NOISE LEVEL NOTIFIER

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Abstract. This paper involves utilizing an Arduino Uno as the primary hardware to measure the sound level in a library. The amount of noise in the region is measured using a sound sensor. The sound sensor signals are amplified using the operational amplifier function of the integrated circuit LM 567. There are two types of output available: audio and visual. The audio output takes the form of a personalized message that is played over speakers. LEDs are employed to offer visual feedback, with white LEDs used in noise-free environments (sound level 45 dB, yellow LEDs used when sound levels are above 65 decibels, and red LEDs used when sound levels are significantly above 80 decibels). A TIP 220 transistor is used to amplify the signals. A TIP 220 transistor amplifies the signals to create an output for the speaker. There is an audio message that corresponds to each sound level.

1 Introduction

The Latin word "nausea," which denotes something unpleasant and undesirable, is where the English word "noise" first appeared. Any unwanted electromagnetic signal that obstructs tranquility, comfort, and communication is referred to as noise pollution. Noise-induced hearing loss, which also happens to be a major factor in sensorineural hearing loss, is one of the most often reported occupational ailments. This ailment is also one of the most common illnesses at work. NIHL affects 22 million American adults between the ages of 20 and 69, and 30 million workers globally are at risk of developing it. Hearing loss is reported to be 44% for carpenters and 48% for plumbers, respectively. A typical carpenter at age 25 is comparable to that of a person at age 50 who is not exposed to loud noises**.** As per the World Health Organization, approximately 360 million people across the globe suffer from debilitating hearing loss, with 91% of them being adults and only 9% being children. In Southeast Asia, the prevalence of debilitating hearing impairment is 2.4% in children, 9.5% in adults under 65, and as high as 48% in individuals over 65 years old. Age-related

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deafness is often linked to noise pollution as the primary etiological factor. The National Institute on Deafness and Other Communication Disorders reports that 15% of the population experiences impaired hearing due to loud noise, which can arise from work-related activities, recreational pursuits, or even the use of a cell phone.

Using a mobile phone may result in a temporary hearing loss of up to 10 dB, according to two publications in the Indian Journal of Otology, and if used for more than 30 minutes nonstop, sensorineural deafness. Around 3% of the general population experiences hearing loss, including conductive and sensorineural hearing loss. However, noise pollution, particularly in metro areas, is driving a surge in occurrence, especially in families where the condition runs in the family, individuals who have anaemia or vitamin D insufficiency, or those who have other linked conditions. A transitory hearing loss or dullness of hearing due to exposure to sound beyond an average level of 85 dB is known as temporary threshold shift (TTS). Within the first 10 to 15 days following exposure, TTS may go away. TTS becomes a permanent threshold shift, nevertheless, if hair cells and the surrounding nerve fibres are frequently or constantly subjected to noise. (PTS). Extreme loudness can have negative consequences, such as psychological problems or permanent memory loss. The theories for noise-induced hearing loss include metabolic weariness, activity-induced ischemia, ionic poisoning from ruptured cell membranes, and mechanical injury from the motion of the basilar membrane. Although it is preventable, exposure to harmful sounds damages the sensitive inner ear structures, resulting in noise-induced hearing loss, which is permanent once it happens.

The Indian Journal of Otology reports that using a mobile phone nonstop for more than 30 minutes may result in sensorineural deafness and a temporary 10 dB hearing loss. Deafness affects 3% of the population currently, but the incidence is growing because of noise pollution, which can be especially bad in cities, among those who are genetically susceptible, those who have anomia or vitamin D deficiency, and those who have other connected diseases. When the hair cells and associated nerve fibres are frequently or continuously exposed to noise, temporary threshold shift (TTS), a transient hearing loss that may quickly heal within 10 to 15 days, might turn into permanent threshold shift (PTS). Communication difficulties, difficulty concentrating, worry, weariness, emotional disorders, raised blood pressure, an accelerated heartbeat, and hearing loss are just a few of the psychological and physical effects of noise pollution. Non-auditory effects of noise include safety concerns, changes in physiology and behaviour brought on by stress. Irreversible hearing loss, which can hinder communication, a vital component of human life, is the main problem with occupational noise exposure. Ultimately, noise pollution should be avoided to prevent damage to the sensitive inner ear structures because any noise has the potential to upset the surrounding region and impede activities. Fundamentally, noise sources are present in every element of human life. Any noise might disrupt the neighbourhood and stop activity. Communication, concentration, and other psychological activities may be hampered by noise. (Stress, fatigue, emotional). The effects of noise on health are also possible. Noise can cause temporary to permanent deafness by increasing blood pressure, quickening the heartbeat, and damaging hearing. The length and volume of noise exposure have an impact on hearing loss. Voice plays an important role in communication. However, there may also be noise pollution or annoying sounds. Fundamentally, noise sources are present in every element of human life. Any noise might disrupt the neighbourhoods and stop activity.

