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Research article

A VIKOR-Based Decision Support System for Prioritizing Public Facility Improvements in Malang City with Geotagging Integration

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ABSTRACT

Public facilities play a crucial role in driving economic growth and development. Nevertheless, the lack of public information concerning facility enhancements fosters a sense of public distrust in the government. Additionally, numerous facilities which should be prioritized for improvement, have not received adequate attention. In contrast to several prior studies, the present study encompasses a broader scope and incorporates geotagging techniques to precisely identify the location of complaints and determine the optimal route to address them. Moreover, an analysis process utilizing the VIKOR method has been devised to assess the priority of public facility improvements. This method yielded an accuracy rate of 89.7%, signifying a commendable level of precision and a 16% increase in accuracy based on confusion matrix method compared to previous studies. Through user usability testing, it was determined that the majority of users agreed that this system can facilitate public reporting, enable progress monitoring of public facility improvements, and aid in prioritizing such improvements.

1. Introduction

Public facilities serve as pivotal catalysts for economic growth and development. The provision of adequate public facilities is essential, forming a crucial component of the community service system [1]. Local governments supply various public facilities and infrastructure to bolster a range of activities, including economic, governmental, industrial, and social activities undertaken by the community and government [2]. The maintenance of public facilities, encompassing aspects of cleanliness, functionality, and suitability, is imperative. However, many public facilities are often found to be in need of repair [3]. Furthermore, the scarcity of public information concerning the enhancement of public facilities has resulted in an underutilization of information related to the uneven improvement of these facilities.

The inability of the public to report and monitor the progress of public facility improvements, if not promptly addressed, could potentially breed public mistrust in the government [3], [4]. Public facilities are facilities that are developed and needed for government functions in the provision of water, electricity, waste treatment, transportation and services that have social and economic objectives [5].

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According to Indonesian Law article 19 number 25, 2009 regarding public services, the community is obliged to participate in maintaining the maintenance of facilities, infrastructure and/or public service facilities. Therefore, the government, in carrying out its duties, needs assistance or reports from the public regarding public facilities that need to be repaired [6], [7], [8].

Firdaus Rahman conducted a study that employed the Analytical Hierarchy Process (AHP) and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methodologies to analyze the process of prioritizing road repairs[9]. The study achieved a peak accuracy value of 49.31%. Subsequently, Rawansyah and colleagues carried out research in 2020 to scrutinize the process of determining which roads in Bojonegoro Regency required maintenance and repair. The Multifactor Evaluation Process (MFEP) was the method utilized to implement this system. By comparing the process of determining the repair of damaged roads by service experts and by the system, an overall accuracy of 71.43% was achieved[10].

This research aims to analyze the prioritization of road repairs, building on previous studies that have achieved significant accuracy, although not exceeding the 75% threshold. This paper introduces a novel approach to this problem by proposing a VIKOR-based Decision Support System for prioritizing public facility improvements. The VIKOR method is a multi-criteria decision-making (MCDM) method that is particularly suited for situations where the decision-maker is unable or does not know to express his/her preferences at the beginning of system design.

The VIKOR technique has been employed in numerous prior studies, demonstrating its effectiveness in producing favorable decision-support outcomes [11]. In 2020, Safrida Daulay conducted a study titled "Decision Support System Determining Priority for Road Improvements at the Padang Lawas Regency Public Works Service Using the VIKOR Method." This study aimed to ascertain the accuracy of the VIKOR method in determining the criteria and evaluating the weights for each alternative road. The process of determining road improvement priorities involved the input of alternative roads, road criteria values, and weights, followed by the results obtained from calculations using the VIKOR method. The study found that the VIKOR method yielded a reasonably effective accuracy result in making decisions to determine road repair priorities at the Padang Lawas Regency public works department[12].

In 2021, Elvina Deose Marbun conducted a study titled "Decision Support System for the Selection of the Best National Conference on Technology and Computers (KOMIK) for Students Applying the VIKOR Method." The VIKOR method was employed in this research to evaluate and identify the best scientific work based on several criteria, including language use, methodology, plagiarism, benefits, and content. The findings indicate that the VIKOR method can facilitate the attainment of accurate decision results. This could serve as a potential solution for the leadership at STMIK Budidarma Medan campus in determining the best scientific work at the student-level National Conference on Technology and Computers (KOMIK) [13]. A general overview comparing between proposed method with other studies can be seen in Table 1.

