

Noise Pollution in Major Places in Dhaka and Proposing a Device to Keep Noise Log

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This study attempts to build awareness to the noise pollution level of our city and also cultivate the areas of Dhaka city that are prone to health and environmental hazards in terms of noise pollution, by taking readings of certain locations in Dhaka city (Residential and commercial), and comparing it with the standard stated thresholds of DOE (Bangladesh department of environment). The purpose here is not only to analyze how good or bad the current noise level is but also to understand exactly why this situation should be taken seriously. We also found a pattern that suggested that noise pollution differed according to the time of the day. At the end a small proposal is placed, suggesting how we can use a miniature palm sized computer to record sound from places that are prone to health hazards. This will help keep a log of sound and help understand the situation of noise pollution we are having and may have in the future. It will also help in keeping sound files for analysis, and engage concerned people to keep a log of sound levels at a daily basis. Moreover, the analysis from the raw file can be used in traffic management system as well because most of the time, noise pollution occurs due to bad traffic management and due to vehicles not being maintaining. The major question is, do we have enough data collecting mechanisms to make such changes efficiently? We shall help resolve this matter.

Field of Research: Environmental Engineering

1. Introduction

Noise pollution, a phenomenon which can be described as disturbing or excessive noise that harms not only the natural environment around us but also the living things. According to the journal of Ayaz and Rahman (2011) the acceptable level of noise/sound level in decibel, recommended by Bangladesh Department of Environment (DOE) is given in table 1 which located in the methodology section.

In table 1, it shows the maximum threshold of Noise level that should be maintained, but unfortunately, our report will further prove the fact that the acceptable threshold benchmarked by the DOE are not being fulfilled by we the people. We selected certain commercial and residential places to provide the fact that noise pollution is in fact haunting us.

We analyzed the sound impact in decibel in major places in Dhaka city. Furthermore we propose a device that can help collect sound data for long period of time, which can help in understanding noise pattern and help to take decisions regarding traffic control, road management and help avoiding Health Hazards due to noise pollution. To do that we further classified the scenario of our objectives into the following manner. i) Collecting Sound reading on working days and non-working days of the

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selected areas; ii) Analyzing and comparing the maximum, minimum and average noise impact in dB; iii) Comparing the results that we obtained with the standard set by the earlier research; iv) Proposing a miniature palm sized device to record sound from places that are prone to health hazards and further research purpose.

We know that noise pollution is full of uncertainties, but in order to fully understand this trend of noise, we must look into it more intensely. We would like to add to our research work a way that would help the government understand the areas that are noisy and need intensive traffic management solution, as noise pollution has most of its roots entangled in traffic.

2. Literature Review:

The topic of Noise pollution has been an issue to many research works in the past. “Status of Noise Pollution in Mixed Areas of Dhaka City” (Haq et al., 2012), presents a similar contrast to this problem. Researches here show that due to urbanization and other factors, noise levels in the city throughout the course of the day varies, and varies in an un healthy manner for us humans. It also raised some conclusions on how the government can take such issues into considerations. A similar work was done, called “Noise Pollution and Its Effect on Students of Some Selected Educational Institutes of Dhaka Metropolitan City” (Scribd 2013) which raised awareness of how noise levels of the city did not meet the WHO standards and how this situation affected the humans in the long run.

In a journal known as “Traffic Induced Noise Pollution in Dhaka” (Alam et al., 2001) points are raised on noise pollution and how it is affecting the human beings. It also proposed ideas of reducing the impact that noise pollution can have on the environment. Researches here have shown that the city is indeed being plagued with noise pollution. A similar journal was published regarding traffic Noise at different locations in Dhaka city (Hassan and Alam, 2013) which stated about how the roadside traffic noise varies from place to place.