Many people find it unpleasant when noise causes them to experience hearing discomfort. Our daily life can be hampered by noise pollution, which may affect our ability to hear and communicate due to sounds from conversations, music, vehicles, and machinery. The effects of noise might include everything from communication and hearing

problems to psychological problems. Unwanted noise in a space can be distracting and make it challenging to focus. Like this, working in an environment where there is equipment that produce sound over the human hearing threshold can influence employee health. A Sound Levels Meter (SLM), which measures sound levels in decibels, can be used as one method of determining the effect of noise on a person. (dB). While there is little doubt that technology may increase productivity and efficiency in many different contexts, some gadgets have limitations. For instance, a specific device could only be able to gauge the noise level in a specific area. Fortunately, new methods are now readily available that can instantly alert the public to the noise levels in particular circumstances. Those who desire to control their noise exposure can benefit from this development. The device allows for the measuring of noise levels for a variety of purposes, and has useful applications in the sectors of health, industry, and agencies. It is crucial to consider how noise affects different settings, such as workplaces and learning environments. Excessive noise can have a negative influence on productivity and academic results by posing health hazards, contributing to exhaustion, and making it difficult to focus. So, it's essential to monitor and manage noise levels to give people a safe and pleasant atmosphere. When necessary, technology can assist people take preventive measures by providing real-time data on noise levels using sensors and the internet of things. It may be advantageous for businesses and educational settings to build devices that can remotely monitor and manage noise levels.

2 Literature Review

A tool that can measure the noise level in real-time is the Sound Level Meter (SLM). However, it is useful to have a noise level metre that can automatically show findings on a computer to make it easier for people to comprehend and quantify the noise. Researchers used a computer, an Arduino UNO microcontroller, a MAX4466 sound sensor, and software created with Delphi 7.0 to collect data and report measurement results using data and graphs. Using the SLM technique, the researchers calculated the noise level in a space with a 44.6 dB sound intensity. An average noise level of 44.19 dB was obtained by taking measurements with the sound sensor once every second for a total of 30 seconds. The researchers deduced that the system's architecture was working well because there wasn't much of a difference between the two results [1]. This tool's noise level detector has a 16 x 2 LCD screen with a notification capability, an LED indication set, and a little sound. If the noise level exceeds 75 decibels, the red LED will turn on to alert people to the hazard. If the measured value is greater than 56 dB, the LCD will beep and display a yellow LED. In contrast, the sound indicator will say it is calm and not noisy if the noise measurement value is less than 55 dB The research's conclusions show that the SNL gadget can detect and display noise levels between 50 and 100 db. It also offers audio-visual alerts concerning noise levels, demonstrating its usefulness as a tool for monitoring and measuring noise [2]. For encouraging healthy living and securing a brighter future, monitoring noise and air pollution levels is essential. A promising method for keeping track of these environmental problems is the development of smart sensor networks, which combine electronics, wireless communication, and computer science. To track noise and air pollution levels in any relevant location, a wireless embedded computing system is suggested in this research study as a feasible solution. Researchers and decision-makers can better comprehend these environmental concerns and create more potent solutions by utilising this technology [3].

Numerous environmental issues exist in the globe today, including air and water pollution, noise pollution, and climate change. Population expansion, industrialization, infrastructure expansion, rising car ownership, and the usage of fossil fuels have all made

