



Analysis of Audio Quality Using Equalizer Analysis (Case Study: Notification Sounds at Purwokerto Train Station)

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ARTICLE INFO

Keywords: Audio Design, Equalizer Analysis, Design Thinking, Train Station

Received : 14, May

Revised : 28, May

Accepted: 29, June

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ABSTRACT

The audio quality produced in the delivery of public information, particularly in train stations with high traffic, plays a crucial role in ensuring clear information dissemination to passengers. This research employs a qualitative method with a design thinking approach up to the define stage, as the researcher aims to provide recommendations to relevant parties. Subsequently, the resulting audio quality can be analyzed by examining existing data samples and applying equalizer analysis. This analysis allows us to determine the quality characteristics of the audio data. Consequently, the findings of this research will enable us to assess whether the produced audio quality is suitable for listening and delivery to passengers or the audience at Purwokerto Train Station.

INTRODUCTION

The analysis of audio quality using equalizer analysis, particularly in the context of notification sounds at Purwokerto Train Station, is a crucial step toward improving the clarity and effectiveness of public communication in transportation spaces. Notification sounds play an essential role in delivering timely and relevant information to passengers, including train arrival and departure announcements, platform changes, and emergency alerts (Yang et al., 2020). Therefore, the quality of the audio used must meet certain standards such as clarity, loudness, proper frequency distribution, and suitability to the acoustic characteristics of the station environment, which is often crowded and echo prone. Equalizer analysis involves the process of adjusting the balance between various frequency components of an audio signal. In this study, equalizer analysis is utilized to evaluate the frequency spectrum of the notification sounds played at the station. The goal is to determine how the low (bass), midrange, and high (treble) frequencies are handled so that the transmitted message is clearly heard, not excessively loud or shrill, and able to cut through background noise effectively (Al-Saggaf et al., 2022).

Initial observations revealed that the notification sounds at Purwokerto Station often become inaudible during peak hours due to high ambient noise levels. This issue is likely caused by an imbalanced equalizer setting, particularly with underemphasized midrange frequencies, which are critical for speech intelligibility. In addition, the architectural design and materials of the station such as metal roofing, tiled floors, and concrete walls contribute to excessive reverberation, which further distorts the audio clarity (Alvarez-Diazcomas et al., 2023). Thus, this research aims to assess the current audio settings and identify technical improvements through equalizer adjustments. Through sampling and spectral analysis, it was found that the current notification sounds exhibit a frequency response dominated by low and high frequencies, while the midrange frequencies typically between 500 Hz and 2 kHz are insufficient. As a result, the initial tone of the announcement may be attention-grabbing due to high treble, but the core information usually conveyed through speech lacks clarity. To address this, the equalizer should be adjusted to boost mid frequencies to enhance speech intelligibility, especially in a noisy public setting like a train station (Alvarez-Diazcomas et al., 2020).

In addition to frequency distribution, this study considers loudness and dynamic range. If notification sounds are too quiet, they are easily masked by environmental noise. Conversely, if they are too loud, they can cause discomfort or even hearing fatigue. Ideally, the sound pressure level (SPL) of announcements in public spaces should range between 70 to 75 dB, which is sufficient for clear perception without being intrusive. This balance ensures that messages are effectively delivered to passengers without creating auditory stress (L. Huang et al., 2022). The effectiveness of notification sounds also heavily depends on the choice and placement of speakers. Many public transportation facilities in Indonesia, including Purwokerto Station, still rely on conventional public address systems without adequate consideration for acoustic distribution. Reflections from hard surfaces often result in echoes, which impair speech clarity.

A more strategic approach involves using directional speakers placed at optimal angles and locations to direct sound toward passenger zones, thereby minimizing reflections and reverberation. Equalizer settings must then be tailored to match the acoustic properties of each speaker's area of coverage (Lauinger et al., 2022).

To further enhance audio quality, the implementation of digital signal processing (DSP) systems is recommended. DSP allows for real-time audio adjustments, including automatic equalizer tuning, feedback suppression, and echo cancellation. These systems can adapt to changing environmental conditions, such as crowd density or noise levels, ensuring consistently clear notification sounds throughout the day. By integrating equalizer analysis with DSP, the station's public address system becomes more intelligent, responsive, and effective (Freire et al., 2023). The equalizer analysis of notification sounds at Purwokerto Train Station highlights the need for more balanced frequency settings, better acoustic planning, and the adoption of adaptive technologies to ensure high-quality audio delivery. Improving the midrange frequency response, optimizing loudness, strategically placing speakers, and implementing DSP solutions are all critical actions for improving passenger experience and safety. When notification sounds are clearly heard and understood, passengers can navigate the station more efficiently, reducing confusion and improving the overall service quality of the railway station (H. Huang et al., 2020).

