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Mapping Building Outdoor to Analysis Noise Leq with Matlab and 3DField

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Abstract - Noise Level Standards are the maximum limit of noise levels that are permitted to be released into the environment from businesses or activities so that they do not cause harm to human health and environmental comfort. Sound Level Meter is a tool used to measure noise, unwanted sounds, or those that can cause pain in the ears. Sound Level Meters are usually used in work environments such as the aviation industry, malls, campuses and so on. This time the Sound Level Meter was used to measure noise in the Animal Health Building environment at Gadjah Mada University which was carried out on Friday 17 February 2017 from 13.00 WIB to 17.00 WIB. Sound Level Meter is used to measure noise between 30-130 dB in dB units from frequencies between 20-20,000Hz. Research was also carried out during the Practicum Class for the Analysis and Instrumentation Course. The research is carried out by holding the Sound Level Meter parallel to the practitioner's head and the results will be obtained after the Sound Level Meter sounds by waiting for an interval of 5 seconds when the dB value in the Sound Level Meter is stable, then the resulting dB value is written on a sheet of paper that has been made in a table. The aim of the practicum is so that students can understand the sound phenomena that occur in our environment, understand the level of noise that occurs in our environment and understand how the Sound Level Meter works clearly.

Keywords: Noise level; Noise standard; Mapping building; Sound Level Meter

1. Introduction

Along with the complexity of human life, it causes excessive noise in some environments. Excessive noise is a complaint of people in housing, especially in urban areas. This makes humans research noise in the environment, one of which is noise mapping research. The concept of noise mapping has been developed for years. The most advanced mapping research has been conducted in European countries. For example, Germany has conducted relevant research for more than 25 years. Based on previous research, traffic noise is often identified as the main source of noise. Urban areas close to busy roads are usually selected for the initial implementation needed to compile a noise control scheme mapping system. Noise can interfere with conversations so that it affects ongoing communication, in addition, the impact of noise disturbances is significantly present in areas with high populations, namely the influence on their daily lives, such as sleeping, working, studying. This results in hearing loss and even causes psychological disorders such as anxiety, and fear.

Noise is the occurrence of unwanted sound that disturbs or endangers health (Asriyadi, 2018). Noise can cause various disturbances such as physiological disturbances, psychological disturbances, communication disturbances, and deafness. This noise causes a serious negative impact on the people living around the environment (Aldulaimi, 2023).Psychological disturbances can include discomfort, lack of concentration, difficulty sleeping, and irritability (Pusat Penelitian Metrologi, 2016). There are various sources of noise originating from the environment, including industrial noise (factories), airports, highways, and entertainment venues. Some jobs that are always faced with noise include mining, tunneling, excavation (blasting and drilling). Jobs using heavy machinery (printing, iron forging processes, textile machines, and paper machines). Driving machines with strong combustion power (trucks or construction vehicles) and jet engine testing. The magnitude of noise can be measured using a Digital Sound Level Meter Digital ST (Standard Technic) 904 (SLM) measuring instrument.

Additionally, the presence of noise can interfere with quality of life and health (HeyLaw, 2023). One alternative technology that can be used to address the problem so that the community can know the large volume issued by the loudspeaker can be done using a digital Sound Level Meter Digital ST (Standard Technic) 904 measurement with dB (decibel) units. The function of this tool can measure sound pressure levels (Gaetano Fava, 2016). The use of alternative technology from the digital Sound Level Meter Digital ST (Standard Technic) 904 can be used for very high precision noise measurement in control rooms and for academic research (Standards,

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2023). This alternative is classified as a technology that has existed for a long time and has been widely sold on the market. This tool has the advantage of being able to measure sound intensity with high decibel (dB) units. The advantage of digital sound level technology is that it has been calibrated and is in accordance with instrumentation tool use standards, so even though it has many types, the sound level detected will be the same reading on all DB level meter products (Nihayatus Sa'adah, 2023). Traffic noise levels are affected by traffic volume and average speed (Setiawan, 2014)

The issues that arise in the field of transportation are not only traffic jams, but also environmental problems such as noise or sound pollution. Noise can be defined as unwanted sound that disturbs a person. The effects of this noise are detrimental to both road users and the surrounding community. Roads with many heavy vehicles and light vehicles increasingly cause noise (Jumadil, 2020).