these problems worse. To ensure a healthy life and a brighter future, it is essential to monitor these issues and provide solutions. The creation of smart sensor networks, which combine electronics, wireless communication, and computer science, is one field of research that can help in monitoring noise and air pollution levels [4]. The data gathered by sensors can be processed, stored, and analysed at a centralised government data centre to help authorities make informed judgements and take corrective action promptly. Government agencies can apply the body area network (BAN) and wireless sensor network (WSN) created in this research on a broad scale to evaluate the risks of uncontrolled noise levels and their effects on public health. A centralised government data centre can process, store, and analyse the collected data, giving officials access to real-time information and statistical data to help them make educated decisions and move quickly to address problems. For people living in the affected areas, this can help to establish a safer environment [5]. The purpose of a noise detector-equipped automatic recording system is to identify and capture noise. It is hard for a teacher to constantly monitor every noise, and the rising noise levels in companies and classrooms have become a serious issue. An Arduino-based noise detection system with an automatic recording feature has been created to solve this problem. When it detects loud discussion (sound levels exceeding 120dB to 140dB), this device notifies us and captures the conversation, saving it as a file. To maintain decorum, these tools are employed in hospitals, libraries, labs, as well as in schools and colleges. This technique not only identifies obtrusive persons so that appropriate action may be taken against them, but it also aids in maintaining a quiet workplace [6]. Maintaining a calm and tranquil environment at a library is essential for promoting learning and research. Others may be inconvenienced by some patrons who may not be aware of the library's rules and who act in a disruptive manner. The goal of this study is to create a system that can classify and monitor noisy distractions in libraries. The system makes use of a DFROBOT Analog Sound Level Meter Sense sensor and an ESP32-WROOM32U-connected Arduino Nano 33 BLE microcontroller. The Convolutional Neural Network algorithm, which enables the system to accurately categorise data, is trained using the Feature Extraction technique. The system is connected to Wi-Fi, integrated with websites created using the PHP programming language and Laravel framework, and the data is stored in a MySQL database. The system can issue a noise warning when human or mobile phone sounds exceed the threshold, with an average classification accuracy of 82.78%. The system operates best when the distance from the sound source is between 30 and 100 cm. [7]

In addition to being a substantial environmental stressor, noise pollution from factories and industrial sites can have a severe impact on worker concentration and health, creating dangerous working conditions and an unfavorable atmosphere. A low-cost instrument called LCDONE has been created to track occupational noise exposure to address this problem. This system is built on an ESPDuino-32 that has been programmed with Arduino Wi-Fi UNO and uses ThingSpeak's IoT analytics platform service to collect real-time data for monitoring. The data has been verified using a recognized sound level meter and is shown in decibels (dB) through the ThingSpeak Viewer [8]. Many sorts of noise in the environment can be a serious cause of disruption and have dangerous impacts on life. It's crucial to keep an eye on and manage these noises if we want to solve this problem. The sound level, which is a quantity measurement for sound waves reflecting their loudness, can be detected, and measured using a sound monitoring device. A sound sensor coupled to a microcontroller, like the Arduino Uno, that can measure the sound level continually while carrying out other duties, can make up the system. With little systems with little memory and other resources, microcontrollers are made to do simple tasks. Our suggested system can track and show the volume as well as the precise location of the sound source, which can be found using smartphone map services. This system offers a complete solution for tracking and managing environmental noise [9]. Rapid urbanization and overpopulation

have had a harmful impact on the environment, particularly in major cities. Increasing noise levels, which can negatively affect people's health, are a major issue in these places. This study suggests using Internet of Things (IoT) technology to monitor noise levels in Skopje, the nation's capital, in a way that is environmentally friendly. Many measuring stations are used throughout the city as part of the platform, which provides 24-hour monitoring and acts as a monitoring portal and early warning system for elevated noise levels. The study also evaluates the city's noise exposure condition to forecast and stop future noise pollution, and it proposes a low-cost sensor design for converting monitoring units into decibels. To better understand the dynamics of variations in noise levels and contribute to noise pollution control, the analysis concentrates on the regions, times of day, and months that are most exposed to noise [10].