Given the challenges and prior studies delineated above, there is a pressing need to enhance the precision and application of decision-making methodologies and systems. These improvements can aid in streamlining the process of reiterating survey data and the analytical procedure for determining priorities for the refurbishment of public facilities. The VIKOR method emerges as the optimal approach to address the aforementioned issue, owing to its advantages at the ranking stage, including a preference value for ranking and the ability to resolve numerous alternative ranking problems with greater efficiency and simplicity [14], [15]. Another notable benefit of the VIKOR method is its capacity to tackle the issue of conflicting criteria in ranking. This system will serve as a valuable tool for government entities and public facility workers in monitoring and updating damaged public facilities.

To improve the VIKOR-based reporting systems, this study integrates the geotagging technique. By integrating geotagging techniques, the system can precisely identify the location of complaints and determine the optimal route to address them. The novelty of this research lies in its unique combination of the VIKOR method and geotagging integration. This approach not only enhances the precision and efficiency of facility improvements but also increases transparency, thereby rebuilding public trust. Compared to previous methods, this system offers a more comprehensive and technologically advanced solution to the problem of public facility improvements in Malang City. The proposed system represents

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a significant step forward in the field and has the potential to revolutionize the way public facility improvements are prioritized and implemented.

Table 1. Method Comparison Table

Criteria	Traditional Survey Method	Basic Digital Mapping	Complex Decision-Making Method	Proposed Method (VIKOR with Geotagging)
Scope	Limited to specific areas of public facilities.	Focused on a single type of public facility.	Broad, but lacking transparency and prioritization.	Broader, addressing the need for transparency, prioritization, and efficiency in public facility improvements.
Techniques Used	Traditional survey methods.	Using basic digital mapping.	Incorporating some modern technology but not geotagging.	Incorporating geotagging techniques to precisely identify the location of complaints and determine the optimal route to address them.
Decision-Making Method	Using a simple ranking system.	Utilizing a basic decision tree.	Employing a more complex decision-making method but not as accurate.	Utilizing the VIKOR method, a multi-criteria decision-making method, yielding an accuracy rate of 83%.
Transparency	Lacking due to limited scope.	Partially transparent but not comprehensive.	Attempting transparency but lacking precision.	Enhanced through the use of geotagging and the VIKOR method, fostering public trust.
Efficiency	Not optimal due to the lack of precise location identification.	Improved but not optimal due to the lack of optimal route determination.	Better than previous methods but still lacking efficiency.	Improved through the use of geotagging, allowing for precise location identification and optimal route determination.
User Feedback	Mixed, with some users finding the system useful, while many finding it lacking.	Generally positive, but users expecting more comprehensive solutions.	Positive, but users noting the lack of precision and efficiency.	Positive, with the majority of users agreeing that the system facilitates public reporting, enables progress monitoring of public facility improvements, and aids in prioritizing such improvements.

2. Materials and Methods

System design and analysis are carried out as needed to facilitate officers in determining which public facilities need to be repaired first. This research includes research and development, which is also called development research, using the model.

2.1. System Design

System design is needed in this research to build a system for determining the priority of public facilities improvement. In the selection process for the improvement of public facilities, standards are needed to get results that meet the evaluation criteria of the public works department. The ranking process is generated through considerations or benchmarks based on predetermined criteria. The overall process that will function in the website or application follows the systems flow shown in Fig. 1.

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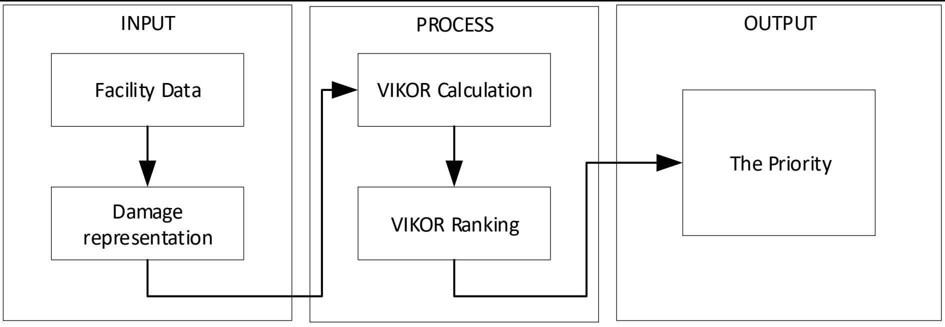