The A scale is found to best represent the hearing threshold and human response of the human ear to noise, including noise that can cause hearing impairment. The A scale is expressed in dBA units (Djalante, 2010). A sound level meter is usually a portable instrument with a microphone; this instrument's microphone diaphragm reacts to changes in air pressure caused by sound waves and indicates the sound pressure level (dB) (Kjær, 2021). Emission patterns classify pollutants from point sources, line sources, and area sources, and the main concern is major pollutants such as noise from motor vehicles (Fikruddin, 2020). Environmentally friendly transportation is prioritized for those with low carbon emissions and no noise (Nugraha, 2020). Noise can be generated from traffic activity, transportation, and activities produced by industry.

The method used in this study is a quantitative method with relatively little data, assisted by manual analysis by writing the research results from the Sound Level Meter on sheets of paper that have been provided by the assistant lecturer of the D3 Metrology and Instrumentation study program with the Instrumentation Analysis course with Matlab supporting software and also 3D Field which will be developed in a Dissertation Book to complete the graduation requirements of the Doctoral Study Program in Technology and Vocational Education with the hope that this book will be useful for the readers of the book which is summarized in this journal.

Noise is an unwanted sound because it is not in accordance with the context of space and time so that it can cause disturbances to human comfort and health. The sound that causes noise is caused by a vibrating sound source. The vibration of this sound source disrupts the balance of the surrounding air molecules so that the air molecules also vibrate.

The vibration of this source causes a wave of mechanical energy propagation in the air medium according to a longitudinal propagation pattern. The propagation of waves in the air is known as sound.

In general, in the industrial world, sound sources are a combination of several components of sound sources, namely (Quadrant Utama, 2002):

a. Fluid turbulence, noise formed by vibrations caused by collisions between particles in the fluid, for example in pipes, valves, exhaust gas.
   Moving and vibration parts, noise caused by vibrations caused by friction, collisions or imbalances in the movement of parts. machines / equipment such as bearings on compressors,
b. turbines, pumps, blowers.
c. Temperature Difference, noise formed by the expansion and contraction of fluids, for example in aircraft jet engines.
d. Electrical equipment, noise caused by the effects of changes in electromagnetic flux on core parts made of metal, for example generators, electric motors, transformers.

Noise is an unwanted byproduct of an industrial environment that affects not only machine and vehicle operators, but also other occupants of the building where the machine operates, passengers in vehicles and especially the community where the machine, factory, and vehicle are operated (Departemen Kesehatan (Depkes) RI, 1995).

The continuous increase in noise levels from various human activities in an industrial environment can lead to noise disturbances. The effects of noise are: 1) Psychological effects on humans (noise can be shocking, disturbing, disrupting concentration). 2) Interfering with communication in conversations and furthermore will interfere with work results and work safety. 3) Physical effects (noise can cause hearing loss and pain at very high levels).

The intensity of noise in industry is divided into 3 classes, namely: 1) noise 95 dBA 2) noise 85-95 dBA 3) noise > 95 dBA (Doelle, 1985)

The sound pressure unit as a unit of noise or sound level is less practical because the human hearing area has a very wide range ($2x10^{-5}$ Pa to 200 Pa) and the human ear's response is not linear to sound pressure, but is logarithmic. Based on this reason, the noise level measurement is usually expressed in a sound pressure level scale (SPL) with decibel units (dB).

Sound system planning cannot be separated from noise requirements that are adjusted to the function of the building, so that the comfort of the building's occupants/users can still be met. The table below shows the noise level for certain sound sources. (Kang Ting-Tsai, 2008)

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Table 1. Noise levels for certain sound sources

Sound Source	Noise Level (dB)	Description
-	150	Can cause deaf ears
The plane takes off	140	Pain threshold
The sound of a bullet exploding	130	Ears feel deaf
Siren Sound at 30m distance	120	Uncomfortable threshold
The sound of music "rock, wood saw	110	
Train sound	100	Noisy, difficult to have a
Factory sounds, car exhausts	90	conversation
Printing, supermarket	80	Noisy, talking requires shouting
Moderate traffic	70	Talking can be normal
Hotel lobby, restaurant	60	
Office, Hospital, Bank	50	
Private Office, Home	40	Quite Quiet
Radio Studios	30	
Empty auditorium, noisy	20	Very quiet
Human Breath	10	Human hearing threshold