Designing a project that can aid in more effective trash management is a terrific idea. Using technology to keep track of the amount of trash in the trash can help prevent overflowing and the unsanitary circumstances that can result. The level of trash in the trash can may be precisely measured with the aid of Node mcu and ultrasonic sensors. It may be integrated with IFTTT Webhook so that it can deliver alerts when the trash can is more than 70% full. This can assist in timely garbage bin emptying and prevent overflow and its related issues. These initiatives can also aid in raising awareness of waste management and its significance for preserving a clean and healthy environment [11]. The installation of a burglar alarm system that includes a magnetic field sensor component is an excellent way to combat the rising incidence of theft in places like houses, banks, businesses, and retail establishments. A hall sensor is the sensing component utilized in this system, and it can detect the magnetic field and translate it into instructions for the alarm to go off. A 16x2 LCD display shows the system's output, which offers real-time data on the strength of the magnetic field observed. The burglar alarm system's latest technology is helpful for boosting security and giving consumers peace of mind. This technology can assist in reducing losses and damages brought on by burglaries by detecting and warning people about possible theft. Overall, the burglar alarm system's usage of hall sensors offers an effective and dependable method for guaranteeing security in a variety of scenarios [12]. Automated security systems frequently use biometric-based identification yet contact biometrics can promote the spread of diseases like COVID-19. This problem is addressed with a non-contact biometric authentication method that examines biological traits like Wolflin nodules, crypts, and pigment patches in the iris. The Wolflin nodule, crypt, and pigment spot of the iris region are subjected to different feature extraction techniques using BRISK, SURF, FAST, MinEigen, MSER, and Harris after the features are separately segmented into rectangular shapes. The most appropriate feature extraction method for each feature is determined by statistically analysing the amount of feature points extracted from each methodology. Feature matching is carried out on the trained and untrained features of the data set, which is split into a 60% training and 40% untrained group. The study of the number of feature matches reveals that the pigment spot, crypt, and Wolflin nodules each have authentication threshold values above 3, 2, and 0, respectively. This technique offers a safer and cleaner alternative for biometric-based authentication [13-14].

The number of vehicles has increased, which has resulted in more traffic congestion and difficulty locating parking spaces, particularly during rush hour. This paper suggests a Smart Parking System using Arduino components to solve this problem. The technology is made to precisely identify available parking spaces and display them on an OLED screen, cutting down on the amount of time needed to find a spot [16]. Additionally, this approach aids in reducing parking infractions and fees. It can enhance overall traffic flow and lessen congestion brought on by drivers looking for parking places by developing an effective and user-friendly parking system [17]. Major cities' fast automotive growth has created traffic control problems, including lengthy delays at traffic lights. Different types of traffic light

control systems are being investigated as a solution to this issue. Three modes are suggested in this article: normal, density, and emergency. To make switching between modes easier, these modes are interfaced with a PIC 16F877A microcontroller using embedded C [18].

3 Proposed Method

The creation of the circuits used in the SNL system served as the starting point for the endeavour. Transistors and other SNL system auxiliary devices, such as noise detectors, were also created. A microcontroller, a module which is of Arduino UNO type, a sound sensor, an amplifier which is of IC LM 567 type, a transistor TIP 220, and an LED are some of the parts used to build the system.

3.1 Block Diagram

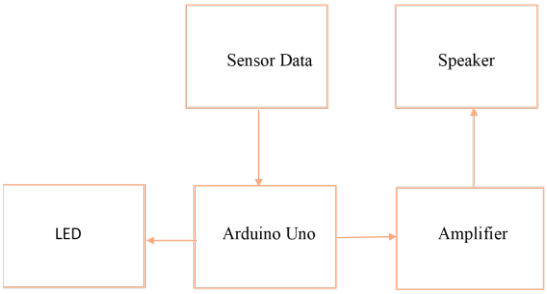

Fig. 1. Block Diagram

3.2 Sensor Circuit

The LM 567 decoder and a condenser microphone were used to build the noise sensor circuit. The circuit design included op-amps and the tone decoder LM 567. An op-amp is a two-input, one-output electrical device that generates a voltage proportionate to the voltage difference between the inputs. There are many benefits to using operational amplifiers in circuit design, including the opportunity to work with perfect characteristics and simpler circuit design.