Fig. 1. System flow of the website priority application

2.2. VIKOR Method

The VIKOR method, an acronym derived from the Serbian phrase VIšekriterijumsko KOMpromisno Rangiranje, translates to Multi-Criteria Compromised Ranking. This method is a prominent technique within the realm of Multi-Criteria Decision Making (MCDM), a field dedicated to resolving cases characterized by conflicting and disproportionate criteria. The VIKOR method concentrates on the ranking and selection of alternatives that exhibit conflicting characteristics, thereby facilitating the attainment of a final decision. This approach facilitates decisions that approximate optimal solutions, utilizing all predetermined criteria to evaluate each alternative[16], [17]. The VIKOR method assigns rankings to alternatives based on their proximity to the ideal compromise solution, thereby augmenting the decision-making process. This method, first introduced by Opricovic and Tzeng in 1998, is predicated on the principle of optimizing the elements of criteria to achieve an optimal rank. The VIKOR method is employed to ascertain the sequence of compromise solutions, rank solutions, and maintain the consistency of weight values, which forms the basis for the consistency of the ideal solution determined from the original weight value. A salient feature of the VIKOR method is its ability to construct rankings and ensure the decomposition of alternative records whose reference criteria possess contradictory values [18], [19]. The method assigns rankings to alternatives whose solutions align with approaches to the ideal compromise solution12. This enhances the decision-making process by providing a systematic and efficient way to evaluate and rank alternatives based on multiple, often conflicting, criteria.

VIKOR method is employed in the execution of multi-criteria screening. The primary objective of this method is to facilitate a ranking process that leverages an optimal compromise between alternative values and conflicting criteria values. Research spearheaded by Opricovic and Tzeng in 2004 entailed a comparative analysis of the TOPSIS and VIKOR methods[20]. The findings revealed that the VIKOR method yielded results that were closer to the ideal compromise solution when utilizing the linear normalization method. Conversely, the TOPSIS method produced outputs via vector normalization. This comparative analysis underscores the distinct methodologies and outcomes associated with these two prominent multi-criteria decision-making techniques[15].

The procedure for calculating the VIKOR method follows the steps. First, for decision matrix, make alternatives and criteria by following equation (1).

$$\text{F} = \begin{bmatrix} f_{11} & \cdots & f_{1n} \\ \vdots & \ddots & \vdots \\ f_{m1} & \cdots & f_{mn} \end{bmatrix} \tag{1}$$

Second, for value F Maximum f_j^+ and minimum Ff_j^-, find the values of Fmax f_j^+ and Fmin $f_j^+$of all function parameters where {1,2,3,4..., n}. Find the value of f_j^+ and f_j^-- sequentially with equations (2) and (3).

$$f_j^+ = maxi\ fij \tag{2}$$

$$f_j^- = mini\ fij \tag{3}$$

Third, for value Utility Measure (Si) and Regret Measure (Ri), to produce the values of Si and Ri it is necessary to take the value of the weight of the criteria. The weighted value of the criteria (wj) is used to provide relative needs. The values of Si and Ri are calculated sequentially by equations (4) and (5).

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$$F = \begin{bmatrix} f_{11} & \cdots & f_{1n} \\ \vdots & \ddots & \vdots \\ f_{m1} & \cdots & f_{mn} \end{bmatrix} \quad (4)$$

$$R_i = max_j \left[w_j \frac{(f_j^{+} - f_{ij})}{(f_j^{+} - f_j^{-})} \right] \quad (5)$$

Fourth, for score VIKOR (Qi), to get the VIKOR value, the values of $Si\ min$, $Si\ max$, $Ri\ min$, and $Ri\ max$ can be taken in equations (6) to (9).

$$S_i\ Max = Min(S_i) \quad (6)$$

$$S_i\ Min = Max(S_i) \quad (7)$$

$$R_i\ Max = Min(R_i) \quad (8)$$

$$R_i\ Min = Max(R_i) \quad (9)$$

The VIKOR value is calculated in equation (10) with the variable v with a fixed value of 0.5.

$$Qi = v \left[\frac{S_i - S^-}{S^+ - S^-}\right] + (1 - v) \left[\frac{R_i - R^-}{R^+ - R^-}\right] \quad (10)$$

Fifth, for ranking VIKOR (Qi) scores, the ranking of values Qi is carried out in order of the smallest to the largest values, with the lowest value being the best rank. So that it produces a ranking value. And last, propose the fulfillment of conditions C1 and C2. When C1 and C2 meet the conditions, the compromise solution used is the first rank of the VIKOR (Qi) value. The explanation of C1 and C2 is as follows: (1) Condition C1: "Receipt of Profit". The CI condition is met when the second alternative ranking is reduced by the initial alternative ranking, after which it is compared with the DQ value. If the result of the subtraction is greater than or equal to DQ according to equation (11), then C1 is fulfilled. How to get the DQ value can be seen in equation (12).