Noise is a source of sound that is disturbing to human hearing. Noise level is a measure of the degree of high or low noise expressed in decibels (dB). dBA is a unit of noise level in class A, which is a class that corresponds to normal human response. High levels of noise sources can interfere with human health and psychology. Noise sources with high intensity levels have a minimum value of 85dB which can cause humans to experience serious decline in general human health conditions. And if left for a long period of time, it is not impossible to experience hearing loss and can have more fatal consequences. Therefore, noise control is needed so that these disturbances can be minimized. There are several ways to control noise, including:

1. Control of noise generated by the source.
2. Control of transmitted noise.
3. Control at the receiver

When the sound source vibrates, it will cause vibrations that occur every second. That is called frequency. Frequency has a unit of Hertz (Hz). The human sense of hearing can generally hear sounds at a frequency of 20Hz as the lowest frequency limit that can be heard and the highest frequency that can be reached by the human sense of hearing is 20kHz. The magnitude of the frequency value is closely related to the human ear because it has different levels of response to be able to capture certain frequencies due to the different sharpness of the human ear. For example, the human ear that is often in an area with high noise sources, its level of sharpness is lower in receiving sound responses with low frequencies than the human ear that is often in a quiet environment, has a better level of sharpness in receiving low frequencies. Likewise, acoustic materials that receive different treatments depending on the use of the materials.

Decibel is a unit of noise caused by a sound source. Generally, noise source measurements use high noise levels so that the magnitude of the noise attenuation level caused by the noise source can be determined rather than measuring the noise source using low noise levels. The sensitivity level of the human ear ranges from 0 dB to 140 dB. The sound level unit is adjusted to the object of the sound. For example, dBA, dBB, dBC and dBD. The dBA scale is the response that best suits human hearing. The human sense of hearing can detect the presence of sound in the frequency range of 20Hz to 20kHz. The frequency area that covers this range is the sonic area. There are also several standards used, including OSHA and government regulations that limit noise levels in several places (Menteri Negara Lingkungan Hidup, 1996).

Types of noise reviewed from the relationship of sound level as time, noise can be divided into:

1. Continuous noise, fluctuations in noise intensity are not more than 6 dB with a wide frequency spectrum. For example, noise caused by a chainsaw, the sound of a leaking gas valve.
2. Intermittent Noise, the sound source is loud and will slowly disappear. For example when a train passes, highway activity.
3. Repetitive Impulsive Noise, the time needed to reach the highest noise peak is not more than 65ms and the time needed for the intensity to decrease to 20dB below the peak is not more than 500ms. For example, the sound of a forging machine.

Noise is the occurrence of unwanted sound that disturbs or endangers health (Asriyadi F. , 2018). Noise can cause various disorders such as physiological disorders, psychological disorders, communication disorders and deafness. Psychological disorders can be in the form of discomfort, lack of concentration, insomnia, and irritability (Center for Metrology Research, 2016). There are various sources of disturbance originating from the environment, including industrial noise (factories), airports, highways, and entertainment venues. Some jobs that

are always faced with disturbances include mining, tunneling, hobbies (blasting and drilling). Work that uses heavy machinery (printing, iron forging processes, textile machines, and paper machines). Work driving machines with strong combustion power (trucks or construction vehicles) and jet engine testing. To determine the amount of disturbance can be measured using a Digital Sound Level Meter Digital ST (Standart Technic) 9064 (SLM).

Furthermore, the presence of noise can disrupt quality of life and health (HeyLaw, Your Trusted Legal Edutech Platform Retrieved from HeyLaw Indonesia, 2023). One alternative technology that can be used to address this issue is to use the ST (Standart Technic) 9604 Digital Sound Level Meter, which measures sound pressure levels (Gaetano Fava, 2016). The ST (Standart Technic) 904 Digital Sound Level Meter can be used for very high-precision noise measurements in control rooms and for academic research (Standards, 2023). This alternative technology is considered a long-standing technology and is widely available on the market. This tool has the advantage of being able to measure sound intensity in high decibel (dB) units. The advantage of digital sound level technology is that it has been calibrated and complies with instrumentation standards, so even though there are many types, the detected sound level readings will be the same across all dB level meter products (Nihayatus Sa'adah, 2023). Traffic noise levels are influenced by traffic volume and average speed (A, 2014)

