JERSS Multidisciplinary : Journal of Education, Religion, Social, and Science

Vol. 1 No. 1 January–July 2026, Pages 52-65
ISSN: 0000-0000
DOI:

Analysis of Air Quality in Urban Campus Areas Based on Real-Time AirVisual Data: A Study of Pollution Exposure in the UIN Jakarta Campus Environment

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Keywords
Air Quality Monitoring, AirVisual App, UIN Jakarta Campus Environment, Particulate matter ($PM_{2,5}$,PM_{10}), and Environmental Awareness

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Article Information
Submitted: 2026-04-29
Review: 2026-06-10
Accepted: 2026-06-29
Published: 2026-07-12

Abstract:

Air quality has become an increasingly pressing environmental health issue, particularly in densely populated urban areas such as Jakarta. As a region with high levels of human activity and motor vehicle traffic, air pollution from particulate matter (PM_2.5, PM_{10}) and hazardous gases such as CO2, NO2, and O_3 has had a serious impact on public health, ranging from respiratory problems to long-term illnesses. Campus environments, including the State Islamic University (UIN) Jakarta, which should be comfortable places for learning and carrying out activities, are not immune to this threat. However, awareness of air quality conditions around the campus remains low due to limited access to real-time, easily understandable air quality data. This study aims to implement the AirVisual application to monitor air quality on the UIN Jakarta campus. The use of this digital technology is expected to provide accurate, easily accessible, and real-time air quality information, thereby supporting efforts to prevent health risks arising from exposure to air pollution. The results of the study show that pollutant concentrations tend to increase from morning to afternoon, with the third week of observation showing the poorest air quality compared to the other weeks. These findings indicate that transport activities and meteorological factors contribute to increased pollutant concentrations on campus. This study demonstrates the potential of the AirVisual

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application as a practical alternative to air quality monitoring systems, supporting the adoption of more adaptive and sustainable campus environmental policies.

INTRODUCTION

Air is an essential component for the survival of living organisms. Air quality in various urban areas continues to deteriorate in line with increasing anthropogenic activities, such as transport, industry, infrastructure development, and the use of fossil fuel-based energy (Arulmozhi et al., 2023). These activities increase the concentration of various pollutants in the atmosphere, leading to environmental degradation and an increased risk of public health problems (Dewi, 2021; IQAir, 2024; Organization, 2021). In addition to causing respiratory problems, long-term exposure to air pollution is associated with increased risk of cardiovascular disease and neurological disorders, as well as reduced quality of life for urban populations (Cholianawati et al., 2024; Wang et al., 2024). This situation indicates that air pollution has become one of the environmental health challenges requiring serious attention from various sectors, including higher education institutions.

Air is one of the environmental components vital to life, as it provides the oxygen required for the respiratory processes of living organisms. Good air quality has a significant impact on human health; however, declining air quality due to rising pollutant concentrations can lead to various health problems. Air pollutants such as particulate matter ($PM_{2.5}$ and PM_{10}), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), and carbon monoxide (CO) can enter the respiratory system and affect various organs of the body. Consequently, air quality is a key indicator in creating a healthy and sustainable environment (Zulkarnaen & Putri, 2021).

Exposure to air pollution, whether short-term or long-term, can increase the risk of various diseases, particularly disorders affecting the respiratory, cardiovascular, and nervous systems, as well as reproductive health. In particular, fine particles such as $PM_{2.5}$ are so small that they can penetrate as far as the alveoli of the lungs and even enter the bloodstream. This can trigger inflammation and oxidative stress, as well as increase the risk of chronic diseases such as chronic obstructive pulmonary disease (COPD), heart disease, stroke, and fetal developmental disorders in pregnant women. The groups most vulnerable to the effects of air pollution include children, the elderly, pregnant women, and individuals with underlying health conditions (Organization, 2021; Programme, 2022).

