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Assessing the Noise Levels in Adama City, Ethiopia

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Abstract: ***Environmental noise consists of all the unwanted sounds in our communities except that which originates in the workplace, and the excessive concentrations beyond the tolerable limits always pose a threat to our health and well-being. There is an ever increasing trend in the magnitude, extent and severity; the natural environment is being aggressively attacked because of population growth, urbanization, industrialization and technological advancement. This paper is sought to ascertain the sources and effects of noise pollution around the residential areas of Adama Town, Ethiopia. The study adopted a survey research design and an experimental approach. The sound levels were monitored using SLM Model for 8hours in three intervals (Morning 8-11AM, Afternoon 1-4PM and Night 7-10PM) at different places for weekdays in each of the four selected kebeles. In the social survey part, a five point Likert scale questionnaire was administered on 100 Nos respondents from the study area. The results of study revealed that traffic noise, noise from Religious Places and other commercial/social sources had negatively affected the day to day activities of the residents which resulted in health impacts such as stress, annoyance, loss of sleep and difficulty in conversation. It was found that the sound levels in the study area exceeded the standards as prescribed by the WHO standards, and necessary measures must be ensured to reduce the noise levels in promoting peaceful living.***
Keywords: Noise, Pollution, Kebele, Monitoring, Social survey.

I. INTRODUCTION

In the present day of living, environmental pollution problems are universal in almost all the countries. We are never far away from the reach of environmental pollution in one or other form. One sided use of technology towards development had caused a situation, where land, air or water is not left pollution free. The word "Noise" is derived from the Latin word "nausea" meaning seasickness, and noise may be defined as an unwanted sound. It can be considered as the wrong sound in the wrong place at the wrong time. The perceptions relating to the magnitude and extent of noise received by humans depend on several factors such as age, sex, health, mood of person etc. Because of the rapid increase in industrialization, urbanization, transportation and other communication systems, noise pollution has reached to a disturbing level over the years. Noise pollution is distinguished from other pollution categories due to its source and diffusion characteristics, which can adversely affect public health and environmental quality in urban environment. There has been a considerable increase in noise from manmade sources during last 100 years, which is now doubling after every ten years. The temporary deafness experienced by a loud noise is quite common, but prolonged and regular exposure for eight hours a day might result in permanent hearing loss. Currently, noise pollution is globally recognized as a major problem which is affecting the quality of life in urban areas. Many surveys have been carried out to assess the noise pollution in many cities of the world including some countries in Africa. Actions to control noise effects had been an important concern in countries of the developed world. These are evidenced by a large number of anti- noise laws, regulations and noise policies. However, such action remains limited in the developing countries, especially in Africa. Ethiopia is one the most rapidly developing nation in the sub-Saharan Africa, the significant changes due to industrialization, urbanization; road networks etc., have increased the vehicular population over the last few decades. Thereby leading to an increase in noise levels that have negative effects on the living standards of the citizens. Assessing the problem and programming actions for controlling noise and its adverse effects have become an issue of immediate concern for better living standards in many countries. Nowadays, people prefer to live in places far away from noisy urban environment, the residences far from the noisy sources and near silent secondary roads are becoming very popular. There is an urgent need to study the existence of noise level in our living areas, to adopt control and preventive measures. The present study is intended to study the assessment of noise pollution in the residential areas of Adama town. This will exhibit the present status of noise levels in the town and provides the information about the control measures needed to cope up with this situation.

A. Study Area

The city of Adama (Adaamaa or Hadaamaa) also known as Nazret or Nazreth; is a city in central Ethiopia and the earlier capital of the Oromia region. It is located at 8.54°N 39.27°E at an elevation of 1712 meters, 99 km southeast of the Ethiopian capital city