3. Methodology:

Table 1: Acceptable Sound Levels Recommended By Bangladesh Department of Environment (DOE)

Description of area	Noise level dB(A)	
	Day Time	Night Time
i) A sensitive area where quietness is of primary importance such as schools, hospitals, mosques etc.	45	35
ii) Residential areas	50	40
iii) Mixed areas, which are, used as residential areas as well as commercial and industrial purposes.	60	50
iv) Commercial areas	70	60
v) Industrial areas	75	70

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The methodologies were designed in such a way, that the entire process had enough data to produce standard results from a well-defined sample sites.

We covered the major commercial, residential and mixed zones in Dhaka city. Table 2 depicts the places with respect to its type.

Table 2: The Places According to the Three Categories

Type of Places	Place
Commercial Areas (C/A)	Agargaon, Asad Gate, BijoyShoroni, Farmgate, Gabtoli, Gulistan(Zero-Point), Mirpur 1, Mirpur 10, Notun Bazar, Nilkhet, Paltan, Technical, Shodorghat, Motijhil
Residential Areas (R/A)	Bashundhara, Gulshan, Malibag, Narda, Shantinagar, Shahajadpur, Uttara
Mixed Areas	Banani, Badda, Shamoli, Kollanpur

We used a standard Recording microphone-Cosonic CT780 microphone and attached it to a laptop Hp pro book 440 containing the IDT High Definition Audio CODEC, for the recording purpose. We later used the free sound recorder/analyzer software audacity to record the sound of the selected places. The recording was done at sample rate 44100 Hz in dual channel mode. The recording was done in wav format. The sound sample was recorded from each place 3 times (3 minutes each time), in the morning between (9am-12pm), in the afternoon (1pm-3pm), and at evening /night (5pm-8pm). The samples were taken approximately 6 feet away from the road. The samples were then processed in VSLM (Sourceforge 2014). To make sure that the data we collected were not anomalies, we repeated the entire process of sound recording for a second time and verified our data.

4. Discussion

4.1 Quantitative Data Analysis and Results

4.1.1 Sound in Working Days:

The selected residential and commercial area's data had been collected on working days, so that we could identify the noisy places. The mean, maximum and minimum of these areas were recorded and later processed. Table 3 shows the mean and maximum of selected places of Dhaka city.

According to table 3 maximum mean sound level is found at Farmgate (mean=76.9444 dB) and the maximum sound level was found at Badda 92dB. Badda being a mixed area according to the DOE must have sound limits of 60dB at the day and 50dB at night, but in our case, the readings were very high.

Table 3: Sound Data of Working Days

Place	Mean	Max	Place	Mean	Max
Agargaon	73.2019	89.20	Mirpur 1	75.0256	90.30
Asad Gate	75.398	88.90	Mirpur 10	73.72743	89.70
Badda	75.3387	92.00	Motijhil	75.14473	90.13
Banani	73.9273	86.40	Nilkhet	75.34733	89.45
Bashundhara	74.5826	88.30	Notun Bazar	73.94967	87.20
BijoyShoroni	74.3182	89.50	Paltan	75.273	89.46
Farmgate	76.9444	90.30	Shahajadpur	72.20287	89.00
Gabtoli	75.3728	91.40	Shamoli	75.65413	91.50
Gulistan	73.0727	88.50	Shantinagar	68.42783	85.60
Gulshan	71.2751	85.70	Technical	74.86997	89.40
Kollanpur	75.1241	89.60	Uttara	73.416	85.92

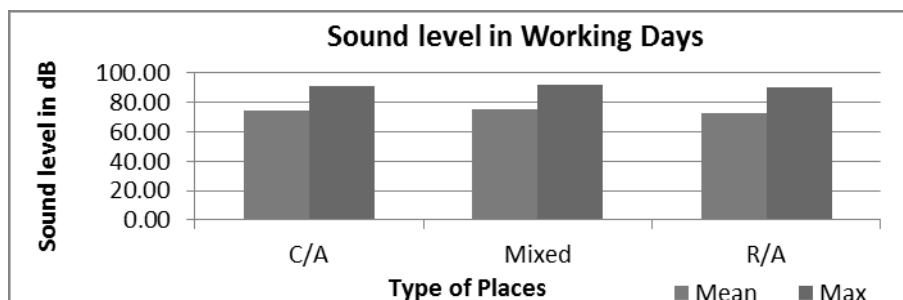
According to the table 3 residential areas all together have mean sound levels higher than the standards of sound provided by the Bangladesh department of environment.