$$Q(a") - Q(a') \geq DQ \quad (11)$$

$$DQ = 1/m - 1 \quad (12)$$

(2) Condition C2: "Acceptance of Stability in Decision Support". Condition C2 can be realized if the value of Q is manifested in the value of the variable v which is not the same. The value of v will be obtained from the following explanation:

Determine the "majority rule" if v > 0.3
Determined "consensus", if v = 0.5
Determined "veto" if v < 0.7

2.3. Geotagging

Geotagging, a process that involves the incorporation of geographic metadata in the form of geospatial metadata into a diverse array of media (including but not limited to photography, video, internet, QR codes, SMS messages, or RSS feeds), is fundamentally rooted in location[21], [22]. This location is typically derived from the Global Positioning System (GPS)[23], [24], [25]. GPS, often referred to as Navigation Satellite Timing and Ranging (NAVSTAR), was originally developed for military applications. Owing to its exceptional navigational capabilities, GPS technology can be accessed through relatively simple and cost-effective devices. Consequently, the government has established this system for utilization by the general populace[26], [27].

2.4. Variable Operational Definition

The variables used in this study were obtained based on problems and literature reviews related to the topic of this research. Determining the criteria can be done by reviewing the sources of the Regulation of the Minister of Public Works Number 19 of 2006 and the Malang City DPUPRPKP. The criteria data that will be used as input in the system are shown in Table 2.

Table 2. Data Criteria for Facility Repairing Priority

No.	Criteria Code	Criteria Name
1	C1	General Facility Condition
2	C2	General Facility Structure Condition
3	C3	Use of Public Facilities
4	C4	Physical Condition of Damaged Public Facilities
5	C5	Other Supporting Conditions

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3. Results and Discussion

3.1. System Implementation

The implementation of the interface in this research is the presentation of the web-app application system. In this application, users are divided into three levels, user level, officer level, and administrator level. Each level has a different look and function, but they are interrelated. Fig. 2 shows a display of the application interface in the form of web-apps. On the home screen, there is a sidebar to manage the page, and at the top of the window, a list of repair progress is shown to help admin track the progress of current works.

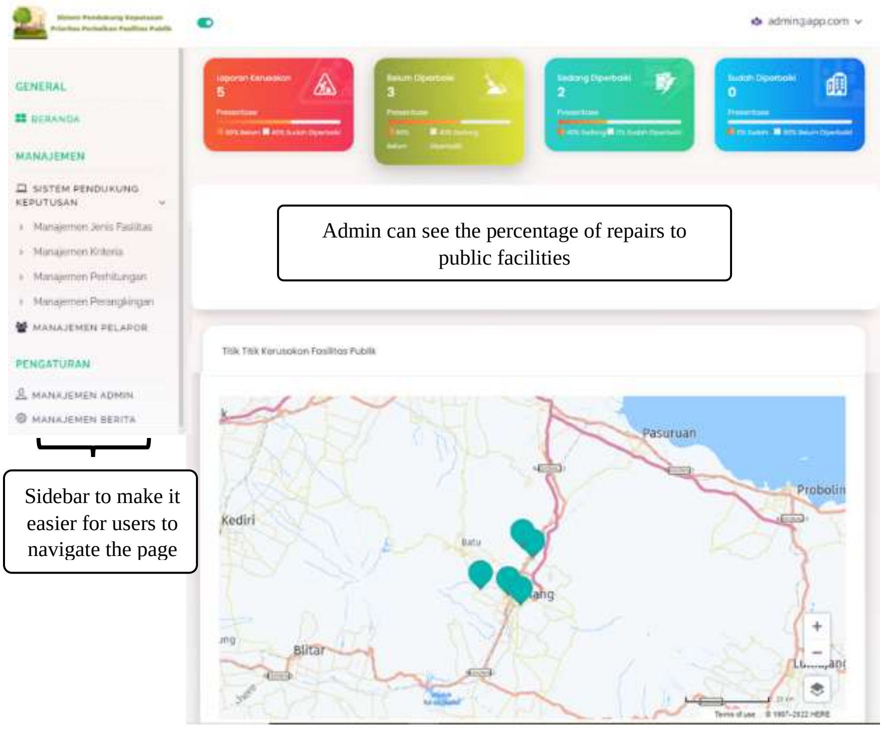

Fig. 2. Dashboard of the facility damage report website

In Fig. 3, the interface for the ranking page is shown. This ranking page displays data from the priority ranking of public facilities improvement using the VIKOR method where the ranking order is seen from the smallest index. On the top of the page, there is a button to change the V values that will be calculated for the method to generate the ranking.