Addis Ababa along the main road from Addis to Djibouti. The city is one of the reformed cities in the region with an historical background founded in the year 1924, and currently the city administration consists of 14Nos urban kebeles and 4Nos rural kebeles. It has a minimum annual temperature falling between 19 ^{0}C to 22 ^{0}C, with an annual average rainfall of 760mm. As per the Central Statistical Agency (CSA) 2012 census the total population of the town is 299,621. The four largest ethnic groups reported in the study area were the Oromo (39.02%), the Amhara (34.53%), the Gurage (11.98%) and the Silte (5.02%); all the other ethnic groups made up 9.45% of the population. Amharic was mostly spoken as a first language by 59.25%, 26.25% spoke Oromiffa and 6.28% spoke Guragiegna; the remaining 8.22% spoke all other primary languages. The majority of the inhabitants i.e., about 63.62% practiced Ethiopian Orthodox Christianity, while 24.7% of the population were Muslims and 10.57% were Protestants. Adama being a busy commercial, industrial and transport center in the rift valley, is mostly prone to noise pollution. Hence in this study, four residential Kebeles viz., Bole,Ganda Gara, Ganda Hara and Ganda Oda were choosen to conduct the sound levels monitoring and the social survey.

B. Objectives of the Study

Exploring the major sources and the health effects of noise pollution on the living of the residents in the residential areas of Adama town was the main focus of the study. The objectives of the study includes,

1) To study the existing status of noise levels in the study area by recording the noise intensity at various locations.
2) To identify the main sources and effects of noise pollution in the residential areas of Adama town.
3) To assess the impact on human work efficiency due to road traffic parameters, different noise indices, and attitudinal response.
4) To propose suitable mitigation and abatement measures.

II. LITERATURE REVIEW

Rachel N. Zakpala, et al (2014), carried out extensive studies to map the intensity of noise during night time in Ghana. These studies were done in high-intensity noise impact zones around airports/major roads, and the exposures to religious noise were plotted. The study revealed that the magnitudes were high for night-time exposure and they had a remarkable effect on public health. Zenith Kucha (2014) conducted a research study on the evaluation of noise pollution in educational Institutes of Addis Ababa, Ethiopia. The areas covered included the source of noise at school environment; the effects of classroom noise on student-teacher performances; student-teacher annoyance due to noise; and surveys of classroom noise levels. The results showed that it was found that the noise resulted in uncomfortable feeling, thereby affecting the teaching and learning process. Farzad Mehrjo et al (2013) conducted an assessment study on noise pollution in Behbahan city, Iran. The Testo 815 Sound level meters device was used to measure the sound levels at 8 stations during day and night times for 28 circadian. The instrument was placed at a height of 1/2 meter from the ground, in the nearest distance from residential/commercial areas. It was found that on comparison with the noise levels standards of Iran, Behabana city was found to be stressed with noise pollution. The width of streets, the vehicular traffic and distance disregard between commercial- residential areas contributed for noise pollution. Dibyendu Banerjee (2012) conducted a review on the articles related to research on road traffic noise and human health in India. In this attempt, the literature from 1991 to 2011 were critically analyzed, and it was stated that most of the earlier studies focused on the monitoring, recording, analysis, modeling, and to some extent mapping related themes. Negligible studies were observed in areas of physiological and sleep research exposure–effect context, most impact studies have been associated with annoyance and attitudinal surveys. The review of papers showed that road traffic noise is a cause for annoyance to a variety of degree among the respondents. A generalization of impacts and meta-analysis was not possible due to variability of the study designs and outputs preferred. Yahaya Mijinyawa and Femi Peter Alege, (2012), carried out an assessment survey of Noise pollution generated in Swine production units in Ibadan, Nigeria. It was found that the workers spent between 3-6 hours daily within the units and were wearing no noise protective devices. The levels of noise generated in the farms ranged from 95-103 dB, sounds were found to be excessive during the feeding period and other activities. The study revealed that swine workers in Ibadan, were exposed to excessive occupational noise hazards and remedial measures were desirable in order to protect them. The provision of Personal Hearing Protective Devices (PHPDs), adequate medical check-ups as well as use of personal noise dosimeters for the swine workers and good housing structures and facilities for the animals were recommended

III. DATA SOURCES AND METHODOLOGY

The assessment study included two parts, viz., the experimental and social survey parts. In the Experimental study, the SLM4001 Model Sound Level Meter was used to measure the sound levels in the selected areas, on a daily basis for seven days in the four selected area. The measurements were made for a period of 9 hrs in three slots (Morning b/w 8-11AM, Afternoon b/w 1-4PM and

Night b/w 7-10PM); at major junctions and important places within the appropriate regions. Out of the readings/observations taken, the minimum, average and maximum sound levels recorded were tabulated and graphs were prepared. The graph plotted indicated the sound pressure level Decibel db (A) versus time.