Table 4: Sound Levels of All Three Types of Area on Working Days

Area Type	Mean	Max
C/A	74.72	91.40
Mixed	74.97	92.00
R/A	73.10	90.30

According to the Table 4 it can be seen that the mean and the max sound levels of the areas (C/A, Mixed and R/A) are quite high. According to statistics, anyone exposed to sound levels of nearing/above 80dB for a long time can suffer hearing problems.

Figure 1: Mean and Max Sound Value of Working Days in Different Types of Area.(Ref: Table 4)



4.1.2 Sound in Non-Working Days:

The sound data of the same places had been recorded in non-working days as well. The mean sound level and the max sound level are given in table 5.

The noise levels according to table 5 are still fairly high compared to the standards of sound provided by the Bangladesh department of environment which claims that residential areas should have 50dB level at day and 40dB at night. The mean sound levels are lower than that of the working days, but are significantly high according to the standards provided by the DOE.

Table 5: Data of Non-Working Days

Place	Mean	Max	Place	Mean	Max
Agargaon	64.8321	84.5	Mirpur 1	60.45573	82.8
Asad Gate	68.8838	86.8	Mirpur 10	64.64893	82
Badda	69.271	89.7	Narda	70.32497	85.8
Banani	73.2097	88.2	Nilkhet	70.5278	85.2
Bashundhara	70.0901	84.4	Notun Bazar	69.22993	84.9
BijoyShoroni	58.164	77.4	Paltan	70.90263	82.4
Farmgate	63.3925	86.9	Shahajadpur	61.3759	79.6
Gabtoli	64.9703	86.6	Shamoli	62.9167	88.1
Gulistan	70.2441	86.367	Shantinagar	55.07223	77.5
Gulshan	69.1035	83.3	Shodorghat	72.38103	82.9
Kollanpur	61.421	87.2	Technical	57.37767	86.8

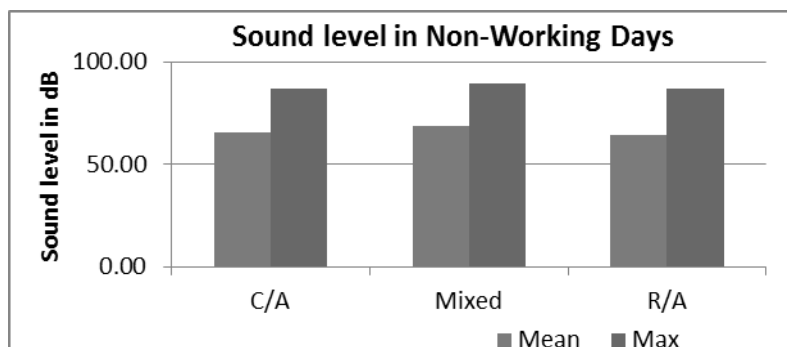
According to table 6, it can be observed that the residential areas have maximum sound level of 87.20 dB, a significantly high amount that can cause health issues. We can generally see that the sound in mixed areas tend to have a higher mean sound level than C/A and R/A.

Table 6: Sound Level of All the Three Types of Area on Non-Working Days

Area type	Mean	Max
C/A	65.85	86.90
Mixed	68.47	89.70
R/A	64.45	87.20

In Figure 2, it can be seen that Max sound levels in C/A, Mixed and R/A tend to go beyond 80db

Figure 2: Mean and Max Sound Value of Non-Working Days in Different Types of Area (Ref: Table 6)



4.1.3 Comparison between Working Days and Non-Working Days:

In fig 3, we can observe that the deviation in the average values of sound compared to the working and non-working days is very high. In the non-working day, sound levels tend to rise from morning to the noon, and tend to lessen in the evenings. Looking at the curve of the weekdays, it can be seen that the sound level increases as the morning passes by, but tends to increase at a further pace at evening. Here it can be clearly seen that the average sound level is quite high in working days compared to non-working days. In fig 4, at weekend the maximum sound levels increase till the peak of noon and from there tend to fall at a steady rate until evening. It can be observed that the maximum sound level in the weekends tend to be at the noon. Comparing the curve of weekdays, almost the same trend can be observed; the maximum sound levels tend to keep rising till the peak of noon and fall at a steady rate from the mid-noon towards evening. At both working and non-working days, the maximum sound levels are high.

