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Harmful Noise Intensity Level Pre Determination System for Noise Generated Sources

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Abstract

Sound waves propagate in all direction through air and materials due to diffraction effect. Interference of sound signals generated by several devices could create a noisy state which is harmful for the human being at certain instances in which noise intensity level is beyond 90 dB.

The system discussed in this research, facilitates to find noise intensity levels at different places simultaneously and further it identifies and point out the places where the noisy state is harmful for human being. Corresponding calculation by the system is mainly done based on the direct source and reflection effects for the selected area.

As the first step, requirements are analyzed. In the designing state as next, the programs are written to implement identified requirements. The visual basic is utilized to implement relevant programs because of its user friendly facility. Then the testing is carried out for each sub program and finally for the entire system. In general, the noise intensity level is estimated in the absent of the sound generated instruments.

Noise transition calculation formulas have been used to find noise intensity levels at relevant places within the selected area.

Keywords: Noise Intensity, Diffraction, and Interference.

Introduction

The system is developed based on the functional specification of the noise intensity

behavior. It can calculate noise intensity levels at several points simultaneously. In the application process of the programme, it is required to enter data one after another and the calculation process is done once for entire selected area. Further, the system is facilitated to identify and point out the places with relevant distance and angles where the noisy state is harmful for human being.

In general, intensity level must be less than 90 dB and places where the noise intensity level beyond the above specified limit could be harmful for human ears.

Theoretical Background

Noise is very often and most simply defined as unwanted sound. It had never being considered as pollution till it would realized that noise can cause loss of hearing and leads to anxiety, stress, or fright, with consequent adverse physiological effect. Noise pollution is thus the unwanted sound dumped into the environment without regard to the adverse effect it may be included (join2green, 2010).

The traveling of sound wave transits energy in the direction of its propagation. The rate at which the work is being done is defined as the 'Sound Power'. 'Sound Intensity' is defined as the time weighted average sound power per unit area normal to the direction of propagation of the sound wave. Sound power and intensity are related each other by the expression given below.

$$I = \frac{W}{A}$$

Where
W – Sound Power,
I – Sound Intensity, and
A – Area. (HyperPhysics, 2010)

Noise Intensity level is the combination of noise level generated by different devices. When a background noise is 50dB then Noise intensity Level at a point is given by the following expression.

$$\text{Noise Intensity Level} = 10 \log\left\{ 10^{\left(\frac{50}{10}\right)} + 10^{\left(\frac{X}{10}\right)} \right\} \text{ dB}$$

Where
X – Noise Intensity of the source

The noise intensity level at the particular point mainly depends on the distance to the sound generated source with respect to the above specified point. Let the source is established at the point 'S' while the relevant measurements are taken at the point 'P', then

$$\text{Intensity Level at point P} = \left\{ \text{Intensity Level at point S} - 20 \log 10\, r \right\} \text{dB}$$

Where

R – the distance to the source with respect to the measuring point (Meegama R.G.N. 1998)

Methodology

The particular research develops a system that would identify and point out harmful intensity level points accurately and efficiently. The relevant measurements are carried out in several steps. The overall process is depicted in Figure 3.1

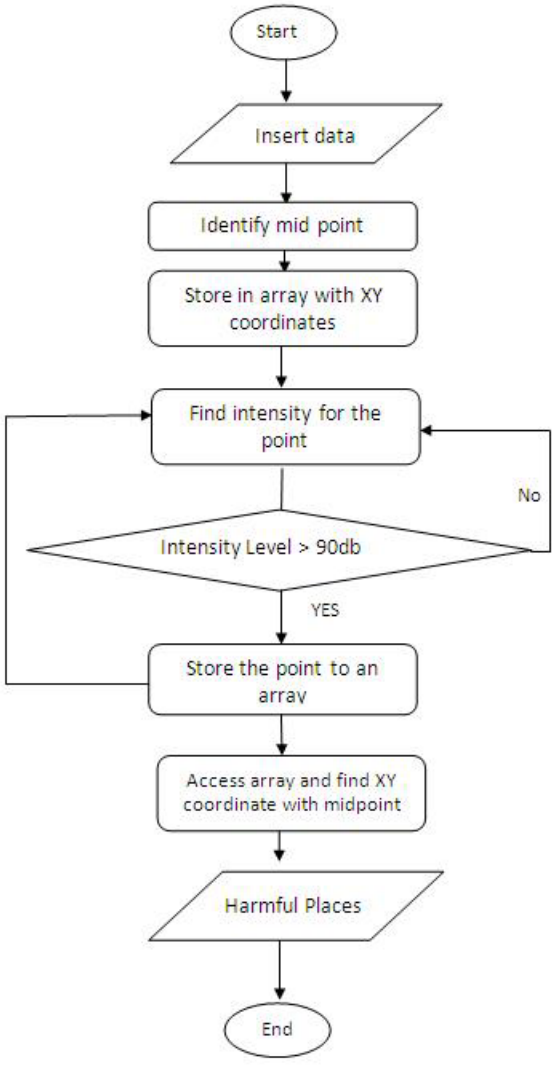

Figure 3.1: Methodology of the System which calculates noise intensity level and identifies places harmful for the human ears.