In addition to affecting individual health, air pollution also has a far-reaching impact on people's quality of life. Accordingly, various studies indicate that high exposure to air pollutants can reduce productivity, increase healthcare costs, and exacerbate the social and economic burden resulting from rising cases of air-quality-related diseases. Consequently, efforts to control emissions, conduct regular air quality monitoring, and raise public awareness are crucial steps in mitigating the adverse health impacts of air pollution (Organization, 2023).

Air pollution has become one of the global environmental challenges requiring serious attention, as it contributes to rising rates of morbidity and mortality from respiratory and cardiovascular diseases (Kahfi & Sujono, 2026). The campus environment, as a centre for educational activities, research, and community service, is also not immune to the threat of air pollution. The high mobility of the academic community, motor vehicle traffic, construction activities, and energy use on campus can increase concentrations of air pollutants (Haya, Nisa, Ladipasa, Suriani, & Media, 2025). These conditions can affect the comfort, learning productivity, and health of the entire campus community. Therefore, monitoring air quality on campus is a crucial step towards creating a healthy and sustainable educational environment.

Globally, air quality remains a matter of grave concern. The 2023 World Air Quality Report published by IQAir shows that only 10 out of 134 countries meet the World Health Organisation's (WHO) annual air quality guidelines for $PM_{2.5}$ concentrations. Jakarta was even recorded as the capital city with the fifth-highest level of air pollution in the world in 2023, with an annual average $PM_{2.5}$ concentration of 37.2 $\mu g/m^3$, far exceeding the WHO's recommended annual threshold of 5 $\mu g/m^3$ (IQAir, 2024). The risks associated with exposure to this air pollution are even more concerning when combined with fine particulate matter, which has the greatest impact on health. One pollutant receiving particular global attention is particulate matter measuring less than 2.5 micrometres ($PM_{2.5}$). Long-term exposure to $PM_{2.5}$ is known to be associated with an increased risk of chronic respiratory diseases, cardiovascular diseases, stroke, neurological disorders, and cognitive decline (Organization, 2021; Wellid et al., 2024). Recent research also indicates that variations in $PM_{2.5}$ concentrations are influenced by meteorological conditions, human activities and local area characteristics; consequently, continuous monitoring is required to obtain accurate information on air quality conditions (Cholianawati et al., 2024).

The Syarif Hidayatullah State Islamic University (UIN) Jakarta faces the challenge of deteriorating air quality due to the high mobility of the academic community, heavy motor vehicle traffic around the campus, and urban activities originating from the Greater Jakarta (Jabodetabek) metropolitan area. Daily academic and operational activities on campus, combined with high traffic density both within and around the campus, contribute to increased concentrations of air pollutants. According to the DKI Jakarta Environment Agency (2023), the transport sector accounts for more than 44 per cent of $PM_{2.5}$ emissions in the DKI Jakarta region. This situation has the potential to affect the health, comfort and productivity

of the academic community if adequate monitoring and management are not carried out (Hanamanth, 2023).

Conventional air quality monitoring is typically conducted using reference-grade monitoring stations. Although these offer a high level of accuracy, using such systems requires a relatively high investment and operational and maintenance costs, limiting the number of monitoring points. Advances in digital technology and the Internet of Things (IoT) have opened new opportunities for air quality monitoring through low-cost sensors and mobile applications. (Irbah, Nurika, & Ramani, 2024) demonstrate that digital technology-based air quality monitoring systems are capable of providing real-time air quality information, thereby raising public awareness of the environmental conditions in their surroundings.

One of the most widely used platforms today is AirVisual, developed by IQAir. This application integrates data from air quality sensors, government monitoring stations and satellite modelling to present real-time, location-based information on the Air Quality Index (AQI), $PM_{2.5}$, PM_{10}, NO_2, CO and O_3. This technology enables users to access air quality information more easily than with conventional monitoring systems (Kumar et al., 2015). Real-time air quality monitoring on campus plays a vital role in supporting health, comfort and the sustainability of academic activities (Rahmadani, Syaifudin, Setiawan, Panduman, & Funabiki, 2025). Furthermore, the use of low-cost air quality sensors can provide a representative picture of variations in $PM_{2.5}$ and CO_2 concentrations on campus (Wang et al., 2024). Consequently, integrating digital technologies such as AirVisual can serve as an alternative air-quality monitoring system that is more accessible to the campus community.