Figure 3: Mean Sound Level at Different Times

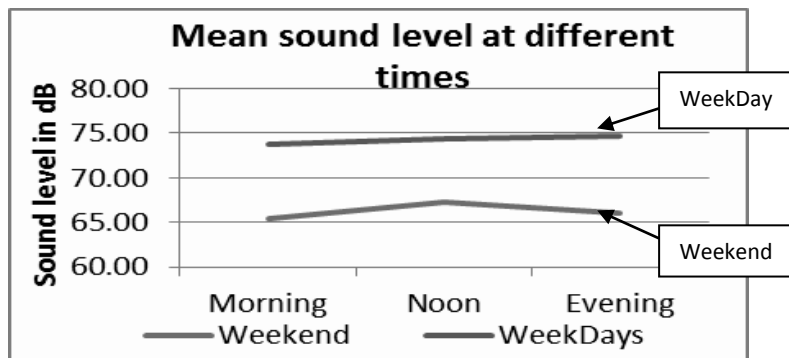
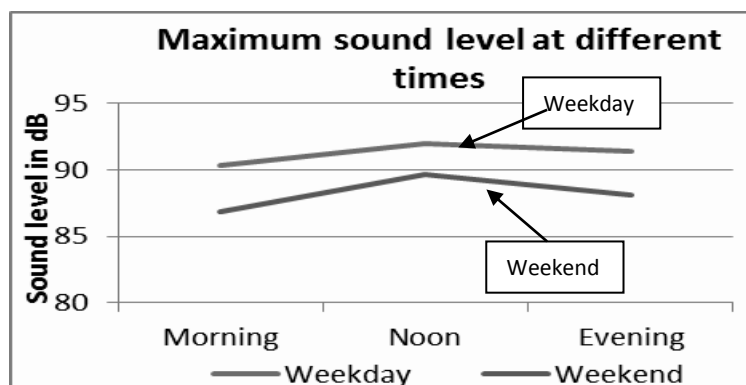


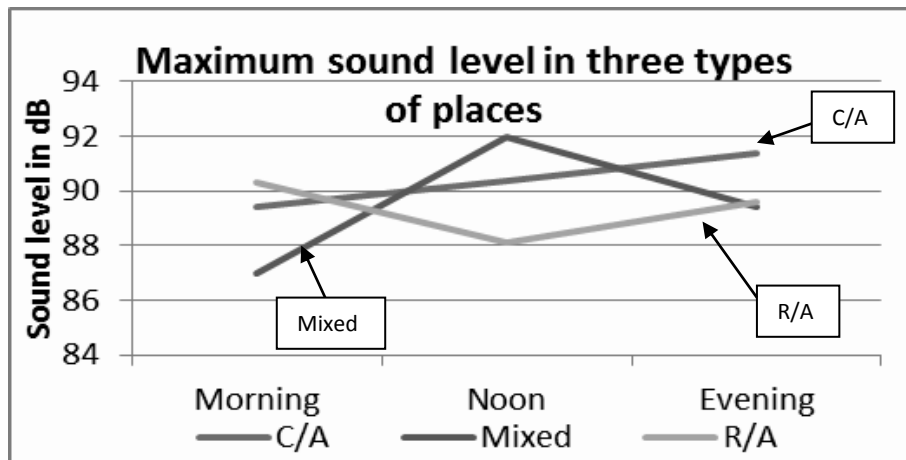
Figure 4: Max Sound Level at Different Times