In the social survey part, a pre tested close-ended and open ended questionnaire titled "Noise Pollution and Perceived Health Effects on the Inhabitants of Adama city " was distributed among the respondents. The questionnaire was made up of four parts which included, Section-A: personal data of the respondents, Section-B: sources of noise, Section-C: Awareness levels about noise pollution and Section-D: perceived effect on respondents health. In the present study, 24Nos from each kebele of the four Kebeles (Bole,Ganda Gara,Ganda Hara and Ganda Oda) comprising 96Nos were randomly selected respondents and 4Nos Professionals were purposively selected, and in total 100 Nos sampled respondents were addressed in the study.

IV. DATA ANALYSIS

Prior to the actual starting of the data collection, a pilot study was carried out to assess the effectiveness, clarity of the questions and reliability of the questionnaire. Seven individuals who were experts in this area were approached and necessary modifications were incorporated in the questionnaire. The final set of questions framed was successful in achieving the research objectives. The data analysis was conducted by collecting the sample results and evaluating through Statistical Package for Social Studies (SPSS) and MS-EXCEL. In this attempt, the questionnaires collected from the sampled household respondents (randomly selected-96Nos) and experts (purposively selected-4Nos) were evaluated and analyzed for descriptive and inferential statistics. In the purposive study, four respondents composed of officials and experts from Environment, climate and Forest Authority and Municipal sanitation and greenery division, Health office and Kebele Chairmen were involved. The personal field observations and secondary data (reports, journals, earlier relevant studies) were utilized in drawing meaningful conclusions. Since Amharic is the official language and Oromigna is the regional language, the questionnaires were translated into the both language, for easy understanding and getting better responses from the respondents. Understanding of various technical and social aspects related to the present study required that the respondents were aware and having sound knowledge of the present situations in the study area. Hence, the respondents

S.No.	Location/ Kebele	Measuring time	Sound Pressure Levels, dB		
			Mean	Min	Max
1	Bole	Morning (8 To 11 Am)	57.25	41.6	72.9
		Afternoon (1 To 4 Pm)	57.75	42.9	72.6
		Night Time(7 To 10 Pm)	55.45	40.3	70.6
2	Ganda Gara	Morning (8 To 11 Am)	58.3	44.2	72.4
		Afternoon (1 To 4 Pm)	60.3	48.4	72.2
		Night Time(7 To 10 Pm)	55.1	42.2	68.9
3	Ganda Hara	Morning (8 To 11 Am)	60.5	46.8	74.2
		Afternoon (1 To 4 Pm)	59.2	46.2	72.3
		Night Time(7 To 10 Pm)	58.75	48.4	69.1
4	Ganda Oda	Morning (8 To 11 Am)	57.1	40.3	73.9
		Afternoon (1 To 4 Pm)	60.4	48.2	72.6
		Night Time(7 To 10 Pm)	61.4	39.6	83.2

with age of 20 years and above were chosen.

V. RESULTS AND SISCUSSIONS

A. Measurement of Noise levels

By using the SLM4001 Model Sound Level Meter, the sound levels were measured in the junctions/ major crossings/ important places within the study area. The instrument was placed at 1mts above the ground level and readings were noted (Morning b/w 8-11AM, Afternoon b/w 1-4PM and Night b/w 7-10PM). From the readings/observations taken, the minimum, average and maximum sound levels recorded were tabulated and graphs were prepared. The variations of noise measurements are shown in the table below. The maximum sound levels were 74.2dB observed at Ganda Hara and 83.2dB observed at Ganda Oda, during the daytime and nighttime respectively. The least level of the maximum sound levels observed during the daytime and nighttime were 72.2 at Ganda Gara and 70.6dB at Bole kebeles respectively. It was observed that in all the monitoring sites, the sound levels exceeded the ranges

specified by the WHO standards, and this clearly indicated that the environment is quiet disturbing for residential purpose.Table I: Variations of Sound levels observed (Jan 2017)