Studies specifically utilising the AirVisual application for air quality monitoring on Indonesian university campuses remain relatively limited. Information regarding temporal variations in air quality at UIN Jakarta has also not been widely reported in the scientific literature. These limitations indicate a research gap that needs to be addressed to generate more comprehensive, contextually relevant air quality data in higher education settings. Therefore, this study was conducted to expand the use of digital air quality monitoring technology whilst providing scientific information that can support more effective campus environmental policy-making (Rahmadani et al., 2025; Wang et al., 2024).

Against this background, this study aims to implement and evaluate the use of the AirVisual application for air quality monitoring within the UIN Jakarta campus environment. This study focuses on three main aspects. Firstly, identifying temporal variations in air quality based on observation times. Secondly, analysing patterns and trends in $PM_{2.5}$ concentrations, the primary indicator of air pollution. Thirdly, the monitoring results are compared with national ambient air quality standards and WHO air quality guidelines.

METHOD

This study employed a quantitative descriptive method, aiming to describe air quality phenomena using systematically collected numerical data. According to

(Sugiyono, 2023), quantitative descriptive research is a method for describing a phenomenon using measurable data without manipulating research variables. This approach was chosen because it is well-suited to identifying temporal patterns in on-campus air quality using data from the AirVisual app. The study was conducted during November 2025 at several strategic locations on campus characterised by high levels of vehicle activity and student mobility.

The main instrument used in this study was the AirVisual app installed on Android-based smartphones. The air quality parameters observed included PM2.5, PM10, CO2, NO2, O3, and the Air Quality Index (AQI). Data were collected in real time at predetermined observation locations. Data collection was carried out daily throughout the study period at three observation times: 08:00 WIB in the morning, 13:00 WIB at midday, and 17:00 WIB in the evening. At each observation time, all air quality parameters displayed by the AirVisual application were recorded. The data were then compiled into a Microsoft Excel spreadsheet to facilitate processing and analysis.

Data analysis was carried out using descriptive statistics, including mean, maximum, and minimum values, as well as patterns of change in pollutant concentrations over observation times. Subsequently, the measurement results were compared with the Air Pollutant Standard Index (ISPU) categories and the World Health Organisation's (WHO) air quality guidelines to determine the level of air quality on the UIN Jakarta campus. This study focuses on describing air quality conditions. It has not yet analysed causal relationships or the factors that directly influence changes in pollutant concentrations, such as meteorological conditions, vehicle traffic volume, the density of academic community activities, and emissions from surrounding areas. Therefore, it is recommended that future research integrate these variables and apply inferential statistical analyses, such as correlation tests, regression analysis, or multivariate analysis using SPSS software, so that the factors influencing air quality in the campus environment can be identified more comprehensively (Cholianawati et al., 2024; Wang et al., 2024).

RESULTS AND DISCUSSION

During the research process, testing was carried out in several stages, yielding results presented in the following tables. Table 1. Spatial distribution of the average air pollutant concentrations during the first week on the UIN Jakarta campus in November 2025.

Week 1 average	**Time or Hours**	$PM_{2,5}$ **(µg/m)**	PM_{10} **(µg/m³)**	NO_2 **(µg/m³)**	CO_2 **(µg/m³)**	O_3 **(µg/m³)**	AQI^+
Monday	08.00	12	25	20	450	18	35
	13.00	35	60	40	650	35	80
	17.00	48	82	55	800	45	110
Tuesday	08.00	13	27	21	455	19	36
	13.00	36	63	42	670	36	83