This case study underscores the importance of scientific and technical approaches to public communication system design, especially in mass transportation hubs where clear, timely, and reliable information can significantly impact passenger flow and operational safety. It also provides a framework for future improvements and serves as a reference for similar projects in other stations across the country. Good sound quality is an essential aspect of everyday life, particularly in public spaces such as train stations. Clear and easily understandable announcement sounds greatly assist passengers in obtaining necessary information, such as departure schedules, important announcements, and other details (Magele et al., 2022). This makes it a crucial aspect that must be given significant attention. The numerous facility improvements in railway services are not limited to train carriages; supporting facilities must also be maximally addressed. Train stations, serving as the central hub for arrivals and departures, play a pivotal role as the main source of information for passengers. One of the key elements to consider is the delivery of information through audio media (Pellegatti et al., 2023).

By using Equalizer Analysis, the quality of sound produced can be assessed to determine its adequacy for passengers to hear comfortably in such environments. This study focuses specifically on Purwokerto Railway Station to evaluate the extent to which the information provided by the station is effectively delivered to its passengers or customers. The objective of this research is to analyze the quality of announcement sounds at Purwokerto Railway Station to determine whether they meet acceptable standards. Instances where passengers fail to hear important announcements can lead to missed trains, causing passengers to cancel their trips or purchase new tickets for subsequent schedules.

This underscores the need for the researcher to assess the audio quality provided by the station to ensure clearer information dissemination (Movalled et al., 2023).

The implementation of the Equalizer Analysis method is expected to offer a technical solution for optimizing audio quality in public spaces, particularly at train stations. Furthermore, this study integrates soundscape elements, including the effects of environmental sounds, background music, and announcements, to provide an enhanced auditory experience (Mishra, 2021). Employing a design thinking approach, this research prioritizes the needs and experiences of passengers as the end users. This research offers dual benefits: improving the quality of railway transportation services and contributing scientifically to the development of audio design in public spaces. The findings of this study are expected to be applicable not only to Purwokerto Railway Station but also to other train stations across Indonesia, enabling the creation of better and more responsive information dissemination systems tailored to user needs (Audu et al., 2023).

THEORETICAL REVIEW

Audio Quality

Audio quality refers to the clarity, balance, and fidelity of sound as perceived by listeners. In public spaces such as train stations, high-quality audio is essential to ensure that important information is delivered effectively, without distortion or misunderstanding.

Equalizer (EQ)

An equalizer is a tool used to adjust the amplitude of specific frequency bands within an audio signal. Equalizer analysis allows for the identification and correction of imbalances—such as excessive bass or lack of mid-range frequencies—that may impair speech clarity or listener comfort.

Frequency Range

Sound frequencies are typically divided into:

- Low frequency (Bass): 20–250 Hz, which adds depth and power but can overwhelm speech if too dominant.
- Mid-range frequency: 250–4000 Hz, the most important range for human speech intelligibility.
- High frequency (Treble): 4000–20,000 Hz, contributing to detail and brightness, but potentially harsh if overemphasized. Balanced frequency distribution is critical for producing natural, intelligible sound.

Speech Intelligibility

Speech intelligibility is the degree to which spoken words are understood by listeners. It is influenced by the clarity of vocal frequencies, background noise, reverberation, and the presence of competing sounds. In public address systems, poor intelligibility can lead to confusion and missed information.

Acoustic Environment

The acoustic environment encompasses the physical characteristics of the space—such as room size, wall materials, ceiling height, and ambient noise—which affect how sound behaves. Poor acoustics may cause echo, sound reflection, or “dead zones” where audio is inaudible or unclear.

Speaker Placement

Speaker placement refers to the positioning and orientation of loudspeakers within a space. Proper placement ensures even sound distribution and reduces issues like overlapping audio signals or areas with insufficient sound coverage. Strategic positioning is crucial for effective communication in large or open areas.

Notification Sound System

A notification or public announcement system is designed to deliver time-sensitive and essential information in public areas such as train stations. The efficiency of such a system depends not only on equipment quality but also on frequency balance, speech delivery, and environmental acoustics.

METHODOLOGY

Study This done use approach qualitative for analyze quality audio design at Purwokerto Main Railway Station. Data collected through observation field during three month present directly at the station train, then listen to in a way direct delivery information provided by the officer station, as well as documenting the resulting audio recording from announcement information mentioned in several speaker sound points include space Wait passenger adjacent south, space Wait passenger adjacent north, door area enter passengers, purchasing area ticket passengers, passenger toilets and platform areas or track train fire. Observation covers observation condition acoustic Where can observed with see placement speaker position on the station and response passenger to announcement information generated and identified challenges faced related clarity information the.