B. Social Survey

The objective of the current research was to investigate and analyze the source, effect and the knowhow of residents about environmental noise pollution. Apart from the physical site data measurements, data from survey was also important to make sure the study achieves its objectives and surveys in the form of questionnaires are given to the residents and officials of the study area. It was identified from the questionnaires collected that, the gender wise bifurcation of the total sample respondents was 56Nos (56%) male and 44Nos (44%) were female respondents respectively. The data showed that the percentagewise distribution of respondents were 2Nos, 70Nos, 17Nos 6Nos and 5Nos in the age groups of 21-30, 31-40, 41-50, 51-60 and above60 years respectively. It was observed that the major contributors about 70% of the respondents were under the age scale of 30-40 years; this signified the data furnished by the respondents was matured and reliable in all aspects. In this attempt, the respondents were asked about their perceptions, experiences and related issues, and these are presented in the tabular form (Table-2) below showing the details of all the monitoring stations.

Table II: Table showing the responses for the questions posed.

S.No	Questions relating to the assessment.	Responses (Percentage wise)			
		Bole	Ganda Gara	Ganda Hara	Ganda Oda
1	Experienced Noise as annoying and unappealing	92	96	92	92
2	Engaged in conversation with neighbor	58	58	63	63
3	Lodged a complaint on neighbor	63	63	58	58
4	Awareness about rules & regulation pertaining to Noise	37	33	42	40
5	Sources: • Traffic • People • Animals • Religious places • Household • Others	 20.00 18.33 15.83 15.00 12.08 18.75	 17.53 16.78 17.53 16.78 15.32 16.05	 17.02 16.31 17.02 16.31 16.31 17.02	 18.55 14.65 16.32 17.06 15.58 17.81
6	Noisiest times: • Morning (8-11AM) • Afternoon (1-4PM) • Night (7-10PM)	 33 39 28	 35 38 27	 34 39 27	 34 40 26
7	Health related Impacts • No disturbance • General Disturbance • Headache • Hypertension • Loss of sleep • Stress	 3.78 19.67 19.67 17.56 19.67 19.67	 15.45 16.30 17.38 15.87 16.98 18.02	 1.00 23.18 21.25 10.15 22.22 22.22	 1.00 23.18 21.25 10.15 22.22 22.22

VI. INTERPRETATION AND DISCUSSION

A. Noise Pollution Around Residential Areas

The main focus of this study was to assess the sources and extent of noise levels around the residential areas of Adama town and its effect on day to day activities of the residents. Other central issues were to examine the influence of noise exposure in the residential environment and how the nosiest environment around the residential area could be improved. According to WHO guidelines for maximum noise levels for commercial, residential and industrial areas during the day and night time; 75dB, 65 dB,

55 dB and 70 dB, 55 dB, 45 dB respectively. The main finding of the present thesis indicates that irrelevant speeches and religious practices at louder sounds are most annoying and it increased the noise levels. Assessments of noise are done through various noise parameters, i.e. L10, L50, L90, Leq, LNP and TNI. The results of the four specific sites of study area in respects to dissatisfaction score of various noise parameters are represented in Table below; it was found that in most of the monitoring sites the value of L10, L50, L90, Leq, and LNP exceeded the WHO specification. So peoples of the study area are overall suffering from uncomfortable feeling to a position of noise annoyance.