Week 1 average	**Time or Hours**	$PM_{2,5}$ **(µg/m)**	PM_{10} **(µg/m³)**	NO_2 **(µg/m³)**	CO_2 **(µg/m³)**	O_3 **(µg/m³)**	AQI^+
	17.00	50	85	56	820	46	115
Wednesday	08.00	10	24	19	440	18	34
	13.00	34	59	39	655	34	79
	17.00	49	83	54	805	45	113
Thursday	08.00	12	26	20	445	18	35
	13.00	37	61	41	665	35	81
	17.00	52	86	58	830	47	118
Friday	08.00	14	28	22	460	20	35
	13.00	39	65	44	680	37	80
	17.00	54	90	60	850	48	120
Saturday	08.00	15	30	23	470	21	40
	13.00	41	67	46	690	38	88
	17.00	56	92	61	860	49	123
Sunday	08.00	12	25	13	450	18	35
	13.00	38	62	40	660	34	82
	17.00	53	87	57	835	46	117

Based on Table 1, no significant increase was observed in most pollutant parameters during the first week. However, concentrations of CO and $PM_{2.5}$ showed an upward trend from morning to afternoon. This is thought to be influenced by increased motor vehicle activity amongst the academic community. These findings indicate that the mobility of the campus community contributes to increased emissions within the UIN Jakarta environment.

Table 2. Spatial distribution of average air pollutant concentrations in the UIN Jakarta campus environment during the second week of November 2025

Week 2 average	**Time or Hours**	$PM_{2,5}$ **(µg/m)**	PM_{10} **(µg/m³)**	NO_2 **(µg/m³)**	CO_2 **(µg/m³)**	O_3 **(µg/m³)**	AQI^+
Monday	08.00	18	32	10	420	18	45
	13.00	42	65	22	560	30	82
	17.00	55	78	30	620	38	96

Week 2 average	Time or Hours	$PM_{2,5}$ (µg/m)	PM_{10} (µg/m³)	NO_2 (µg/m³)	CO_2 (µg/m³)	O_3 (µg/m³)	AQI^+
Tuesday	08.00	17	30	9	415	17	43
	13.00	40	63	21	550	29	80
	17.00	54	79	29	615	37	95
Wednesday	08.00	16	29	9	410	16	42
	13.00	41	64	20	555	28	81
	17.00	56	80	31	630	39	97
Thursday	08.00	18	31	10	425	18	44
	13.00	43	66	23	565	31	84
	17.00	57	82	32	640	40	99
Friday	08.00	17	30	9	420	17	43
	13.00	42	65	22	560	30	83
	17.00	56	81	31	635	39	98
Saturday	08.00	15	28	8	400	15	40
	13.00	38	60	19	540	27	74
	17.00	52	75	28	610	36	92
Sunday	08.00	14	27	8	395	14	38
	13.00	36	58	18	530	25	70
	17.00	50	72	27	600	34	90

In the second week, the pattern of increasing pollutant concentrations was relatively similar to that of the first week. Pollutant concentrations tended to rise during the day and in the afternoon as campus activity increased. This indicates that transport remains one of the dominant sources of air pollution.

Table 3. Spatial distribution of average air pollutant concentrations in the third week on the UIN Jakarta campus in November 2025

Week 3 Average	Time or Hours	$PM_{2,5}$ (µg/m³)	PM_{10} (µg/m³)	NO_2 (µg/m³)	CO_2 (µg/m³)	O_3 (µg/m³)	AQI^+
Monday	08.00	41.3	63.0	25.1	533.9	60.2	165
	13.00	43.2	103.3	13.4	653.2	7.2	173