The ST (Standart Technic) 9604 Digital Sound Level Meter is a tool for measuring noise or disturbing sounds in a particular environment. The ST (Standart Technic) 9604 Digital Sound Level Meter requires calibration to determine its accuracy. The purpose of calibrating the ST (Standart Technic) 904 Digital Sound Level Meter is to address the issue of inconsistent measurement results when using the measuring instrument. (R.Bayu Ramada Meikaharto, 2021)

Problems that arise in the transportation sector are not only congestion, but also environmental problems such as noise or noise pollution. Noise can be defined as unwanted sound that disturbs someone. The effects of this noise are detrimental to both road users and the surrounding community. Roads with many heavy vehicles and light vehicles are increasingly generating noise (Jumadil F. , 2020) Noise measurements use the ST (Standart Technic) 9604 Digital Sound Level Meter, whose measurements are classified into three types of frequency response signs, shown on scales A, B and C. Scale A is found to best represent the limits of hearing and human response of the human ear to noise, including noise that can cause hearing loss. Scale A is expressed in dBA units (Djalante S. , 2010). A sound level meter is usually a portable instrument with a microphone. The diaphragm of this instrument's microphone reacts to changes in air pressure caused by sound waves and indicates the sound pressure level (dB) (Kjaer, 2021). Emission patterns classify pollutants from point sources, or line sources, and area sources, with major pollutants such as noise from motor vehicles being of concern (Fikruddin M. , 2020). Environmentally friendly transportation is prioritized for those with low carbon emissions and low noise (Nugraha T. , 2020). Noise can be generated from traffic, transportation, and industrial activities.

In everyday life, barriers are often referred to as walls, fences or buildings that function as sound wave propagation dampers. The considerations in designing and making barriers that can be used as noise dampers to the maximum include: 1. Position Factor Sound that propagates from the sound source spreads in all directions. However, the sound received by the building is generally sound that propagates horizontally towards the building or at a sharp angle. This propagation occurs through the air propagation medium around the building. There is also propagation that can occur through the ground, but the propagation value is very small because the ground has a large attenuation level value. Therefore, sound propagation that propagates horizontally or propagates at a sharp angle can be dampened by a vertical noise barrier. Sound with a very low frequency will be accompanied by severe vibrations due to the strong amplitude it has. If such a situation occurs, not only the vertical elements of the building will play a role in inhibiting propagation, but also the horizontal elements. This happens because the fairly strong vibrations that accompany the sound cannot be completely dampened by the ground.

1. WAV File
   Wav or Wave is short for waveform, and is the standard Windows audio file format. This format is a derivative of the RIFF (Resource lnterchange File Format) format specification. The RIFF format itself was adopted from the IFF (lnterchange Fiel Format) format owned by Electronic Arts.
2. Sound
   Sound or noise is the result of a vibration that produces waves, due to rapid changes in air pressure. The vibrations that occur have a certain wave pattern which is often referred to as waveform.

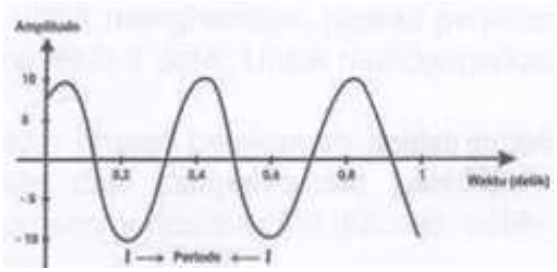

Figure 1. Waveform

3. Frequency

Frequency is the number of vibrations that occur in one second. Frequency is symbolized by the number f and has units of Hertz (Hz) or can also be with units of Cycle Per Second (cps). The following is a classification of frequency types based on their magnitude.