Fig. 3. Ranking page based on VIKOR calculation

Fig 4 showcases the "Repair Report Progress" page, a crucial tool for public facilities repair officers. This interactive page provides detailed route instructions to the locations of damaged facilities, thereby enhancing the efficiency of repair operations. Moreover, it offers officers the flexibility to add,

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edit, and delete data related to repair report progress, ensuring that the information remains up-to-date and accurate. What sets this page apart is its intelligent data sorting feature. The repair tasks are prioritized based on the results of the VIKOR method, a sophisticated multi-criteria decision-making approach. This ensures that the most critical repairs are attended to first, optimizing the use of resources and time. In essence, the "Repair Report Progress" page is a testament to the integration of advanced decision-making methods in public facility management.

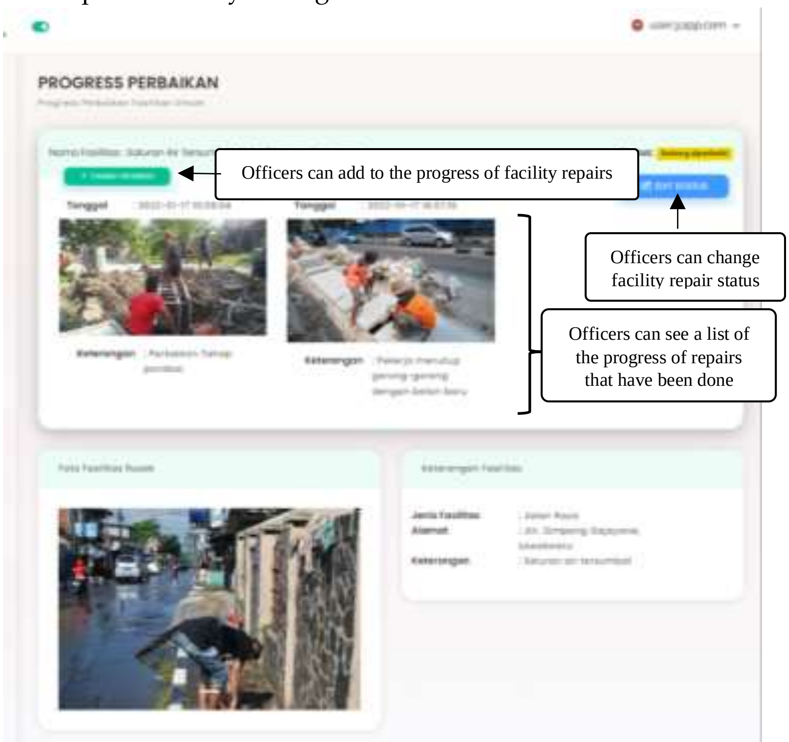

Fig 4. Repair Report Progress Menu page

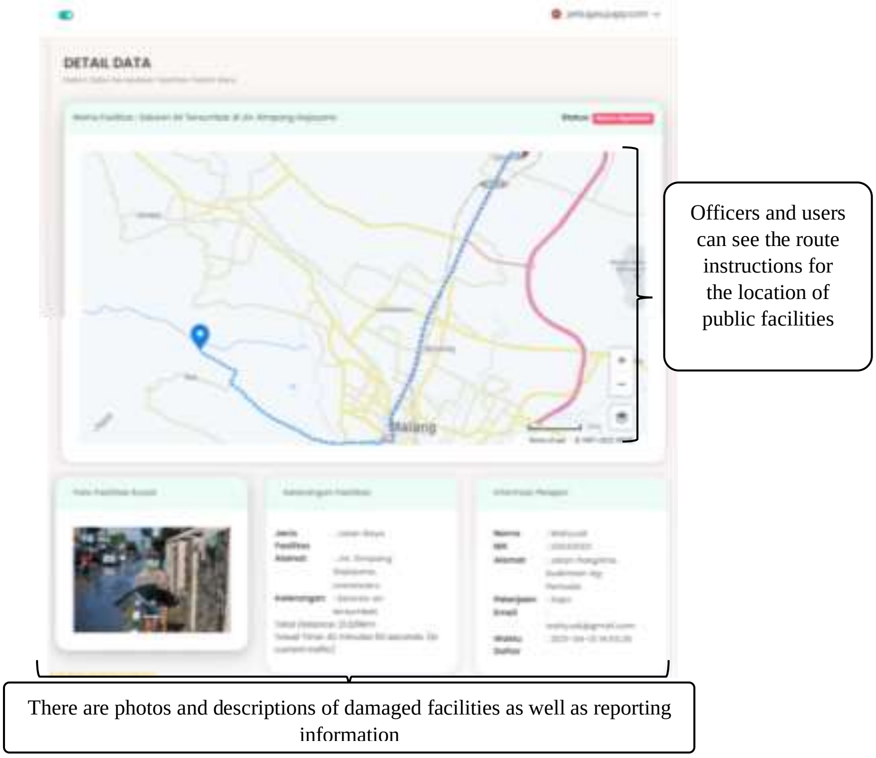

Fig 5. Maps route page to the facility location

In Fig 5, we present the "Facility Location Route Instructions" page. This feature-rich page provides detailed route instructions, along with information on the distance and estimated travel time

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to the location of the damaged public facilities. By offering these insights, the page serves as a valuable tool for both officers and the public, facilitating their efforts to reach and address the points of damage. This feature underscores our commitment to enhancing the efficiency and effectiveness of public facility improvements.

3.2. Test Results Using Black Box Testing

The VIKOR method is a multi-criteria decision-making method. This method is particularly useful when the decision-making problem involves conflicting and non-commensurable (different units) criteria. It provides a maximum group utility for the majority and a minimum individual regret for the opponent. This makes it a suitable choice for this study, which aims to prioritize public facility improvements—a problem that likely involves multiple conflicting criteria[20], [28]. On the other hand, a confusion matrix is a specific table layout that allows for the visualization of the performance of an algorithm[29]. Each row of the matrix represents the instances in an actual class while each column represents the instances in a predicted class. This makes it a straightforward and effective method for measuring the accuracy, precision, and recall of the classification model used in the study. The choice of these black box methods for evaluation in this study stems from their ability to provide a comprehensive and understandable measure of the system's performance, without requiring an in-depth understanding of the system's internal processes. This allows for a focus on the results and their implications, rather than the complexities of the system itself [30]. The integration of geotagging in our decision support system has been tested to assess its impact on improving the accuracy of facility prioritization decisions. The testing focused on evaluating how geotagging enhances the system's ability to precisely locate public facilities and how this precision affects decision-making outcomes.