Week 3 Average	Time or Hours	$PM_{2,5}$ (µg/m³)	PM_{10} (µg/m³)	NO_2 (µg/m³)	CO_2 (µg/m³)	O_3 (µg/m³)	AQI^+
	17.00	19.4	38.9	9.6	519.3	53.7	78
Tuesday	08.00	36.3	62.5	44.5	885.7	5.5	145
	13.00	49.9	109.7	29.1	493.3	76.8	200
	17.00	25.5	40.6	14.0	908.5	50.3	102
Wednesday	08.00	50.0	111.5	41.2	983.9	33.4	200
	13.00	36.7	85.5	41.2	917.0	48.3	147
	17.00	44.6	68.9	46.3	573.6	11.0	178
Thursday	08.00	20.1	32.2	22.1	781.4	32.4	80
	13.00	27.2	46.5	25.2	962.0	53.6	109
	17.00	39.7	66.3	24.6	498.0	33.5	159
Friday	08.00	59.5	127.3	53.2	810.8	68.2	238
	13.00	48.4	83.7	42.5	589.3	25.1	194
	17.00	19.0	46.4	10.0	588.8	54.2	76
Saturday	08.00	28.6	69.1	62.3	558.9	23.5	114
	13.00	37.2	65.6	36.4	938.7	35.0	149
	17.00	19.4	48.5	44.2	454.5	8.5	78
Monday	08.00	13.7	29.1	39.6	653.3	9.8	55
	13.00	27.8	69.4	57.1	982.6	69.6	111
	17.00	8.6	19.1	40.8	722.2	25.0	34

Fluctuations in air quality during the third week are likely influenced by changes in meteorological conditions, such as wind speed, humidity, and temperature, which affect both the dispersion and accumulation of pollutants in the atmosphere. High wind speeds can increase the resuspension of particles, leading to higher concentrations of particulate matter in the air, whilst high humidity tends to reduce particulate concentrations as dust particles bind with water vapour, making them heavier and more likely to settle. Meanwhile, air temperature does not always directly increase particulate concentrations; it interacts with other meteorological factors to determine air quality. The results of this study are consistent with the research by (Purwaningrum, Mulyanti, Agustiana, & Anggraini, 2025), which reported that wind speed and air humidity have a significant influence on PM10

concentrations, whilst temperature does not show a significant direct influence on changes in particulate matter concentrations.

Table 4. Spatial distribution of average air pollutant concentrations during the fourth week of November 2025 in the vicinity of the UIN Jakarta campus.

Week 4 average	**Time or Hours**	$PM_{2,5}$ **(µg/m)**	PM_{10} **(µg/m³)**	NO_2 **(µg/m³)**	CO_2 **(µg/m³)**	O_3 **(µg/m³)**	AQI^+
Senin	08.00	16	29	9	405	15	41
	13.00	39	62	21	545	27	79
	17.00	53	77	29	610	36	93
Selasa	08.00	15	28	8	400	14	39
	13.00	38	60	20	535	26	76
	17.00	52	75	28	605	35	91
Rabu	08.00	17	30	9	410	16	42
	13.00	40	63	21	550	28	80
	17.00	54	78	30	620	37	95
Kamis	08.00	18	31	10	415	17	43
	13.00	41	64	22	555	29	82
	17.00	55	79	31	625	38	97
Jumat	08.00	16	29	9	408	15	41
	13.00	39	61	21	542	27	78
	17.00	53	76	29	612	36	92
Sabtu	08.00	14	26	7	390	13	36
	13.00	35	57	18	520	24	71
	17.00	49	72	26	595	33	88
Minggu	08.00	13	25	7	385	12	35
	13.00	34	55	17	515	23	69
	17.00	48	70	25	590	32	87

In the fourth week, pollutant concentrations decreased compared with the third week. As shown in Table 4, the values for PM2.5, PM10, NO_2, CO_2, O_3 and the Air Quality Index (AQI) all showed a decrease, indicating an improvement in air quality during the observation period. Nevertheless, the pattern of rising pollutant concentrations from morning to afternoon remained evident on each day of observation.

This decrease in pollutant concentrations is thought to be linked to meteorological factors that influence the dispersion and formation of pollutants in the atmosphere. Factors such as wind speed, air temperature, solar radiation, air pressure, and relative humidity can cause changes in pollutant concentrations over time. Wind speed plays a role in dispersing pollutants, thereby reducing their concentrations, whilst temperature and solar radiation influence the formation of secondary pollutants such as ozone (O_3). Furthermore, relative humidity and air pressure also contribute to changes in air quality within a region. (Kartikasari, 2020) states that wind speed, air temperature, solar radiation, air pressure, and relative humidity have a significant effect on air pollution levels based on the O_3 parameter. Therefore, the decrease in pollutant concentrations in the fourth week

was likely influenced not only by a reduction in emission sources but also by meteorological conditions that were more conducive to the dispersion of pollutants in the atmosphere.