Research materials covering notes observation the field that has been conducted and audio data recording of announcements. In data collection the equipment used covers Sound Level Meter for measure noise, audio recorder for documentation or them results the sound produced as well as device audio software for equalizer analysis function read frequency the sound produced from the data. Analysis done with method Equalizer Analysis for evaluate audio frequency and level its clarity where can read with low, mid, and treble frequencies as well design thinking approach to design solution based on need user covering stage empathize, define and ideate.

At the stage empathize researcher pass observations that have been made explained before, then furthermore researcher will do define stage with This aiming for formulate the problem that will solved in a way clear and measurable with do recording data analysis the voice that has been collected for identify

unmet needs fulfilled. To get definition problem with right so that the resulting solution relevant and effective on voice characteristics.

Research result presented in form visualization like graphic equalizer with use device Adobe Audition software, tables, and diagrams for to clarify findings. Research This aiming give recommendation technical use increase quality audio system, ensuring clarity information, and create experience more auditory Good for passengers. The recommendations generated expected can implemented not only in Purwokerto but also at the station others in Indonesia.

RESEARCH RESULTS

Researchers at this stage will make a discussion regarding the results of one of the data that the researcher analyzed.

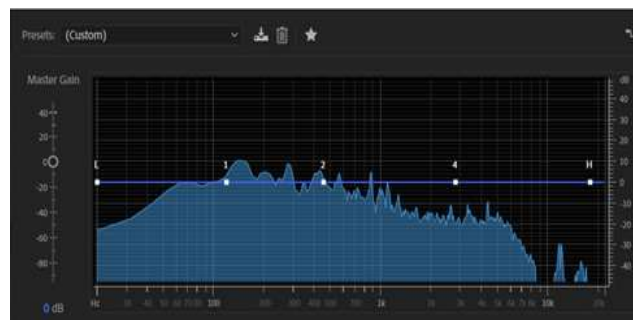


Figure 1 Screenshot Equalizer Analysis Data 1 (South Passenger Waiting Room)

Source: Personal documentation, 2024

An equalizer analysis of the audio system in the south waiting area of the train station revealed several significant issues affecting announcement clarity. The primary problem is the excessive dominance of low-frequency (bass) sounds, which compromises the intelligibility of mid-range frequencies—critical for conveying human speech. As a result, announcements become muffled or distorted, making them difficult to understand in a public setting where clear communication is essential.

A second major issue is the suboptimal placement of speakers. Observations indicate that speakers are aligned in a straight line without considering sound wave distribution, leading to uneven sound coverage. This results in acoustic "blind spots" where announcements are barely audible, especially in areas near walls or corners, where excessive sound reflections cause echoes and further reduce clarity.

The third problem is the concurrent use of background music, particularly tracks with dominant vocals, during announcements. This causes auditory competition between the music and spoken messages, resulting in message overlap and listener confusion. High music volume exacerbates the issue, rendering important information inaudible.

These three core problems—bass frequency dominance, poor speaker placement, and inappropriate background music—significantly degrade the overall quality of the announcement system. The consequences include passenger confusion, reduced accessibility for vulnerable groups, and operational inefficiencies, such as delays or misdirected travelers.

To address these challenges, several technical and strategic solutions are recommended. First, comprehensive recalibration of the audio system is essential, especially the equalizer settings, to reduce bass dominance and enhance mid-range clarity. Second, speaker placement should be optimized using modern acoustic design principles, such as wide-distribution speakers or sound zoning systems, to ensure even sound coverage. Third, background music settings must be reevaluated; if used, music should be instrumental, low in volume, and automatically reduced or muted during announcements via smart audio controls.

If existing issues are too complex for partial fixes, replacing the entire audio system with a more modern and integrated solution may be necessary. Advanced systems offer features such as volume automation, noise cancellation, and adaptive sound distribution, which can significantly improve clarity and user satisfaction.

Implementing these improvements is expected to enhance communication quality, increase passenger comfort, and support operational efficiency across the train station.

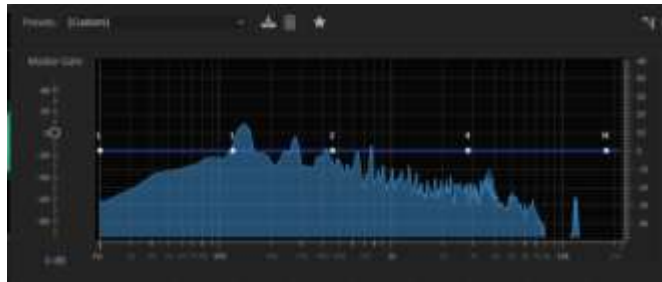


Figure 2 Screenshot Equalizer Analysis Data 2 (North Waiting Room)

Source: Personal documentation, 2024

An analysis of the audio equalizer results in the north waiting area revealed several critical challenges affecting the quality of public announcements. The primary issue is the imbalance in sound frequencies, particularly the excessive dominance of low-frequency (bass) sounds. This overemphasis on bass masks mid-range frequencies—crucial for vocal clarity—resulting in announcements that are unclear and difficult to understand. Since mid-range frequencies are essential for human speech intelligibility, this imbalance significantly reduces the effectiveness of information delivery.