Table 2. Frequency Classification

Group Wave	Frekuensi
Infra Sound	0-20 Hz
Human Hearing Frequency	20 Hz-20 kHz
Ultra Sound	20 kHz-1 GHz
Hyper Sound	1 GHz-10 THz

The American National Standards Institute (ANSI) explicitly defines SLM performance and accuracy tolerances. Type 1 SLMs must be accurate within ±1 dB, and Type 2 SLMs must be accurate within ±2 dB. A third category, the Type 0, references high-precision instruments typically used in the laboratory rather than for field measurements.[21] A Type 2 SLM is typically appropriate for use in meeting occupational noise monitoring requirements set by the Occupational Safety and Health Administration (OSHA),[22] and ideally smartphone-based apps would meet the Type 2 criteria if they are to be useful in estimating noise hazard.(Nast, 2014)

Along with the teaching and learning activities in the campus area of Gadjah Mada University. Research was conducted on campus, especially in the parking area of the animal health building of Gadjah Mada University. Located coincident with the student entrance or parking lot, the sound in this area is likely to have high noise pollution or noise that is quite disturbing to students studying in classrooms adjacent to the parking lot or entrance to the building access. Therefore, this area is very appropriate for noise level research. This research produces good things to improve or do things that are expected to ensure students continue to carry out teaching and learning activities in the appropriate lecture room.

2. Research Methods

The implementation of the practicum of Outdoor Building Noise Analysis Using Matlab in the UGM Animal Health building was carried out on Friday, February 17, 2017 from 13.00 to 17.00 by forming 4 groups divided into 6 people each. In this practicum, it was divided into 3 teams, namely Team A as a measurer of the gate area in the Animal Health building, Team B measuring the grid/spot in the Animal Health building and Team C measuring the magnitude of the noise value using a tool in the form of a sound level meter to measure the magnitude of sound or noise and a meter to measure the width and length of the room and measure the grids in the Animal Health building. The stages are shown in Figure 2

The practicum begins by forming groups of 4 groups consisting of 6 people, then each group enters the Animal Health building and is divided into 4 locations for 4 groups, then Team A consisting of 2 practitioners in each group measures the width and length of the gate of the Animal Health building, Team B consisting of 2 practitioners determines the measurement grid/spot every 5m, records each coordinate (starting from coordinates 0.0 is (the midpoint of the cardinal points - the south corner), Team C consisting of 2 other practitioners calculates the sound or noise level right above the practitioner's head on the grid/spot determined by Team B and records it in the table provided. After completing the outdoor noise analysis activities, all practitioners enter data into Matlab in the form of an x, y matrix, then use the imagesc(data) function to display distribution graphs with various types and also process data in 3D fields

The constraints experienced were that the sound or noise level tester, commonly called a sound level meter, only had 1 brand, so the practitioner could not compare the measurement results of group 1 with other groups because the tool used was the same brand and had not been calibrated before conducting the practicum, and the practitioner who measured the sound or noise level used a different sound level meter so that the measurement value was not constant and reading the results of the sound level detected in the sound level meter was rather difficult because the numbers always changed every second. The suggestion from the practitioner was that before using the sound level meter, the practitioner must calibrate the sound level meter at least in a soundproof room, using a different brand of sound level meter for each group so that they can compare the accuracy and precision of one tool with another, and using the same practitioner in each grid/measuring spot so that the sound frequency calculated in the sound level meter is constant.

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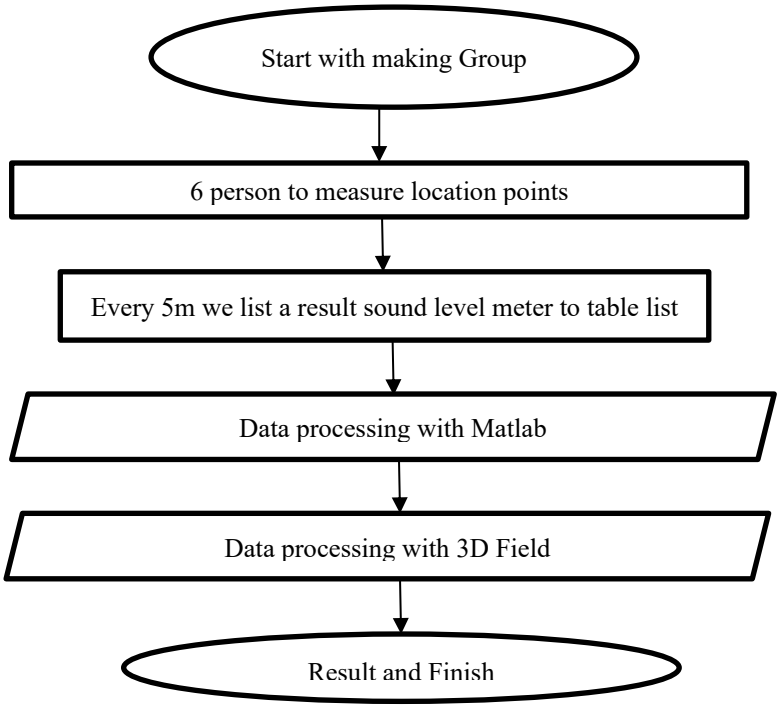