Table III: Table showing the Percentile levels at the monitoring sites

Noise Parameter	Location of Monitoring site			
	Bole	Ganda Gara	Ganda Hara	Ganda Oda
L10	49.60	50.24	50.15	45.48
L50	47.42	52.24	56.45	46.32
L90	56.24	60.16	68.15	60.26
Leq	51.25	54.04	56.92	49.61
LNP	56.27	68.25	73.92	64.86
TNI	59.44	74.14	93.15	94.36
NC	8.15	11.21	15	16.18

B. Sources And Effects Of Noise Pollution

As reported by the respondents and observed in the field investigation, the major source of noise was attributed to vehicular traffic followed by public activities comprising of loud advertisement, loud music, Ambulance siren, Welding machines etc. The maximum noise level was observed in Ganda Oda Kebele (83dB) and the minimum noise level observed was 44 dB in Bole Kebele, it is to be noted that the minimum value was found to be greater than the standards set by WHO guidelines. After analyzing the questionnaires, it was found that the respondents are suffering from health impacts such as disturbance in performing daily activities, mental stress, loss of sleep, headaches and general disturbances. Most of the surveyed residential areas are located in the busiest narrow roads and places of the city. And thereby residential areas are suffering from noisy environment creating disturbance in daily work. According to standards of sound levels in the open air around residential zone of Ethiopia is, 55 dB and 45 dB for day and night times respectively. From the site measurements, during day and night times the sound level were higher than standard, therefore in all four sites of study area noise pollution is exceeding the standard for residential area.

VII. RECOMMENDATIONS

It was observed that the increase in the concentrations of the noise is impacting the healthy living of the residents. Hence, necessary steps should be taken to minimize the level of noise thereby protecting the residents from the detrimental effects. Based on the findings the following practical suggestions or recommendations were forwarded to improve quality with regards to noise. The existing community noise control includes minimization of noise from air traffic, transport system, building constructions, animals, religious places and other noise sources etc. The noises from the above sources can be lowered by adopting the following procedures:

A. Zoning of various activities and restricting the entry of large vehicles during the peak hours, will contribute to a reduction in noise levels.

B. The loudspeakers, radio and music system should be operated at threshold intensity and must strictly comply with the regulations of the Environment, Forest and climate change Authority Office.

C. Public awareness and education promotional activities must be encouraged by the concerned authorities; through radio, television, newspapers etc.

D. Stringent laws should be implemented to control noise pollution. For instance, Motor Vehicle Act of India provides restrictions on heavy vehicles using double sirens while passing through populated areas.

E. Creation of green vegetation as a buffer zone and a sustainable approach to reduce, absorb and dissipate sound energy.

F. Certain building codes and provisions should be enforced, which require sound proofing in the construction of industries, buildings and apartments.

VIII. CONCLUSION

The study was conducted in four Kebeles (Bole,Ganda Gara,Ganda Hara and Ganda Oda and 100Nos respondents were addressed. The research paper explored the sources, effects, reactions and suggestions for controlling the excessive noise. Vehicular traffic, public and public addressing systems (loudspeakers) turned out to be major sources of noise pollution. It appeared that loudspeakers were frequently used for religious functions and advertisements. This is in turn creating a negative impact on the health of the residents, and most of them are facing problems related to stress, loss of sleep, hypertension and others. Since, Adama is an old city, the narrow roads are frequently blocked and the uncontrolled blowing of horns by vehicles is causing too much annoyance. Hence, necessary measures such as widening of roads, restricting the entry of vehicles, creating awareness, legalizing strict regulation and other measures, would promote a healthy living standards.

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REFERENCES

[1] Ahmed Mohammad, Thesis submitted to the School of Graduate Studies of Ethiopian Civil Service University for partial fulfillment of the requirements for the degree of Masters of Environment and Climate Change Management, Addis Ababa, Ethiopia, 2017.