Another contributing factor is the suboptimal placement of speakers. The current linear speaker arrangement does not distribute sound evenly throughout the space, leading to “dead zones” where announcements are barely audible. Poor positioning also increases the risk of unwanted sound reflections, causing echo and distortion, which further compromise audio clarity.

From the content and delivery perspective, the absence of background music during announcements is a positive aspect, as it eliminates auditory competition. However, the issue of unclear vocal output persists, likely due to inadequate audio console configuration and poor equalizer settings. These technical shortcomings lead to flat, unnatural-sounding voices that lack articulation. Furthermore, the monotonous and unclear speech delivery by

announcement personnel exacerbates the issue, highlighting the need for improved vocal training.

In summary, four main factors degrade the announcement system's performance: (1) unbalanced sound frequency with overpowering bass, (2) ineffective speaker placement leading to uneven sound distribution, (3) suboptimal audio console settings that distort vocal clarity, and (4) inadequate vocal delivery techniques by announcement staff. These deficiencies not only affect sound quality but also undermine passenger experience, potentially causing confusion, delays, and a loss of trust in public transport services.

To address these issues, a series of targeted improvements are proposed: recalibration of the audio system to rebalance frequency output; strategic speaker placement based on room acoustics to ensure even sound distribution; professional adjustment of the audio console for natural and dynamic vocal output; and technical training for staff to enhance pronunciation, intonation, and clarity.

Comprehensive implementation of these solutions is expected to significantly enhance the clarity and effectiveness of announcements, thereby improving user experience, reinforcing the station's positive public image, and supporting operational efficiency in railway transportation.

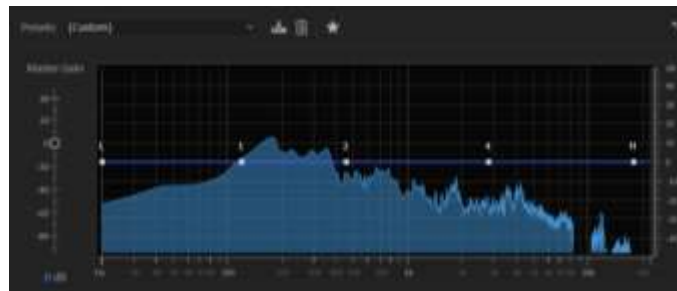


Figure 3 Screenshot Equalizer Analysis Data 3 (Entrance Area)

Source: Personal documentation, 2024

Equalizer analysis of the station entrance area reveals that the on-site audio announcement system performs at a relatively good level, particularly due to the clarity of mid-range frequencies between 200 and 400 Hz. This frequency range plays a vital role in transmitting human vocal information, making its presence a strong indicator of intelligible and effective announcements. The overall sound quality is supported by this clarity; however, residual low-frequency dominance still slightly affects vocal sharpness and contributes to a somewhat muffled tone. This suggests that while the current performance is adequate, further refinement of equalizer settings is needed to reduce bass prominence and enhance overall vocal balance.

The physical environment of the entrance area also influences audio performance. With a relatively small room size and close proximity between speakers and listeners, sound distribution remains fairly even despite the linear arrangement of speakers. Nonetheless, this configuration is not yet ideal. Redistributing speaker placement or incorporating additional sound points

would promote more uniform sound coverage, ensuring that information is clearly heard throughout the entire space, not just in the front-facing areas.

The absence of background music during announcements is another positive feature of the system. Without musical interference, listener attention is better focused on the spoken message. Even so, the effectiveness of vocal delivery could be further improved through enhanced intonation and articulation. A flat or monotonous delivery may diminish listener engagement and reduce the impact of important messages. Proper voice training for announcers would help create clearer, more dynamic communication that captures attention and improves comprehension.

Although the current announcement system at the entrance area performs sufficiently well due to favorable room acoustics and mid-range clarity, opportunities for improvement remain. Fine-tuning the equalizer, optimizing speaker arrangement, improving vocal delivery through training, and ensuring high-quality microphone use would collectively enhance the intelligibility, reach, and effectiveness of announcements. These improvements will support better passenger orientation, reduce the risk of missed information, and strengthen the station's role in delivering professional and accessible public service communication.