Figure 2. Research diagram

3. Result and Discussion

In the "Outdoor Building Mapping for Leq Noise Analysis with Matlab and 3Dfield" practicum, participants obtained results in the form of disturbance data distribution in the UGM Animal Health building, namely by drawing graphs in Matlab as follows:

The required graphs are: 1) Histogram Graph in Matlab. 2) Measurement Plot Graph in Matlab. Using coding to making 2 graps is want to showing because both of grap is good to grapichal in this measurement
Namely by drawing graphs in 3D Field as follows:

1. Noise Distribution Graph in Matlab
2. Noise Level Graph in Matlab
3. Fill Contour Graph
4. Color Cell Graph
5. 3D Color Cell Graph

After list many graaph using, this is the grap we using in the first :

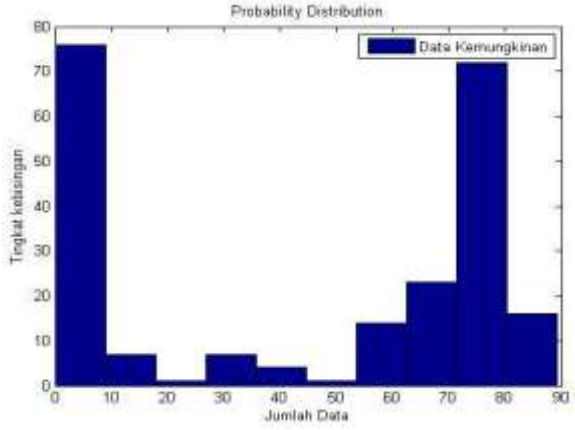

Figure 3. Histogram Graph in Matlab

To create a histogram graph like the one above, use the hist syntax which functions to plot data1 into a bar chart. Title provides a title called Histogram. Xlabel to label the name on the x-axis, namely Noise (dB), while ylabel has the same function as xlabel only on the y-axis, namely the Number of Data. Xlabel to label the name on the x-axis, namely Noise (dB), while ylabel has the same function as xlabel only on the y-axis, namely

the Number of Data. From the graph above, it can be seen that the highest noise level is 89.3 dB. This is because the activity of motorized vehicles and cars has started to increase because of the end of work hours. In addition to being caused by highway activity, campus activity has also increased. Because in the afternoon the campus is used for organizational meeting activities and table tennis by lecturers and several employees.The result is minimal in this graph in number of data 20-30 and 40-50 and the result maximal is in number of data 0-10

Figure 4. Measurement Plot Graph in Matlab

Shows a 2-dimensional plot with x and y variables shown in Figure 5, the data with a color string setting in a circle shape. With the title of the Measurement Plot image, the x variable is the Measurement of Ke and the y variable is Noise (dB). Axis tight is used so that the plot that has been made is maximized according to the data. From the graph above shown by the plot o, it can be seen that the noise distribution is uneven. This is because in the afternoon the roads around the building are often passed by vehicles of people returning from work or college activities. In nuumber of data measuremen 0 until 14 the minimum is in measurement 6 and measurement 4 is very maximum.