Steps of the method

Within the system, it is required to identify sound intensity level and then to find the harmful places for human ears. Therefore the system is divided into several parts as follows.

User interface design

Simple user interface is designed to facilitate the insertion of data of noise generated sources. Data consist of distances from the midpoint, angles and intensities in decibel (dB).

Store data in an array

The system should have facilities to store inserted data for the future calculation. Therefore, inserted data are stored in an array.

Calculate the XY coordinates

The stored data are accessed; calculate the XY coordinate and then they are stored in another array for the future calculation. Now the system can identify source place with XY coordinates.

Calculate the Intensity of specific point

As a first step, (0,0) point is considered and by accessing the array, it is calculated intensities of each and every source for selected points.

Calculate the Intensity level of specific point

Utilizing the computed intensities and the noise transition formulas, it is calculated intensity levels of relevant points within the specified area.

Check for the harmful noise intensity level

With help of calculated intensity levels; the checking is done for the place where the noise intensity level is beyond 90 dB and hence it is recognized relevant human harmful point within the selected area. Intensity level and XY coordinate corresponding to this point are sent to an array.

Find the harmful place

Using stored XY coordinate; it is calculated distance from the midpoint and angle and then it is displayed it in the user interface.

Next harmful place

As followed previous steps; calculation is done for the next point intensity levels and check for other harmful places.

Results and Discussion

In this section, outcomes of the project will be presented and important points are

discussed. Figure 4.1 displays the interface of the system which calculates noise intensity level and identifies places harmful for the human ears.

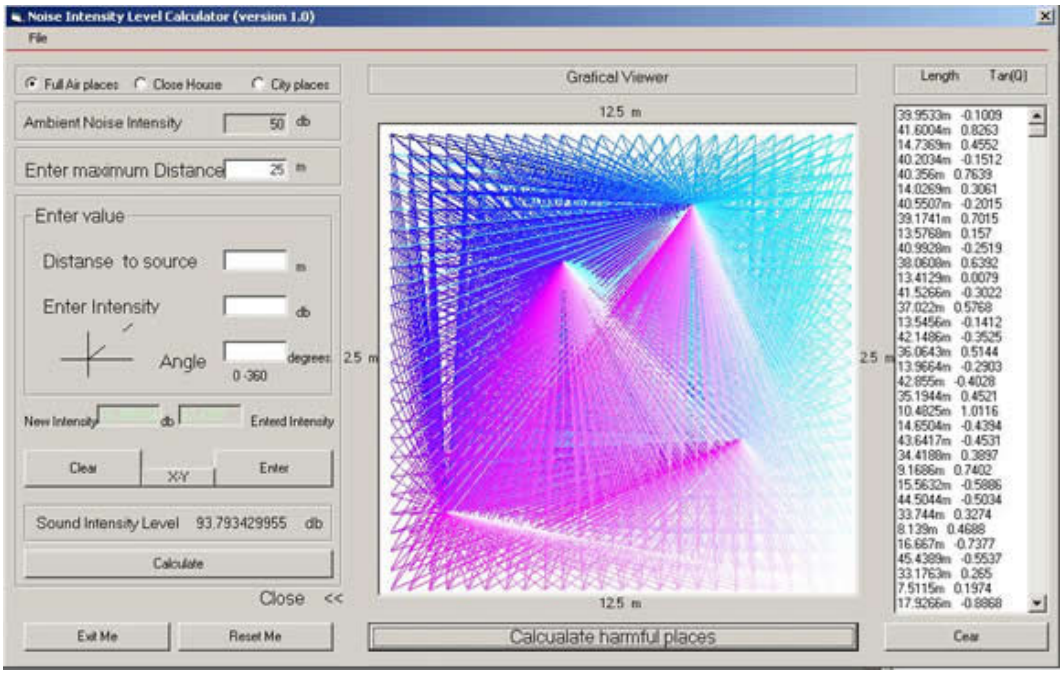

Figure 4.1: Interface of the system which calculates noise intensity level and identifies places harmful for the human ears.

This system is facilitated with inserting noise intensity of the sources to the system. By clicking on the calculate button, user can calculate harmful noise intensity, harmful points with relevant angles and distances of the specified location.

Conclusions and Future Work

The proposed system provides more user friendly, accurate, and efficient working environment to find noise intensity levels at different places and to identify and point out the places where the noisy state is harmful for human ears within the selected area.

The system could further be enhanced in the following approaches,

- Including the transmission effect of sound signals as a corrected factor into the intensity determined system.
- Study new arrangement methods of establishing sound generated devices within the selected area to avoid being reaching intensity level beyond limited level assign by 90 dB.

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