In fig 5, we tried to explain the maximum sound level readings that are generated at the morning, noon and evening in all the C/A, Mixed and R/A. First, discussing about the R/A, it can be seen that the maximum levels of noise are in the mornings and then in the evening, whereas at noon it is slightly lower. This slight change is in fact not a very healthy change as sound levels above 80dB are always dangerous if the exposure is prolonged. Looking at the curve of mixed area, the maximum sound level keeps rising at a steady pace, and reaches its maximum at the peak of noon. From there it tends to reduce slightly towards the evening time, but then again, it is not a dramatic decrease. The worst case scenario in fig 5 has to be the reading of

the commercial areas. The maximum sound levels keep rising from the morning to the evening. Such exposure of noise can be very harmful for the environment and for us human beings.

Figure 5: Max Sound Level of Three Types of Places



4.1.4 Comparison between Previous and Present Studies:

The present data have been compared with some previous study data. Table 7 shows the comparisons of the Mean and Max sound levels.

Table 7: Comparison of Sound Level Data with Previous Data

Place	Previous data(dB)	Our data(dB)
1.Malibag(off day)	Max=74.3 (Haq et al., 2012)	Max=82.278
2.Nilkhet(off day)	Max=72.7 (Haq et al., 2012)	Max=85.2
3. Gulshan	Mean=56.6,55 (Mahadi 2009, pg.15)	Mean=70.1893
4. Banani	Mean=61.4,61.4(Mahadi 2009, pg.15)	Mean=73.5685
5. Mirpur	Mean=79.4,63 (Mahadi 2009, pg.15)	Mean=68.464425
6. Farmgate	Mean=90,81 (Mahadi 2009, pg.16)	Mean=70.16846667
7. Motijhil	Mean=82,83 (Mahadi 2009, pg.16)	Mean=75.14473333

It can be seen from table 7 that the rise in noise pollution is indeed creeping to the higher mark. In figure 6 & 7, the data of table 7 are represented in graph.

Figure 6: Comparison between Previous Max & Our Max

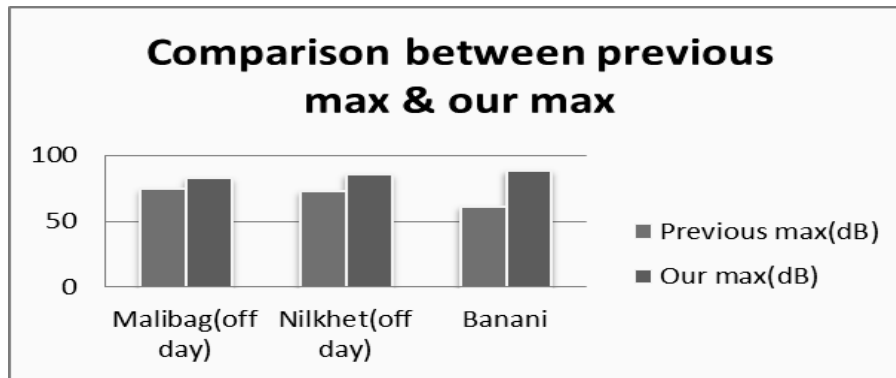


Figure 7: Comparison between Previous Mean & Our Mean



4.2 Qualitative Sound Hazard in Human Health:

4.2.1 Survey Result Analysis:

According to this, information, we can observe that places like Mirpur 1(C/A) Badda(Mixed), Motijhil(C/A), Farmgate(C/A), Gabtoli(C/A) Shamoli(Mixed) have maximum sound levels above 90dB.

Noisy places tend to make humans angry in general (Donnerstein and Wilson, 1976) According to the Abstract cited (Donnerstein and Wilson, 1976), it was observed that high intensity noise can be a source of anger issues.