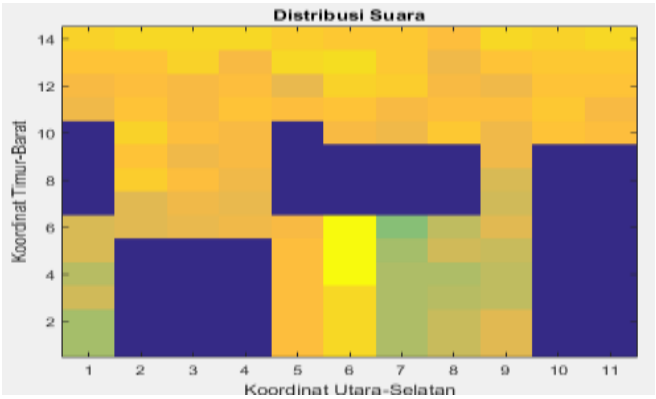

Figure 5. Noise Distribution Graph in Matlab

In Figure 6, the imagesc syntax is used to display the scale of the x-axis and y-axis images. With the title of the image Temperature Distribution and the x-axis is the north-south coordinate and the y-axis is the east-west coordinate. From the graph above shown by the noise distribution contour, it can be seen that the noise distribution is uneven. This is because in the afternoon the road around the building is often passed by vehicles of people returning from work or lecture activities marked in red. While the blue color is a classroom that is not measured so that the noise level is 0 dB, the redder the color shown, the higher the noise level produced.

Syntax surf functions to draw a surface plane graph that has an x-axis and a y-axis of data. Shading flat so that the surface shown is flat. The x-axis is the North-South Coordinate, the y-axis is the East-West Coordinate and z is the Noise Intensity value. From the graph in Figure 7 shown by 3 dimensions of noise distribution, it can be seen that the noise distribution is uneven. This is because in the afternoon the road around the building is often passed by vehicles of people returning from work or lecture activities marked in red. While the blue color is a classroom that is not measured so that the noise level is 0 dB, the redder the color shown, the higher the noise level produced.

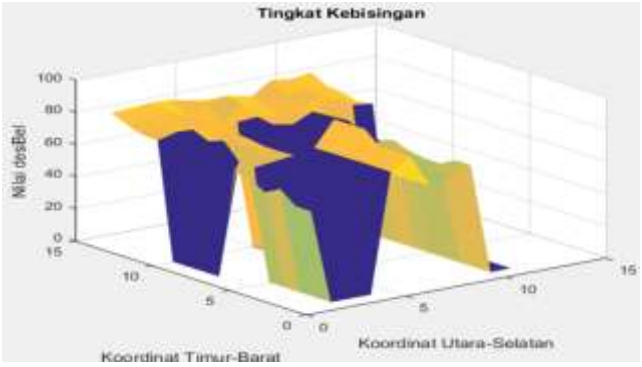

Figure 6. Noise Level Graph in Matlab

The following is the coding for making the graph in Figure 7 in Matlab:

```
>> x=1:14;
>> x=repmat(x,1,14);
>> y=1:14;
>> y=y'
>> y=repmat(y,14,1);
>> figure('name','Grafik 3 dimensi')
>> subplot(2,2,1);
>> hist(data);
>> title('Histogram')
>> xlabel('Kebisingan');
>> ylabel('Jumlah Data');
>> subplot(2,2,2);
>> plot(data,'O')
>> title('Grafik Plot Pengukuran')
>> xlabel('Pengukuran Ke-');
>> ylabel('Nilai desiBel');
>> subplot(2,2,3);
>> imagesc(data), axis xy,
>> title('Distribusi Suara')
>> xlabel('Koordinat Utara-Selatan');
>> ylabel('Koordinat Timur-Barat');
>> subplot(2,2,4);
>> surf(data), shading flat,
>> title('Tingkat Kebisingan')
>> xlabel('Koordinat Utara-Selatan');
>> ylabel('Koordinat Timur-Barat');
>> zlabel('Nilai desiBel')
```

The following are the graphic results using 3D fields:

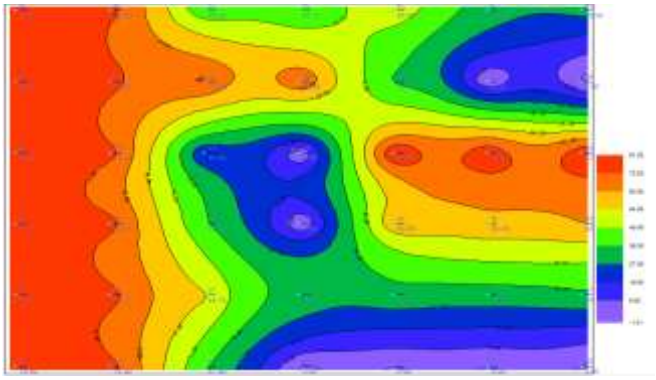

Figure 7. Fill Contour Graph

To get a graph like the Figure 8, by clicking on the map list then select and click color fill contours contour lines then wait until the color appears on the screen and adjust the color as needed by clicking the color scale on the toolbar then select the available colors. From the graph above it can be seen that the blue color marks a closed room or place. This means that the practitioner does not measure the noise level in that place.