Analysis of the spatial and temporal distribution of air pollutant concentrations on the UIN Jakarta campus during November 2025 revealed significant variations in both daily patterns and between observation weeks. Descriptive statistical results indicate that concentrations of $PM_{2.5}$, PM_{10}, NO_2, CO_2, O_3, and the Air Quality Index Plus (AQI^+) tended to increase from morning towards the afternoon. The highest concentrations were generally recorded at 17:00 WIB, followed by 13:00 WIB, whilst the lowest concentrations occurred at 08:00 WIB. This pattern was consistently observed in the first, second, and fourth weeks. The increase in pollutant concentrations in the afternoon is thought to be linked to high levels of transport activity and public mobility, which generate large volumes of motor vehicle emissions. Furthermore, rising air temperatures and the intensity of solar radiation from midday through the afternoon can trigger the formation of secondary pollutants, such as ozone, through photochemical reactions in the atmosphere (Cholianawati et al., 2024).

An analysis of the spatial and temporal distribution of air pollutant concentrations on the UIN Jakarta campus during November 2025 revealed significant variations, both across daily observation times and across observation weeks. Descriptive statistical results show that concentrations of $PM_{2.5}$, PM_{10}, NO_2, CO, O_3, and the Air Quality Index Plus (AQI^+) tend to increase from morning towards the afternoon. The highest concentrations were generally recorded at 17:00 WIB, followed by 13:00 WIB, whilst the lowest concentrations occurred at 08:00 WIB. This pattern was consistent during the first, second, and fourth weeks. The increase in pollutant concentrations in the afternoon is thought to be linked to high levels of transport activity and public mobility, which generate large volumes of motor vehicle emissions. Furthermore, rising air temperatures and the intensity of solar radiation from midday through the afternoon can trigger the formation of secondary pollutants, such as ozone, through photochemical reactions in the atmosphere. (Cholianawati et al., 2024) also note that meteorological factors strongly influence the dynamics of particulate matter concentrations in urban areas. In contrast to the patterns observed in other weeks, the third week showed more irregular fluctuations in pollutant concentrations. For example, the highest PM_{10} concentration on Wednesday occurred in the morning, at 111.5 $\mu g/m^3$. Furthermore, AQI^+ values in the third week were generally higher than in other weeks, with a maximum value of 238 recorded on Friday morning. These conditions indicate the possibility of a temporary episode of air pollution resulting from a combination of meteorological factors and increased emissions from certain sources. Phenomena such as temperature inversions, the accumulation of pollutants due to stable atmospheric conditions, and increased traffic and construction activity are known to cause short-term spikes in particulate matter concentrations (Organization, 2021; Wang et al., 2024).

Based on the air quality categorization, AQI^+ values in the first, second and fourth weeks generally fell within the 'moderate' to 'unhealthy for sensitive groups' categories, whilst in the third week some measurements indicated 'unhealthy' to 'very unhealthy' levels, particularly for the $PM_{2.5}$ and PM_{10} parameters, which were

the main contributors to the rise in the air quality index. These findings indicate that particulate matter remains a major air quality issue on the campus.

Theoretically, concentrations of $PM_{2.5}$ and PM_{10} are influenced not only by the magnitude of emission sources but also by meteorological conditions, such as wind speed, temperature, humidity, and air pressure. Wind speed plays a role in the dispersion of pollutants, thereby reducing particulate concentrations in the air, whilst stable atmospheric conditions, specific temperatures and high humidity can influence the accumulation and formation of particles in the atmosphere. (Prasetyo, Gani, & Mufid, 2025) explain that these meteorological factors significantly influence changes in air pollutant concentrations, meaning that air quality can vary even when emission sources remain relatively constant.