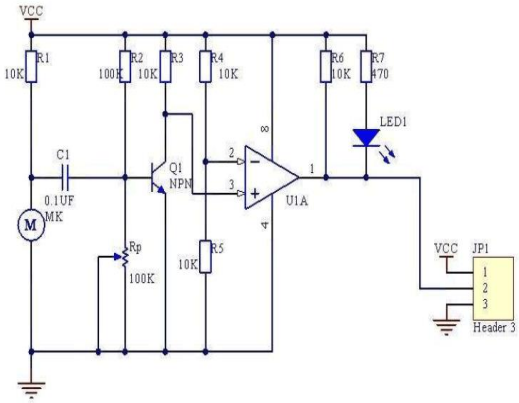

Fig. 2. Sensor Circuit

3.3 TIP 220 Transistor

A versatile and frequently used element in electronic circuits is the TIP 220 transistor. It is a bipolar junction transistor of the NPN type, which is frequently used in amplification and switching applications. The TIP 220 can easily handle high-power loads with a maximum current rating of 5 amperes and a voltage rating of up to 60 volts. This transistor's main application is in power supply circuits, where it helps control and amplify output voltage. Additionally, it can drive motors and adjust their speed in motor control circuits. The transistor also frequently finds use in audio amplifiers, where it can amplify weak signals and generate high-quality sound output. For switching applications, the TIP 220 transistor is a great option. Because of its high current rating, it can manage significant currents, which is important for switching high-power loads. Relay drivers, inverter circuits, and other related applications frequently use this transistor.The low collector-emitter saturation voltage and high DC current gain of the TIP 220 transistor make it unique. It can sustain low power dissipation thanks to its low saturation voltage, and it amplifies even weak input signals to greater levels thanks to its strong DC current gain. The toughness, dependability, and endurance of this transistor make it a great option for both DIY projects and industrial applications. In conclusion, the TIP 220 transistor is a very adaptable electronic part that may be utilised in a variety of circuits, such as power supply circuits, motor control circuits, audio amplifiers, and switching circuits. It is a crucial component in contemporary electronic systems due to its high current rating, low saturation voltage, and high DC current gain.

Fig. 3. Tip220 Transistor

3.4 Speaker

A small, low-power speaker that runs on 5 volts is known as a 5V speaker. When an audio output is needed for a range of electronic applications, this kind of speaker is frequently employed. It is a well-liked option for mobile devices like smartphones and tablets because of its portability and energy economy. A 5V speaker's sound quality can change based on the speaker's quality and the audio signal it is receiving. However, many 5V speakers can deliver high-quality audio with decent loudness and clarity. The best sound output comes from a high-quality speaker, so make sure to get one. The low power consumption of a 5V speaker is one of its main benefits. The speaker is a great option for portable devices that use batteries because it uses very little electricity to operate. This makes it possible for the device's battery to last longer between charges. The simplicity of use of a 5V speaker is another benefit. It is accessible to hobbyists and electronics enthusiasts without specialised skills or knowledge since it may be quickly linked to an electronic project using a straightforward connection wire or socket. Overall, the 5V speaker is a flexible and useful part that has several benefits. It is a great option for a wide range of electrical projects, from

portable devices to small electronic gadgets, because to its small size, low power consumption, and simplicity of usage. The 5V speaker can create high-quality sound output for a variety of audio applications when coupled with a high-quality audio circuit.

3.5 Arduino Uno

A popular microcontroller board called Arduino Uno was created for amateurs and electronics enthusiasts who wish to build their own electronic projects. The board is a top pick for many DIY enthusiasts since it is so simple to use, adaptable, and readily available. The key elements of the Arduino Uno are described in the following sentences:

- The ATmega328P microcontroller: serves as the Arduino Uno's primary processing element. It is in charge of carrying out commands and controlling inputs and outputs.
- Digital Input/Output Pins: The Arduino Uno includes 14 digital input/output pins that can be used to connect to a variety of electronic parts, including sensors, switches, and LEDs. It is possible to code these pins to function as inputs or outputs.
- 16 MHz Quartz Crystal: The microcontroller's precise timing is provided by the 16 MHz quartz crystal. This guarantees that the board operates at a constant frequency and that it can be utilised for tasks that call for exact timing.
- USB Connection: The Arduino Uno is powered and programmed through the USB connection. This makes it simple to use the Arduino Integrated Development Environment to programme the board when it is connected to a computer. (IDE).
- Power Jack: The Arduino Uno can be powered externally by plugging it into the power jack. If the board needs to be powered by a battery or an external power source, this can be used.
- Reset Button: Pressing the reset button restarts the Arduino Uno and the program. When modifying the code or troubleshooting applications, this is helpful.
- Voltage Regulator: The Arduino Uno's voltage regulator controls the input voltage to the board so that the microcontroller and other parts receive the proper voltage. This makes that the board is operating properly and protects it from overvoltage.
- LED: The Arduino Uno contains an LED that may be used for several things, including as an output or to show the board's state. This can be helpful for debugging software and producing straightforward visual outputs.