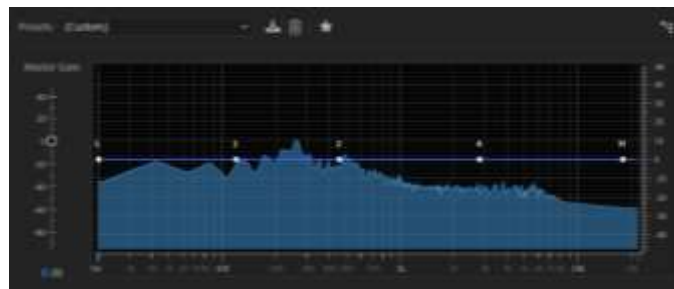


Figure 4 Screenshot Equalizer Analysis Data 4 (Ticket Purchase Area)

Source: Personal documentation, 2024

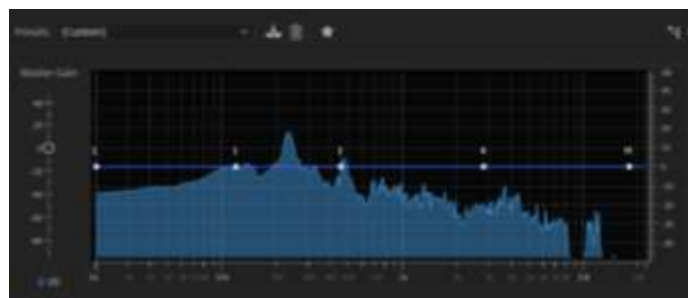


Figure 5 Screenshot Equalizer Analysis Data 5 (Passenger Toilet)

Source: Personal documentation, 2024

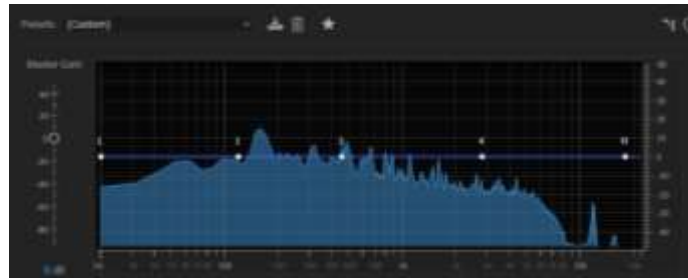


Figure 6 Screenshot of Equalizer Analysis Data 6 (Platform Area)

Source: Personal documentation, 2024

DISCUSSION

This study finds that audio quality at Purwokerto Main Train Station Still face various constraints that affect clarity delivery information. Analysis use Equalizer Analysis method shows that bass (low) frequency too much dominant, so that mid-range frequencies, which should be ideal for dialogue sound, less heard clear. Condition This made worse by the placement of the speakers which is not strategic, causing distribution voice No even and information difficult received by passengers in a way effective.

In addition, the results observation shows that use music concurrent background with announcement often disturbing clarity sound. Noise environment, such as hustle passengers and sound train fire, also become factor main influencing factors experience auditory. These soundscape elements give challenge significant for audio system for convey clear and easy information understood.

By implementing design thinking approach, research This recommend several step improvements, such as adapt audio frequencies using equalizer, fix speaker position for distribution more sound evenly, and arrange repeat use music background so as not to bother announcement. Implementation solution This expected can increase experience auditory passengers, ensure information delivered in a way effective, and improve quality services at Purwokerto Main Railway Station as well as station other.

Characteristics quality voice Announcement at the Station Purwokerto based on results equalizer analysis shows various problems that affect clarity and comfort listener in accept information. Equalizer analysis in several strategic areas at the station, such as room Wait south, space Wait north, and door area enter, show that quality voice announcement not optimal and still need repair technical to be able to convey message with more effective. In space Wait south, the equalizer results show domination frequency very strong low (bass). so that range mid-range frequencies that carry the core information voice vocal become not enough heard. Phenomenon This cause dialogue, or the announcement was delivered become No clear, even sometimes heard rumbling, so that listener have trouble understand the message conveyed. Inclined placement of speakers straight and less strategic cause wave the sound produced No spread in a way evenly. This is creating a less dense area heard voice with well, so distribution voice becomes not evenly distributed in space Wait the. Other factors come into play reduce quality voice is use music background with Colliding Vocals with voice announcement. Vocals from music background compete with voice

announcement, make message become difficult accepted and potential cause confusion for listener.

