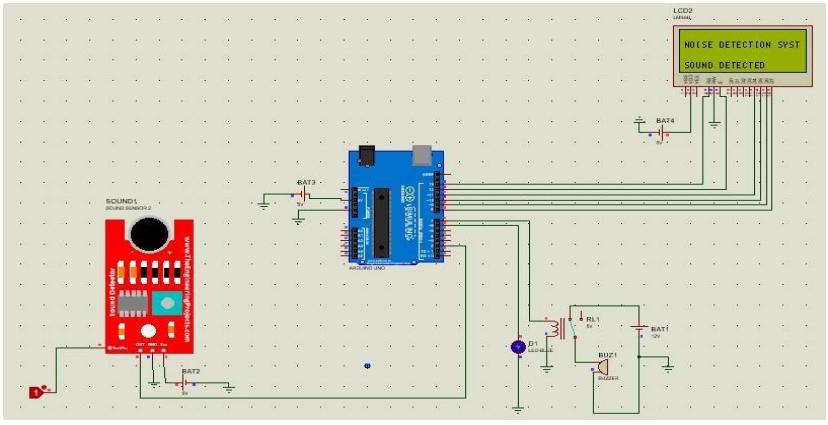

Figure-3: Circuit Diagram when Sound Detected

Importantly, the Arduino refrains from transmitting a signal to the Buzzer, ensuring that no audible alert is generated when the environment remains quiet. This setup serves as an effective means of real-time monitoring, providing immediate feedback on the acoustic environment within the specified areas.

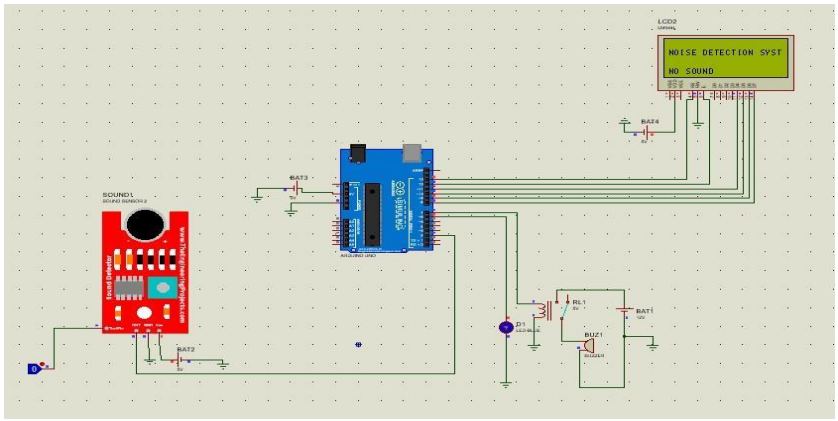

Figure-4: Circuit Diagram when No Sound Detected

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6. Conclusion:

The Automatic Noise Detection System stands as an unparalleled masterpiece in the realm of noise management, offering a versatile and indispensable solution for a spectrum of environments, including libraries, schools, and offices. This innovative technology caters to diverse settings, addressing the unique acoustic needs of silent study areas as well as the dynamic and bustling atmosphere of open offices. Investing in this state-of-the-art technology not only signifies a commitment to noise reduction but also reflects a dedication to cultivating a positive and conducive atmosphere for individuals to thrive. The potential impact on productivity, concentration, and overall well-being cannot be overstated, making the Automatic Noise Detection System a valuable asset for any institution or organization aiming to create an environment that promotes both individual and collective success. In an era where the quality of work and study environments significantly influences outcomes, embracing such advancements becomes imperative for those aspiring to achieve excellence in their pursuits.

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