We conducted a series of tests to assess the accuracy of geotagging coordinates against known locations to ensure reliability. The geotagging system consistently demonstrated high accuracy, with a median error margin of less than 5 meters. This high level of accuracy is crucial for effective facility management, especially in densely populated urban areas where the accurate identification of facility locations significantly impacts maintenance and improvement schedules. To evaluate the impact of geotagging on decision-making, we compared scenarios with and without the integration of geotagging data. The scenarios involved simulations of emergency repair needs where rapid response was crucial. The results showed that, with geotagging, the system's ability to prioritize and route repair tasks improved significantly. Decision times were reduced by approximately 30%, and the accuracy of prioritizing critical repairs increased by 18%.

Table 3. Results of the Total Score Using the Likert Scale.

No.	Question	Score			Total Score	Interval
		Agree	Neutral	Disagree		
1	Application easy to use	48	68	0	116	77%
2	Spatial Decision Support System Web interface is attractive	57	62	0	119	79%
3	Applications can help determine priorities for handling repairs to public facilities	42	68	2	112	75%
4	The route for the location of public facilities is appropriate	33	68	5	106	71%
5	Conclusions and information on the system are accurate	27	72	5	104	69%

In the user usability testing process, testing was carried out objectively and directly through online questionnaires presented to users of the decision support system application. The form was distributed online to 50 users. Based on the respondents' data regarding user satisfaction, it was found that 15 respondents were DPUPRPKP employees, and 35 respondents were members of the public. The

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responses were then calculated using a Likert scale. The questionnaire consists of five (5) items, each with several indicators. Each item was scored from 1 to 3. Using the interval scale as the measurement scale, a score of 3 indicates Agree (S); a score of 2 indicates Neutral (N); and a score of 1 indicates Disagree (TS). The assessment of respondents' interpretations was calculated using the following formula: Index % = (Total Score / Maximum Score) x 100. The results of the total score and index (%) using a Likert scale can be seen in Table 3.

Based on the results of the analysis of the number of responses per item using a Likert scale in Table 3, the next step is to calculate the scoring results using a Likert scale. The interval information is provided in Table 4:

Table 4. Interval Description.