In the room Wait north, results equalizer analysis also revealed imbalance similar frequencies, namely domination frequency low covering frequency middle. Even though it is audible in the mid-range range several intonation vocals, quality No maximum Because still affected by the prominent bass sound. Straight speaker placement return becomes constraints, because distribution voice becomes not enough evenly and creates a dot area blind where is the announcement difficult heard. However, it is different with room Wait south, in the room Wait north No there is music background so that disturbance voice more caused by settings suboptimal audio console and techniques poor pronunciation clear. This is show that arrangement technical audio console and capabilities vocal officer announcements also play a role important in determine quality sound received listener. Poor intonation varied and flat sound make message No easy understood in a way comprehensive, although No There is disturbance voice from music background.

Different with these two areas, the door area enters show characteristics quality more sound Good according to equalizer results. According to (Schmutz, 2024) in this area, the mid-range frequencies between 200-400 Hz carry part big information vocal man heard Enough clear, although Still there is domination frequency low. The position of the speaker is still straight no to become problem because of the room area relatively small with wide around six meters, so that voice can heard Enough by the surrounding listeners. The announcement that only use voice vocal without existence music background also supports clarity the message conveyed. However Thus, intonation under delivery maximum Still become weakness, where technique pronunciation that has not been perfect can cause message heard not enough interesting and less easy understood. This is show that aspect audio technical not only question equipment but also involves ability man in convey message in a way effective.

From these three areas, characteristics quality voice Announcement at the Station Purwokerto influenced by a combination factor technical and human. Dominance excessive bass frequencies in some areas cause imbalance voice so that information vocal become not enough clear. Less than optimal speaker placement also contributes to the distribution voice that is not evenly and creates difficult areas heard. According to (Kratz et al., 2022) use music background with vocals in space Wait south add complexity disturbance sound received listener. On the other hand, the quality technical arrangement audio console and capabilities speaker announcements also have an impact big to clarity and power pull the message conveyed. Flat vocal sound and poor intonation varies make message difficult accepted with Good although No There is disturbance voice other.

Characteristics This show the need integrated repairs, starting from adjustment equalizer settings for reduce bass dominance and strengthening the mid-range, placement reset the speaker for sound can spread evenly, and election music background that is not bother or even deletion music background at the time announcement in progress. In addition to the aspects technical, training Vocals and pronunciation for officer announcements are also very important for delivery

information more effective and easier understood. Quality voice good announcement not only increase understanding listener to information conveyed but can also increase comfort and satisfaction user service station train fire. Clear announcement help reduce confusion and error potential information cause delay or another problem in journey.

Characteristics quality voice Announcement at the Station Purwokerto, based on equalizer analysis results, depicting conditions that are still not optimal and needs to be improved handled in a way comprehensive. Combination between problem technical audio devices and techniques delivery man become key the main thing to do fixed for increase quality communication sound in the environment station. Improvement This not only will increase audio quality but also provides impact positive on service and safety passengers, so that experience users at the station become better and effective in convey information important. Implementation the right and sustainable solution will become step strategic in increase quality system Announcement at the Station Purwokerto to front of it.

Technical factors that influence quality voice Announcement at the Station Purwokerto based on results equalizer analysis consists of from several aspect important that is direct impact on clarity and comfort listener in accept information. Based on observations in various areas of the station like room Wait north, space Wait south, and door area enter, can identified several constraints technical the main cause quality voice announcement not optimal. Factors the covering balancing frequency sound, speaker placement, setup audio console, as well as device microphone used.

One of factor the most prominent technicalities found is imbalance frequency sound, especially domination frequency low or excessive bass. The equalizer results show that in the room Wait North and south, bass frequencies are very dominant so that cover range mid-range frequency that loads part big information vocal human beings. This is causing voice announcement heard rumbling and less clear. In the context of audio, the mid-range range of around 200 Hz to 4 kHz is frequency critical for clarity vocals, because part detail and intonation voice man be in range this. When the frequency low too strong, sound vocal become covered, make the message conveyed become difficult understood. Imbalance This cause experience poor listener comfortable and potential cause confusion, especially in places busy public like station train fire.

Speaker placement is also important factor technical matters that greatly affect quality voice announcement. Equalizer analysis shows that in some areas; the speaker position tends to place in a way straight in one line without consider pattern distribution optimal sound. Poor speaker placement strategic This result in wave voices no spread in a way evenly to entire area of space wait, creating a point zone dead where is the sound become very weak or even no heard. Conditions This especially appear in space Wait north and south, where passengers are outside range distribution voice have trouble in hear announcement with clear. The position of the speaker is too near with wall or object hard others also cause reflection voice that is not desired, causing echo and distortion that worsens audio quality. In the door area come in, even though room relatively small and straight speaker placement No to become problem,

adjustment fixed speaker position required for ensure voice spread even and not there are abandoned areas.