Fig 4. Arduino Uno

3.6 Arduino audio Encoder

Analog audio signals are transformed into digital representation using an Arduino audio encoder. Other devices, like a computer or a microcontroller, can simply store, access, and utilise this digital format. The encoder is a useful tool for a variety of audio tasks, such as sound design, audio recording, and music creation. Typically, a microcontroller, audio input/output circuitry, and memory storage make up an Arduino audio encoder. The audio data is processed by the microcontroller, who also stores it in the memory. The encoder is connected to other audio equipment, such as microphones, speakers, and amplifiers, using the audio input/output circuits. The encoded audio data is kept in the memory storage in a format that other devices may access readily. The VS1053 audio codec module is one of the most popular audio encoders for the Arduino platform. The digital signal processor in this module can encode and decode audio data in several different forms, including MP3, WAV, and MIDI. The module is an all-in-one solution for audio encoding and playback because it includes an integrated microphone input and headphone output. An audio input device must initially be connected to the encoder's audio input circuit to use an Arduino audio encoder. The analogue audio signal is subsequently transformed into a digital format that can be stored in the encoder's memory by the user activating the microcontroller. Other devices, such a computer or a microcontroller, can then access and utilise the encoded audio data. The user can utilise a variety of audio playback gear or software to play back the encoded audio data. A useful tool for music composition and sound design, encoded data can be manipulated and processed using a variety of audio editing programmes. An Arduino audio encoder is a useful tool for a variety of audio applications, to sum up. It enables users to transform analogue audio data into digital format, which is simple to store, access, and utilise by other devices. Due to the increasing use of the Arduino platform, a wide variety of audio encoders are now accessible, making it simple for customers to discover a solution.

4 Limitations

This project faces a major limitation in that it occupies a significant amount of space. The available space inside the Arduino is not good enough to include both the code and the audio samples. We planned on uploading two audio samples, but the Arduino Uno only has space to upload one code only. The audio that is uploaded on the Arduino is compressed. The 320KHz frequency has been reduced to only 8kbps. We used inbuild audio library that supports only audio files with an 8k frequency. Because of this the output from the speaker is relatively low. These problems can be eliminated by:

- A high-end Arduino or one with a large amount of memory can be used.
- We are using both Arduino micro controllers and the Raspberry Pi, which is a high-end board with a minimum of 1GB of memory.
- By using an audio module, the sound from the speaker can be improved but it is not recommended.
- By using the SD card module, it is possible to solve the space problem and improve the sound quality.

Due to its simplicity, affordability, and versatility, Arduino has rapidly grown in popularity as a platform for DIY electronics projects. Users must be conscious of these restrictions when planning and executing their projects, though, as with any technology. The processing power of Arduino is one of its main drawbacks. Although the microcontrollers used in Arduino boards can carry out a wide range of activities, they lack the computing capacity of larger, more potent computers. This means that it may be

challenging to implement complicated projects on an Arduino without affecting the system's overall performance. The memory capacity of Arduino is yet another drawback. Due to their low storage capabilities, Arduino boards provide a challenge for projects that need for extensive data processing or storage. This may also provide a challenge when employing external components like sensors or actuators, which need a lot of memory to retain data. For some projects, the input/output (I/O) restrictions of Arduino can be a problem. For complicated applications that call for several sensors, actuators, or other devices, the restricted number of input and output pins on Arduino boards can be an issue. This can be avoided by increasing the number of I/O pins using multiplexers or other devices, but this can complicate the project.

The memory capacity of Arduino is yet another drawback. Due to their low storage capabilities, Arduino boards provide a challenge for projects that need for extensive data processing or storage. This may also provide a challenge when employing external components like sensors or actuators, which need a lot of memory to retain data. For some projects, the input/output (I/O) restrictions of Arduino can be a problem. For complicated applications that call for several sensors, actuators, or other devices, the restricted number of input and output pins on Arduino boards can be an issue. This can be avoided by increasing the number of I/O pins using multiplexers or other devices, but this can complicate the project. Despite being a strong and well-liked platform for creating electronic projects, Arduino does have some restrictions that may limit what may be done with it. These restrictions include those related to hardware, memory, and programming. The low number of input and output pins on the Arduino platform is one of its primary hardware limitations. This might make it challenging to design projects that need for a lot of sensors or actuators. Furthermore, the Arduino's analog-to-digital converter (ADC) has a low resolution, which may affect the precision of measurements and the calibre of output signals. The memory capacity of Arduino is yet another drawback. The amount of program memory and dynamic memory that can be used is limited, even if newer versions of Arduino boards have more memory. When working on increasingly complicated projects that demand a lot of code or data storage, this may become a problem. When the allotted RAM is used up, the program can crash or act strangely. When dealing with Arduino, programming restrictions are another consideration. Because of the platform's use of a streamlined version of the C++ programming language, working with intricate algorithms or data structures might be difficult. Additionally, the functionality or compatibility of Arduino libraries may be constrained, which might limit the variety of projects that can be created.