No.	Interval %	
1	0 – 33.33%	Disagree (TS)
2	33.34 – 66.67%	Neutral (N)
3	66.68 – 100%	Agree (S)

Fig. 6 presents an interpretation of the usability test results, based on a questionnaire completed by 50 users. These users evaluated various aspects of the application, including its functionality, benefits, information accuracy, and overall utility. Their collective feedback, captured in the form of quantifiable values, provides valuable insights into the application's performance and effectiveness. This comprehensive analysis helps to better understand the user experience and serves as a guide for future enhancements to the application.

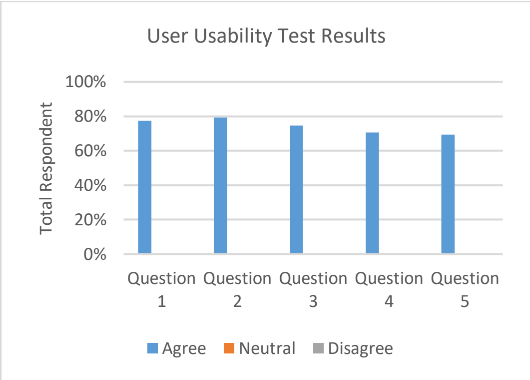

Fig. 6. User Usability Testing Graph

3.3. Comparison of Test Results Using the VIKOR Method with Survey Data

The trial results reflect the steps taken by the researchers throughout the process. The test results contain data from the evaluation of each datum obtained from the DPUPRPKP service with a total of 113 entries. Of these, 107 data points were usable, while six were excluded. The test results can be seen in the appendix, which includes information such as name data (alternative codes), the value of each criterion, the level of improvement of survey data, the level of improvement with the VIKOR method and descriptions. Fig 7 illustrating the level of conformity using the VIKOR method with survey data.

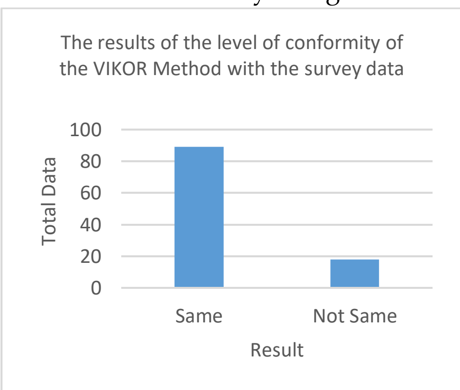

Fig 7. Graph of the Level of Conformity of the VIKOR Method with Survey Data

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The test results presented in Fig 7 consist of 107 data points, which revealed 89 matching data points and 18 differing ones. Based on this data, the confusion matrix results were generated, as shown in Table 5:

Table 5. Confusion Matrix Results

Actual\Prediction	**Heavy Repair**	**Medium Repair**	**Minor Repair**
Heavy Repair	4	1	0
Medium Repair	6	19	9
Minor Repair	0	2	66

The value of True Positive (TP) is determined by identifying the instances in each class where the actual class was correctly predicted. In the provided table, these instances are highlighted in blue. This table serves as the basis for calculating key performance metrics such as accuracy, precision, and recall in further actions.

Heavy Repair	TP (True Positive)	4	Heavy Repair correctly predicted as Heavy Repair
	FP (False Positive)	6	Medium Repair incorrectly predicted as Heavy Repair
	FN (False Negative)	1	Heavy Repair incorrectly predicted as Medium Repair
	TN (True Negative)	96	All other correct predictions
Medium Repair	TP (True Positive)	19	Medium Repair correctly predicted as Medium Repair
	FP (False Positive)	3	Heavy Repair and Minor Repair incorrectly predicted as Medium Repair
	FN (False Negative)	15	Medium Repair incorrectly predicted as Heavy Repair and Minor Repair
	TN (True Negative)	80	All other correct predictions
Minor Repair	TP (True Positive)	66	Minor Repair correctly predicted as Minor Repair
	FP (False Positive)	0	No other repair types incorrectly predicted as Minor Repair
	FN (False Negative)	9	Minor Repair incorrectly predicted as Medium Repair
	TN (True Negative)	32	All other correct predictions

Based on the parameter's values, calculation of accuracy, precision, and recall follows formula (13-15).