Arrangement audio console is factor technical next one that has influence significant to quality sound. From the results equalizer analysis, seen that equalizer settings in some areas are not optimal, especially in arrange balance frequency and volume level. The audio console is lacking Good can cause voice vocal heard flat, not clear, and sometimes too slow or excessive in frequency certain. According to (Othman & Lim, 2019) lack of gain adjustment and settings effect voice makes the audio output less natural and not comfortable heard. Proper equalizer settings are very important. For adapt characteristics voice in accordance with condition acoustic room, so that voice announcement become clearer and easier understood by the listener. In some case, the settings are not right also causing voice vocal lost compete with voice background or environmental noise present at the station.

Use device The microphone is also one of them factor technical role important in determine quality voice announcements. Although in some areas the announcements only use voice vocal without music background, quality microphone used can influence clarity the sound produced. Microphone with lacking characteristics in accordance or quality low can produce a broken, noisy, or cracking sound less natural. The microphone is not sensitive to mid-range frequencies will also worsen quality vocals, so that the message conveyed difficult accepted with good. Selection microphone that has characteristics voice in accordance with need announcement the public is very necessary for their voice vocal heard clear and clean.

Condition acoustic the room also becomes factor technical requirements attention. Waiting room with surface hard like wall concrete or glass without treatment acoustic tend reflect sound, so that cause echo and distortion that can bother clarity announcement. Without Handling adequate acoustics, sound the announcement that came out from the speaker will easy distorted and become not enough comfortable heard. This factor often ignored, even though it is very crucial in increase audio quality in the environment the station that has lots of source noise and space open. In addition to devices and settings technical, aspects maintenance audio system also affects quality sound. The speakers are old, and less maintenance potential experience decline performance like distortion sound, output instability, or even damage components that cause quality voice decrease drastic. Treatment routine and replacement devices that have been obsolete is also included factor important for guard quality announcement remains optimal.

From the whole factor technical said, can concluded that quality voice Announcement at the Station Purwokerto is heavily influenced by a combination of arrangement frequency sound, placement speaker device, settings audio console, usage proper microphone, condition acoustic room, and maintenance audio. Each factor own roles and contributions that are not Can separated in create system effective and reliable announcement understood by all passengers. Handling and repair comprehensive from aspects technical This would be very helpful in increase quality announcement, so that communication information important at the station can walk smooth and optimal.

For overcome problem quality voice announcements, recommendations needed done covering equalizer adjustment so that the bass frequency is not too dominant and strengthening mid-range frequency, tuning repeat speaker position for distribution voice more even, optimization arrangement audio console for adjust the volume and tone right, selection microphone with quality best, and handling acoustic room Wait For reduce reflection voice. No less important is guard maintenance and checking periodic audio system to stay in prime condition. Integrated technical efforts This expected can produce quality voice more announcements clear, crisp and comfortable heard, improve experience Passengers at the Station Purwokerto in a way significant.

For increase quality voice Announcement at the Station Purwokerto based on findings from equalizer analysis, required implementation several solutions integrated and systematic technical. Based on results analysis that has been disclose several constraints main like domination excessive bass frequencies, suboptimal speaker placement, poor sound settings audio console that has not been maximum, and quality microphone still need improved, solution technical following This can made into reference for fix and optimize system announcement at the station.

Equalizer adjustment to step crucial thing to do done. From the results analysis seen that frequency low or bass too much dominant so that cover the all-important mid-range frequencies for clarity voice vocals. According to (Jumadirrohman et al., 2023) the equalizer must tuned repeat with method lowers the bass frequency level and increases the mid-range level, especially in the 200 Hz to 4 kHz range. frequency This is a critical area where most of big information vocals and intonation voice man is. Proper adjustment will make voice announcement heard clearer and more natural, so that the message conveyed can accepted with both by the listener. The use of a graphic equalizer or modern and easy parametric customized would be very helpful audio technician in do calibration in a way accurate in accordance condition acoustic each area in the station.

Arrangement rework and optimize speaker position must be quick conducted. Results of the analysis show that Straight speaker placement in one line without consider pattern distribution voice make audio distribution no evenly distributed. Technical solutions that can applied is do additional speaker installation or adapt angle and height speaker installation for sound can spread more evenly to entire area of space wait and door enter. Selection of speakers with pattern distribution the appropriate sound (dispersion pattern) is also important, such as speakers with wide coverage pattern for large areas or directional speakers for narrow and limited areas. In this way this, every corner room will get coverage enough sound without there are dead zones where the sound announcement No heard. In addition, the speaker placement is far from reflective surface voice like wall hard can reduce effect disturbing echo clarity voice.