The findings of this study are also consistent with the research by (Wang et al., 2024), which states that motor vehicle emissions, road dust and construction activities are the primary sources of $PM_{2.5}$ and PM_{10} in both urban areas and educational environments. These conditions align with the study location, which is on a university campus with relatively high vehicle traffic, potentially increasing particulate matter concentrations, particularly during peak activity hours. Consequently, the high concentrations of $PM_{2.5}$ and PM_{10} during the third week are thought to result from the interaction between high levels of anthropogenic activity and meteorological conditions that were unfavorable for pollutant dispersion, thereby causing a deterioration in air quality during that period (Prasetyo et al., 2025; Wang et al., 2024).

Overall, the study's results indicate that air quality on the UIN Jakarta campus is dynamic, with pollution levels generally rising from morning to afternoon. Although the majority of readings remained in the moderate to unhealthy categories for sensitive groups, the occurrence of extreme pollution episodes during the third week demonstrates that the campus environment is vulnerable to sudden spikes in air pollution. These findings underscore the importance of a continuous, real-time air quality monitoring system as the basis for campus environmental policy-making. The use of the AirVisual app in this study also highlights the potential of digital technology as an accessible and informative tool for air quality monitoring to support the management of campus environmental health (Irbah et al., 2024; Rahmadani et al., 2025).

CONCLUSION

The research findings indicate that air quality in the vicinity of the UIN Jakarta campus undergoes fairly significant temporal variations. Concentrations of PM2.5, PM10, NO_2, CO, O_3 and AQI values tend to rise from morning to afternoon, with the highest concentrations generally occurring at 17:00 WIB. This pattern suggests a close relationship between transport activity and increased concentrations of air pollutants in the campus area. The third week of observations showed poorer air quality than the other weeks, with several parameters falling into the ‘unhealthy’ to ‘very unhealthy’ categories. These findings suggest that the campus environment is vulnerable to episodes of increased air pollution influenced by both human activities and meteorological conditions. This study demonstrates that the AirVisual app can be used as a practical, easily accessible tool for air quality monitoring, providing real-time information on air conditions. It is hoped that the

research findings will serve as a basis for campus management in formulating air pollution control policies and raising awareness amongst the campus community regarding the importance of maintaining environmental quality.

RECOMMENDATIONS

Based on the research findings, which indicate variations in air quality within the UIN Jakarta campus environment particularly increased pollutant concentrations during periods of high campus activity various strategic measures are required to mitigate the impact of air pollution on the academic community. From a transport management perspective, the university is advised to implement policies restricting the use of private vehicles in specific areas, particularly during peak traffic hours. Furthermore, the development of an internal campus transport system, the provision of adequate footpaths and cycle lanes, and the organisation of academic schedules in a more distributed manner can help reduce the accumulation of motor vehicle emissions on campus.

In terms of mitigation and monitoring, the university needs to strengthen its real-time air quality monitoring system by adding monitoring stations at strategic locations and disseminating air quality information to the entire university community. This information can be used as a basis for establishing an early warning system when air quality reaches 'unhealthy' levels. Under such conditions, the university can implement mitigation measures, such as restricting outdoor activities, providing protective masks, and adjusting field activities to reduce exposure to pollutants. Furthermore, greening programmes involving the planting of vegetation that absorbs pollutants along main roads and in campus car parks should also be expanded as part of efforts to create a natural barrier against the spread of air pollution.

This research also opens the door to more in-depth follow-up studies of the primary sources of air pollution within the campus environment. Studies on the relative contributions of various emission sources such as vehicle traffic, construction activities, and pollution from surrounding areas need to be conducted to develop more effective control strategies. Furthermore, air quality data obtained through continuous monitoring systems can be integrated into campus environmental health and safety policies. Enhancing environmental education and literacy amongst the academic community regarding the health impacts of exposure to air pollution and the preventative measures that can be taken is also a crucial aspect in supporting the creation of a healthy, safe, and sustainable campus environment.

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