In order to further explore the health issues that may plague the city folks, we interviewed (through questionnaire) 35 people from Independent University, Bangladesh. The questions included the participant's address, major sources of noise pollution in their areas, physical/mental problems that they suffered due to the noise pollution. We also asked them to give an estimation of the noise pollution level in their respected areas in the range from 1-10 where 1 being the lowest and 10 being the highest factor of noise pollution .Their answers are tabulated as follow:

Table 8: Noise Level Along with the Time and Major Sources

Place	Noise Level (out of 10)	Time of High Noise Level	Major Sources Of Noise
Rampura	9.5	Daytime	Vehicle, People, Animal
Mirpur	8.5	Day and Night time	Vehicle, Animal
Gulshan	4	Morning, Evening	People, Animal
Badda	8.5	All working day time	Vehicle, People, Animal
Dhanmondi	7.5	Daytime	Vehicle, People, Animal
Uttara	9.33	Night time	Vehicle, People, Animal
Khilgaon	10	Morning	Vehicle, People, Animal
Gazipur	7	Midday	Vehicle, People, Animal
Bashundhara	10	Midday	Vehicle, Animal
Tejgaon	9.25	Day time	Vehicle, People, Animal

According to the questionnaire, it was noted that the participants who lived in Bashundhara, Badda, and Uttara claimed that the main road near their residence is noisy. Interviewers who lived in Gulshan were very satisfied about the amount of discreetness around their homes. Participants living in places like Rampura, Mirpur, Badda, Dhanmondi and Uttara, complained of suffering from Headaches, Hyper Tension, Insomnia and stress. It can also be seen that almost every one blames the vehicles and crowding of people to be the major source of noise pollution.

5. Customized Sound Recording Device for Maintaining Sound Log:

We plan to place devices in different location that will record sound automatically within a certain time interval. For this, we opted to choose the raspberry pi (Wikipedia 2014). Just like a computer, we can attach keyboard and mouse to it in order to use it. As the raspberry pi does not have a microphone jack, we attached a USB generic sound card, which had a 3.5mm audio in and out port.

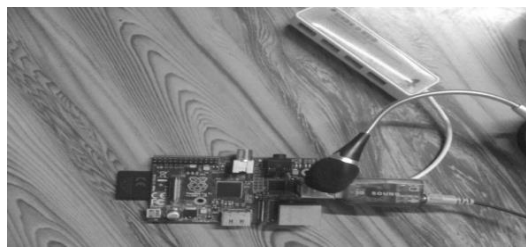
Using the Linux terminal window, we were able to configure the sound card to work as the primary source of input and output of sound. The sound card used in the raspberry pi was generic, but better sound cards can be attached for optimal performance. The following peripherals are required in order to make the proposed device.

Table 9: Noise Level Along with the Time and Major Sources

Device Name	Price in BDT
Raspberry pi	4500
Sound Card (generic)	300
Microphone	1000
USB hub	200
	Total = 6000 BDT

Our hypothesis is that, if devices like the one we mentioned can be placed in numerous areas within Dhaka, concerned individuals can have a continuous sound record logging process which could be later used to identify the noisy areas by simply processing the audio file that are in the raspberry pi's memory card. This can be really helpful because, as the urbanization is taking over the city, so is its side effects. Noise pollution may not appear to be daunting but it definitely is what this city needs to avoid. A logging mechanism like the one we proposed will not only help the concerned individuals but also will help keep data that will help understand noise at a particular time.

Figure 6: The Customized Device



6. Conclusion:

Noise pollution is indeed a very unnecessary by-product of urbanization. We can help understand it and only through understanding of it, can we tackle it. Our proposal will not only help record the sound from places but also help manage a database of noise if a concerned individual may need to do it. But for that, they need samples, and our proposal can help collect that. Not only that, from the data and through the analysis of its log, places that are prone to continuously high noise levels can easily be identified. If the devices are installed for a long term basis, through its data, vital decisions can be taken which can bring forth a well needed change especially in traffic management system where due to traffic and unmaintained vehicles noise pollution occurs even more. Places prone to continuous noise pollution can be identified and actions can be taken accordingly but this is possible if and only if we have large number of data, and this is what our device can help provide.

Till now we have been using the command line interface to record the desired sound using the raspberry pi but, in the future, we wish to make a program in python programming language that will provide the user with more flexibility and features while recording sound.

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