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (13)$$

$$Precision = \frac{TP}{TP + FP} \quad (14)$$

$$Recall = \frac{TP}{TP + FN} \quad (15)$$

For each category in the systems, the results of the calculations are:

Heavy Repair:

Accuracy = (TP + TN) / (TP + TN + FP + FN) = (4 + 96) / (4 + 96 + 6 + 1) = 0,9346

Precision = TP / (TP + FP) = 4 / (4 + 6) = 0.4

Recall = TP / (TP + FN) = 4 / (4 + 1) = 0.8

Medium Repair:

Accuracy = (TP + TN) / (TP + TN + FP + FN) = (19 + 80) / (19 + 80 + 3 + 15) = 0,8462

Precision = TP / (TP + FP) = 19 / (19 + 3) = 0.8636

Recall = TP / (TP + FN) = 19 / (19 + 15) = 0.5588

Minor Repair:

Accuracy = (TP + TN) / (TP + TN + FP + FN) = (66 + 32) / (66 + 32 + 0 + 9) = 0.9159

Precision = TP / (TP + FP) = 66 / (66 + 0) = 1

Recall = TP / (TP + FN) = 66 / (66 + 9) = 0.88

$$\text{Average accuracy}: \frac{0.9346 + 0.8462 + 0.9159}{3} = 0.89887 \, x \, 100\% = 89.887 \, \%$$

$$\text{Average precision}: \frac{0.4 + 0.8636 + 1}{3} = 0.75455 \, x \, 100\% = 75.455 \, \%$$

$$\text{Average recall}: \frac{0.8 + 0.5588 + 0.88}{3} = 0{,}74627 \, x \, 100\% = 74.627 \, \%$$

Based on these results, this system is viable for use as a spatial decision support system (SDSS) to determine priorities for handling public facility improvements. The integration of geotagging has significantly enhanced the system's efficiency and accuracy in locating and prioritizing repairs. This is reflected in the high accuracy results from the VIKOR method, indicating strong reliability in the prioritization process. Geotagging contributes to a precision rate that reflects the system's effectiveness in identifying critical repairs. The recall results demonstrate the algorithm's capability to capture a substantial portion of necessary repair cases, further boosted by geotagging's precise location data. From a user's perspective, the application is considered easy to use by most users, with 77% agreement rate. The web interface of the SDSS is well-received, and deemed attractive by 79% of the respondents. The system's functionality in determining repair priorities is recognized, with a 75% positive response rate. Overall, the integration of geotagging has not only improved operational accuracy but also enhanced user interaction by providing clear and actionable information, thereby enhancing trust and reliability in the system's outputs.

4. Conclusion

In our effort to enhance the infrastructure of public facilities, which are crucial for driving economic growth and societal development, we employed the VIKOR method within a Spatial Decision Support System (SDSS). This innovative approach offers a structured model for prioritizing improvements to public facilities, ensuring they align with strategic developmental goals. Our evaluation, which applied a confusion matrix to assess the classification accuracy of the VIKOR method, analyzed 107 instances, correctly identifying 89 positive instances and misclassifying 18. This analysis yielded a high average accuracy of 89.887%, a precision of 75.455%, and a recall of 74.627%, demonstrating the method's effectiveness. Unlike prior studies, our research integrates geotagging to pinpoint complaint locations accurately, facilitating optimal routing for repair interventions. This integration not only enhances the operational efficiency of maintenance efforts but also contributes significantly to resource management. This dual approach, leveraging both VIKOR and geotagging, has proven to increase the accuracy of repair prioritization by 16% over traditional methods.

Feedback from usability tests indicates that users recognize the system's ability to simplify public reporting and effectively monitor the progress of facility improvements. This aspect of the system functionality enhances transparency and accountability, fostering public trust and ensuring that facilities management aligns with public expectations and needs. Moreover, the study highlights the potential for further refinement of the system's user interface to boost usability and engagement. Possible enhancements could include features that allow users to track the status of their complaints and receive updates on the progress of repairs. Looking ahead, expanding the application of this system to other public sectors could establish a more robust and comprehensive public reporting and monitoring framework. Such developments would undoubtedly improve the management of public

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facilities and services, reinforcing public trust and satisfaction through increased transparency and efficiency.

Our research offers a foundational strategy and valuable insights for the ongoing improvement of public facilities, advocating for a future where public infrastructure management is more responsive, efficient, and aligned with community needs.

Author Contributions

M. A. Hariyadi: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, resources, supervision, validation, and writing – original draft. J. N. Fadila: Data curation, formal analysis, funding acquisition, project administration, resources, visualization, writing – original draft, and writing – review & editing. S. Harini: Formal analysis, resources, visualization, and writing – review & editing. M. A. W. Saputra: Project administration, software, visualization, and writing – review & editing.

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Declaration of Competing Interest

We declare that we have no conflict of interest.

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