Improvement quality device microphone is solution technical that is not lost important. Replacement microphone with type condenser or directional microphone that has response frequency more breadth and sensitivity tall will increase clarity incoming sound to audio system. Good microphone can catch

intonation and voice detail with more well, so message announcement becomes easier understood and not distorted. Microphone with the noise cancellation feature or anti-rumble filter also helps minimize voice background that is not desired, especially in the environment frequent stations crowded and noisy.

Setup and calibration repeat audio console is also very necessary be noted. The audio console must be set with appropriate gain, volume, and tone settings for sound output No too weak or excessive in frequency certain. The use of compressors and limiters in audio systems can also help guard stability of sound volume so that it does not happen surge or drastic decline moment announcement taking place. According to (Makarewicz & Bilski, 2020) flexible use of equalizer on the console can make it easier adjustment voice in accordance characteristics acoustic each room. The audio technician must carry out monitoring periodically and use tool gauge frequency such as real-time analyzer (RTA) for ensure sound output in accordance with expected standards.

Technical solutions related acoustic space is also necessary implemented. Considering part big room wait and door area enter the station Purwokerto use material hard walls and floors, reflections sound (echo) and reverberation become problems that can reduce clarity announcement. Installation of soundproofing material voice such as acoustic panels, carpet, or curtain thick in strategic areas will help reduce reflection voice excess. With management acoustic good space, the sound produced by the speakers becomes cleaner and more focused, so that listener can catch information with easier and more comfortable.

In addition to the solution direct technical relate with device loud and audio settings, training for officer the announcement is also aspect important that is not may ignored. The officer who gave announcement must give training vocals to be able to convey information with clear intonation, good articulation, and speed proper speaking. Natural and trained voice will support quality technical that has been improved, so that in a way overall produce informative and fun announcement for heard.

Maintenance routine to all over audio system is solution preventive measures that must be taken applied so that the quality voice remains optimal in term length. Examination periodically on the condition of the speakers, microphone, and devices essential audio console done for detect damage or decline performance since early. Replacement components that have been wear and cleaning device in a way routine will avoid system from problem technical that can bother quality voice.

Implementation more advanced digital audio technology sophisticated can also be become solution term length. Usage system announcement digital based with feature processing signal sound (digital signal processing/DSP) allows more audio adjustments precision and automatic in accordance condition environment. System this can also integrated with device software that makes it easy monitoring quality voice in real-time and fast adjustment when happen change condition room or disturbance technical (Sasikumar, 2020). Technical solutions that can applied for increase quality voice Announcement at the Station Purwokerto covering equalizer adjustment for balancing frequency, arrangement repeat and add speakers for distribution voice evenly, use microphone quality height, setup

and calibration audio console optimally, repair condition acoustic space, training vocal for officer announcements, and maintenance routine audio system. Implementation solution This in a way comprehensive and sustainable will produce system more announcements effective, improve comfort passenger in accept information important, and support operational station become better and professional.

CONCLUSION AND RECOMMENDATIONS

Conclusion from this study is the audio quality that is formed from announcement the sound at Purwokerto Train Station Not yet fulfill standard. The sound produced based on equalizer analysis low sound still dominate, where voice This No can heard good by humans. So that researcher concludes the need There is repair quality, so that the information captured by the auditory become good and correct information. If in frequency 200-1000 Hz will hear better. The need implementation good equalizer is matter main in delivery information voice.

To improve the clarity and effectiveness of public audio announcements at Purwokerto Train Station, several recommendations can be proposed. First, optimizing audio frequencies through equalization – particularly by enhancing the 2-4 kHz range, which is crucial for speech intelligibility – can significantly improve clarity. The use of directional speakers or line array systems is also suggested to minimize echo and reverberation in open station environments. In addition, installing sound level monitoring systems can help ensure consistent volume throughout the station, avoiding issues of under- or over-amplification. Regular acoustic calibration should be conducted to adjust to environmental or structural changes within the station.

FURTHER STUDY

Future research could focus on user-centered evaluations, such as surveys or focus group discussions, to assess passenger perceptions of audio clarity and comfort. Comparative studies between multiple stations may also help identify best practices in public address system design and implementation. Furthermore, examining the impact of ambient crowd noise on announcement clarity and exploring the use of adaptive digital signal processing (DSP) technologies could offer innovative solutions to maintain consistent audio quality in dynamic environments.

ACKNOWLEDGMENT

Writer to pronounce accept the greatest love to all the party that has contribute to success this journal. We want to convey accept the greatest love to the Master of Design, Telkom University Bandung for support financial and technical during this study.

Award special given to management and staff Purwokerto Train Station on permission for do observation field and providing valuable data that greatly enriches this study. We also thank love to the participating passengers in interview and sharing their experience, who play a role important in to form findings this study.

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