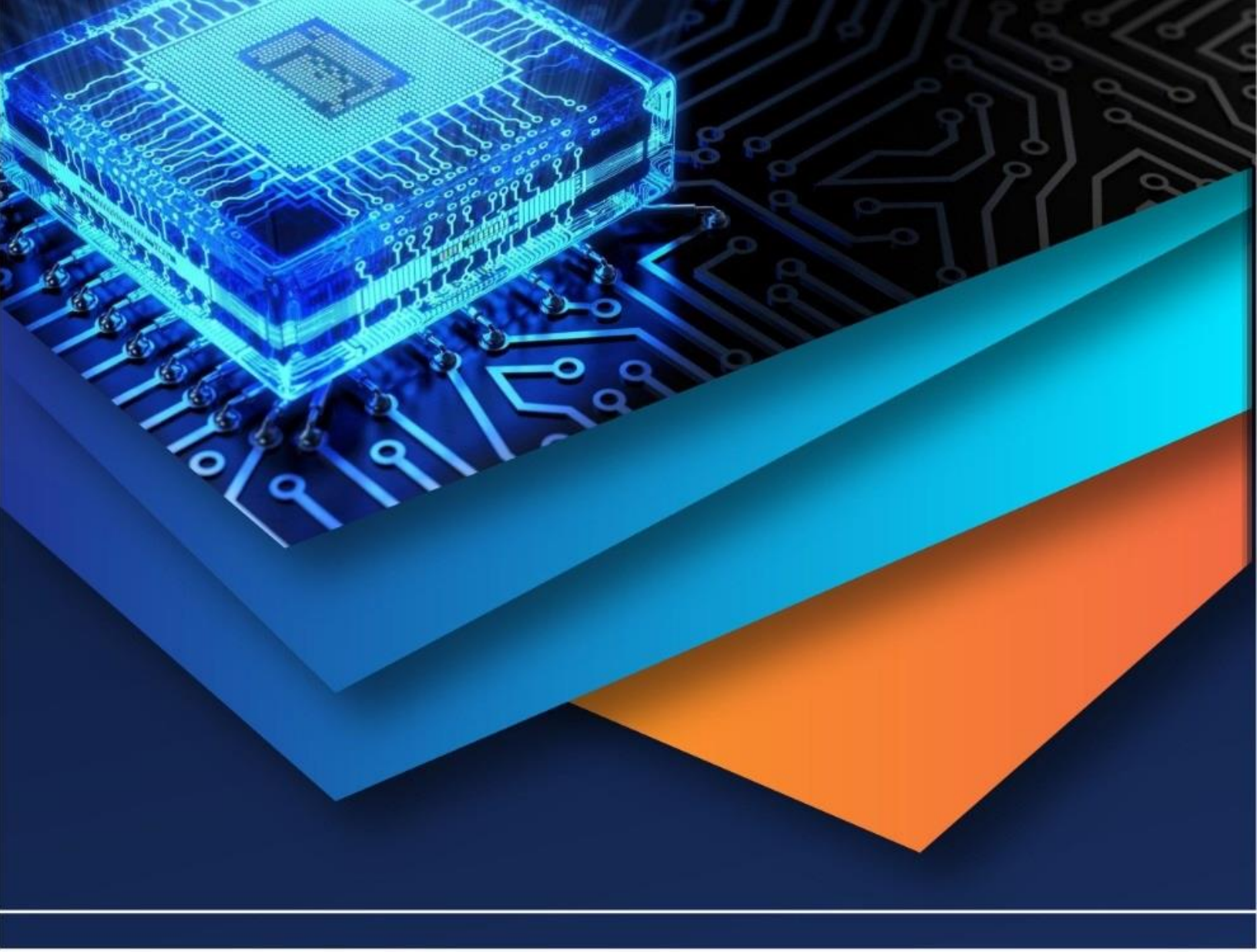
[2] Dibyendu Benerjee, Research on road traffic noise and human health in India -Review of literature from 1991 to current, Noise & Health Journal, Vol-14, Issue:58, 2012 .Pp-113-118.

[3] Farzad Mehrjo , Ali Bozorgi Zaron and Mohammad Nejatolahi, Assessment of noise pollution Behbahan city-Iran, Kathmandu University Jounal of Science, Engineering and Technology, Vol-9 No-II, Dec 2013, Pp28-33.

[4] Rachel N. Zakpala, Frederick Ato Armah, Brigid M. Sackey, and Opoku Pabi, Night-time decibel hell: Mapping noise exposure zones and individual annoyance ratings in an urban environment in Ghana, Scientifica Volume , 2014.

[5] Zenith Kucha, Evaluation of noise pollution in educational institutes of Addis Ababa, submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of Science in Environmental Science, 2014.

[6] Yahaya Mijinyawa and Femi Peter Alege, Assessment of noise levels generated in swine production units in Ibadan, Nigeria, Journal of Agricultural and Biological Science, Vol7, NO. 8, August- 2012.



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