The absence of real-time capability is another drawback. Because Arduino runs on a single thread, it can only handle one task at a time. Projects requiring real-time processing, such as robotics or automation, may experience delays or timing problems as a result. Finally, not all projects can be completed with Arduino. For instance, more powerful platforms like the Raspberry Pi may be better suitable for projects that need a lot of processing power or sophisticated graphics capabilities. Additionally, Arduino might not be compatible with projects that call for specific tools or software. In conclusion, Arduino is a flexible and inexpensive platform for creating electronic projects, but there are some restrictions that must be considered. These restrictions include those related to hardware, memory, programming, real-time capabilities, and applicability for tasks. However, a variety of intriguing and practical projects can still be made using Arduino with proper thought and consideration.

5 Advantages

An open-source platform called Arduino provides a selection of hardware and software tools for making interactive electronic projects. One of Arduino's numerous advantages is its ability to work with sound sensors, which enables users to record and instantly analyze sound waves. When it comes to creating projects using an Arduino and sound sensors, this capacity offers a variety of benefits and drawbacks. One of the main benefits of utilizing sound sensors with Arduino is that it offers a lot of freedom in project design. A wide range of sounds, including speech, music, and other environmental sounds, can be detected using sound sensors. This adaptability enables designers to produce a wide range of projects, from musical instruments and interactive installations to sound-activated lights and alarms.

- Real-time analysis: The capacity to study sound waves in real-time is a big benefit of using sound sensors with Arduino. This capacity enables the development of responsive projects that respond to variations in sound pressure or frequency. A sound-activated light might, for instance, adjust its color or brightness according to the loudness or pitch of the sound it detects.
- Simple to use: Arduino is renowned for its intuitive user interface and wealth of internet information. This enables using sound sensors in projects simple for both inexperienced and seasoned designers. It's simple to start with Arduino and sound sensors because there are so many guides and example codes online.

6 Disadvantages

The sensitivity of a sound sensor to outside noise is one of the biggest drawbacks of utilizing one with an Arduino. In addition to the intended sound, sound sensors can also pick up ambient sounds like traffic, conversation, and other background noise. As a result, the sensor may produce false positives, producing data that is erroneous or untrustworthy. For instance, if you are using a sound sensor to gauge the volume of a space, outside noise could result in erroneous findings. The restricted frequency range of a sound sensor when coupled with an Arduino is another drawback. Most sound sensors are made to pick up noises in a certain frequency range, like 20Hz to 20kHz.This implies that some sound patterns, including those with high pitches or low frequencies, would not be able to be detected by the sensor. This may restrict the sound sensor's uses and render it inappropriate for some projects. Utilizing sound sensors presents another difficulty because of how sensitive they might be to ambient noise. The sensor's capacity to precisely detect and quantify sound can be hampered by even a little amount of ambient noise. When trying to quantify extremely faint noises or while working in a noisy setting, this can be particularly challenging. You might need to take time-consuming and challenging efforts to reduce background noise to acquire accurate findings.The question of compatibility comes last. Even though the Arduino platform is open-source, and a wide variety of sensors and parts are accessible, not all of them are interoperable. To identify components that operate effectively together, you might need to invest a lot of effort in researching and trying various options. Particularly if you have a short deadline, this approach can be tedious and time-consuming. Using the Arduino with sound sensors in projects has many benefits, but there are also some important drawbacks that should be considered. These include potential compatibility problems between various parts, the difficulty of setting up the sensors, the price of some sensors, their sensitivity to outside noise, and the high cost of some sensors. It is crucial to carefully analyse these considerations and decide whether employing these technologies in your project is worth the time, effort, and price.

7 Conclusion

The adoption of this project may have a few advantages, including monitoring and lowering noise levels around classrooms. It is possible to identify excessive noise levels that can annoy and disturb students and teachers by using the sound sensor. Once the source of the noise has been identified, steps can be done to lessen it, such as installing sound-absorbing materials or moving furniture to improve the acoustics of the space. This may improve the learning atmosphere and perhaps even boost student performance. Moreover, the integration of this project with CCTV can also benefit staff members. Staff can monitor the learning area remotely and be alerted to any unusual noise or movement. This can reduce the workload on staff, allowing them to focus on other tasks instead of having to constantly monitor the area. This project can be used in any area where noise levels need to be monitored; it is not just confined to educational settings. For instance, it can be used in businesses to increase productivity by lowering distracting noise levels or in hospitals to guarantee that patients are not disturbed by excessive noise. Overall, this project's implementation has the potential to significantly improve a variety of situations, making it an important tool for noise monitoring and mitigation.