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Several spots in red mean that these places have quite high noise levels because they are close to the noise source. The image above illustrates the noise level conditions in the south-west area of the animal health building which have different contour densities. The denser the contour lines, the area has a variety of noise levels and vice versa, the looser the contour lines, the area has a noise level that is not diverse.

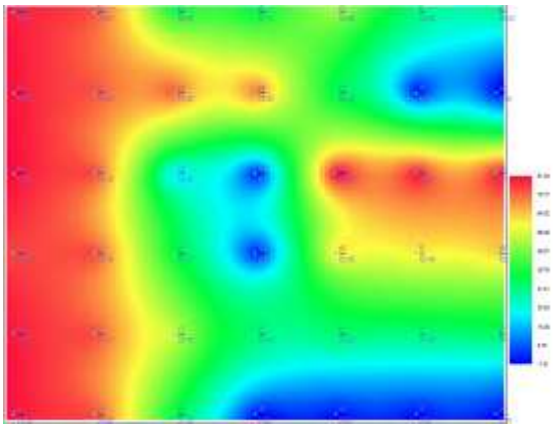

Figure 8. Color Cell Graph

To obtain a graph like the Figure 9, by clicking on the map list then select and click color cell. In the color cell graph, it is the same as the contour graph, the difference is that in the color cell graph there is a grid so that the lines on the graph are not visible. The distribution of noise in the color cell looks more even than in the contour graph because the lines have been removed. The redder the color produced, the higher the noise level of the area and vice versa.

It can be seen from the color cell map above that the distribution of noise levels is uneven, in open spaces it is dominated by green and reddish orange and blue marks closed spaces in the form of classes.

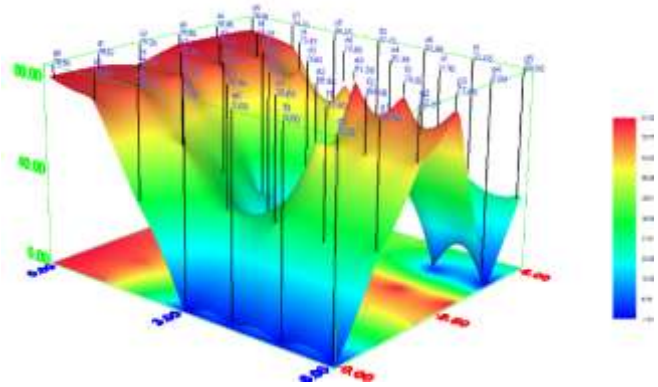

Figure 9. 3D Color Cell Graph

To obtain a graph like the Figure 10, click on the map list, then select and click color cell, then click OpenGL View on the toolbar. After that, wait and the 3D color cell graph appears, set the graph according to your wishes. It can be seen that there are several ends and heights in the graph. The bluer the area, the lower the resulting valley. Conversely, the redder the color, the higher the resulting hill. Each area is described with a black line that determines the noise value.

4. Conclusion

Outdoor Building Noise Analysis Using Matlab on the UGM Animal Health building conducted on Friday, February 17, 2017 from 13:00 to 17:00. The following conclusions and suggestions were obtained: 1) Based on the results of the noise level analysis, the lowest background noise was 58.9 dB (A) and the highest was 89.3 dB (A). 2) According to the standard of the Decree of the Minister of Environment No. 48 of 1996, the campus environment is not suitable for use as a school or campus environment because it has a background noise of 73.01 dB (A). Based on the results of mapping and noise maps, it shows that the noise level that occurs right in front of Jalan Sekip Unit 1 ranges from 74.3 to 89.3 dB (A). This shows that the further away from the noise source (transportation activity), the noise level will decrease.

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