8 Result

The noise level in a certain region will be measured using an Arduino board and a sound sensor in this project. Data from the sound sensor will be received by the Arduino board, which is designed to process it appropriately. The model is put to the test to make sure it operates properly and efficiently. The Arduino board generates visual output through an LED light and audible output from the speaker after the data has been gathered. Depending on how much noise the sound sensor picks up, the LED light emits a variety of colours. For example, if the noise level is moderate, a blue light with a personalized message flashes for a short while. A red light and corresponding warning message are flashed if the noise level. This idea can be put into practice in a variety of places where it is necessary to monitor noise levels, including public places like parks, libraries, hospitals, and schools. The project can contribute to lessening noise pollution and fostering a calmer environment by keeping track of noise levels. is high.

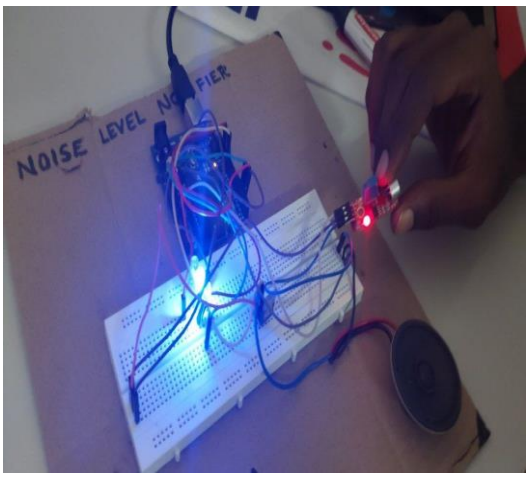

Fig. 5 Final Output

9 Future Scope

The system can be adjusted and changed to fit a variety of applications in various industries. In hospitals, for instance, it can be used to keep an eye on noise levels to make sure that patients aren't bothered by loud noises. Additionally, it can be utilized in industries to keep an eye on the noise levels of machinery and equipment to make sure that no workers are being harmed. The system can be modified to work in many settings and offer insightful. The model created for the library application can also be applied in other situations. It is intended to monitor the amount of noise in a space when the teacher is not present, but it can also be modified for other circumstances. For instance, it might be set up to only record noise levels at specific times, as at night on a hostel veranda. The system can be configured to provide several types of speech notifications through a speaker. The model may be utilized for more things by incorporating security cameras, such keeping an eye on pupils who stay in class after school. Teachers who are unable to oversee these situations first-hand can benefit the most from this. The model is currently constructed using an Arduino, which has a larger amount of memory and a speaker whose voice output frequency is just 8000 Hz, making it less loud than one might anticipate from a Raspberry Pi. The Raspberry Pi can do away with the requirement for loudness in the speaker because it has more storage space and more effective speaker output. The integration of this little endeavour into larger initiatives, such CCTV projects, is conceivable. By combining this project with CCTV, we can use PIR and sound sensors to monitor both movement and noise levels. When a movement is detected, it is possible to establish a project that transmits a photo via text message, email, or another manner. Since there is often less mobility after work hours, this application is very helpful. Any activity outside of regular business hours, such as in the banking industry, could portend a potential financial loss. Additionally, it's possible that students in colleges and universities won't leave their classes, which might be unsafe. Managing these circumstances is not always enjoyable.

In the future, there will be numerous projects that can be created with Arduino, PIR, and sound sensors. Here are some potential concepts:

1. Home security system: Construct a home security system that uses PIR sensors to identify intruders and notifies owners via sound alerts or notifications.
2. System to monitor classroom noise levels: Create a system that can track noise levels in a classroom and warn students and teachers when they get too loud.
3. Intelligent traffic control system: Create a system that can track traffic and modify traffic signals in response to noise and volume levels.
4. Smart lighting system: Construct a system of lights that can change brightness levels in response to sound and motion.
5. Baby monitoring system: Create a system that can track a baby's sleeping habits and notify parents if the child wakes up or if the room is too noisy.
6. Automated irrigation system: Create an irrigation system with a soil moisture sensor that can measure soil moisture levels and change watering rates in response to sound and motion detection.

These are just a few ideas, but the possibilities are endless. Arduino, PIR, and sound sensors can be used in many ways to create innovative and useful projects.

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