



UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA
FAKULTAS TEKNOLOGI INDUSTRI DAN INFORMATIKA

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KEPUTUSAN
DEKAN FAKULTAS TEKNOLOGI INDUSTRI DAN INFORMATIKA UHAMKA
NOMOR 317/D/PK/2025

TENTANG

PENUGASAN DOSEN PENANGGUNG JAWAB MATA KULIAH
PADA SEMESTER GENAP TAHUN AKADEMIK 2024/2025

Bismillahirrahmanirrahim,

DEKAN FAKULTAS TEKNOLOGI INDUSTRI DAN INFORMATIKA UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA,

Menimbang : a. Bahwa dalam rangka meningkatkan mutu pendidikan akademik pada Fakultas Teknologi Industri dan Informatika Universitas Muhammadiyah Prof. DR. HAMKA semester genap tahun akademik 2024/2025 .

b. Bahwa dalam upaya mewujudkan tujuan pendidikan di lingkungan Fakultas Teknologi Industri dan Informatika UHAMKA, perlu adanya dosen penanggung jawab matakuliah yang memenuhi persyaratan akademik sesuai dengan ketentuan yang berlaku.

c. Bahwa untuk tercapainya sebagaimana dimaksud pada konsideran a dan b di atas, dipandang perlu menugaskan dosen penanggung jawab mata kuliah pada semester genap tahun akademik 2024/2025 sesuai terlampir dengan genap Keputusan Dekan Fakultas Teknologi Industri dan Informatika UHAMKA.

Mengingat : 1. Undang – Undang RI Nomor 20 tahun 2003 tanggal 8 Juli 2003, tentang Sistem Pendidikan Nasional.

2. Undang – Undang RI Nomor 12 tahun 2012 tanggal 10 Agustus 2012, tentang pendidikan tinggi.

3. Peraturan pemerintah RI Nomor 4 tahun 2014 tanggal 30 Januari 2014, tentang pengelolaan dan penyelenggaraan perguruan tinggi.

4. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 3 Tahun 2020 tanggal 28 Januari 2020, tentang Standar Nasional Pendidikan Tinggi.

5. Keputusan Dirjen Dikti Depdikbud RI. Nomor 138/DIKTI/Kep/1997. Tanggal 31 Mei 1997, tentang perubahan bentuk Institut Keguruan dan Ilmu Pendidikan (IKIP) Muhammadiyah Jakarta menjadi Universitas Muhammadiyah Prof. DR. HAMKA.

6. Surat Keputusan Rektor Muhammadiyah Nomor 391/A.01.02/2021. Tanggal 13 Ramadhan 1443 H / 25 April 2021 M, tentang pengangkatan Dekan Fakultas Teknik Universitas Muhammadiyah Prof. DR. HAMKA.

7. Pedoman Pimpinan Pusat Muhammadiyah nomor 02/PEND/1.0/B/2012. Tanggal 16 April 2012, tentang Perguruan Tinggi Muhammadiyah .

8. Statuta Univeritas Muhammadiyah Prof. DR. HAMKA tahun 2013.

9. Keputusan Badan Pelaksana Harian Universitas Muhammadiyah Prof. DR. HAMKA. Nomor 001/A.01/1997. Tanggal 30 Agustus 1997, tentang pelimpahan wewenang pengangkatan dan pemberian wewenang Dosen Tetap dan Tenaga Administratif Tetap Universitas Muhammadiyah Prof. DR. HAMKA.

10. Keputusan Rektor Universitas Muhammadiyah Prof. DR. HAMKA. Nomor 828/A.01.02/2022. Tanggal 30 Shafar 1444 H/26 September 2022, tentang penetapan nama Fakultas Teknologi Industri dan Informatika Universitas Muhammadiyah Prof. DR. HAMKA.
11. Buku Panduan Akademik Universitas Muhammadiyah Prof. DR. HAMKA Tahun Akademik 2024/2025.

Memperhatikan : 1. Kalender Akademik Universitas Muhammadiyah Prof. DR. HAMKA. Tahun Akademik 2024/2025 .

2. Hasil rapat pimpinan Fakultas Teknologi Industri dan Informatika Universitas Muhammadiyah Prof. DR. HAMKA tanggal 13 Februari 2025.

MEMUTUSKAN

Menetapkan
Pertama : Menugaskan dosen penanggung jawab mata kuliah pada semester genap tahun akademik 2024/2025 di lingkungan Fakultas Teknologi Industri dan Informatika Universitas Muhammadiyah Prof. DR. HAMKA (terlampir).

Kedua : Kepada dosen yang bersangkutan diwajibkan melaksanakan tugas-tugas dosen mengajar sesuai mata kuliah yang diberikan pada semester genap tahun akademik 2024/2025 di lingkungan Fakultas Teknologi Industri dan Informatika UHAMKA.

Ketiga : Kepada dosen yang bersangkutan berhak menerima honorarium sesuai dengan peraturan dan ketentuan yang berlaku di UHAMKA.

Keempat : Keputusan ini disampaikan kepada yang bersangkutan untuk diketahui dan dilaksanakan dengan sebaik-baiknya sebagai amanah dan ibadah kepada Allah Subhanahu Wata'ala.

Kelima : Apabila ada kesalahan dan atau kekeliruan dalam surat keputusan ini akan diperbaiki sebagaimana mestinya.

Keenam : Keputusan ini berlaku sejak tanggal ditetapkan sampai dengan berakhirnya semester genap tahun akademik 2024/2025 .

Ditetapkan di Jakarta

Pada tanggal, 22 Februari 2025 M.
23 Sya'ban 1446 H.



Dr. Dan Mugisidi, ST., M.Si.

Keputusan ini disampaikan kepada yth.

1. Rektor (sebagai laporan);
2. Wakil Dekan I, II, & IV FTII;
3. Para Ketua Program Studi FTII;

Universitas Muhammadiyah Prof. DR. HAMKA.

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TANGGAL : 22 Februari 2025 M

: 23 Sya'ban 1446 H

DAFTAR MENGAJAR
SEMESTER GENAP TAHUN 2024/2025

Nama Dosen : Dr. Dan Mugisidi, ST., M.Si

Tempat, Tgl Lahir : Jakarta, 1 Desember 1969

Pendidikan Terakhir : S3

NIRD / NIDON : D100703 / 0301126901

Status Kepegawaian : Dosen Tetap

Jab. Akademik : Lektor Kepala

Prodi	Kode MK	Nama Matakuliah	SKS	Kelas	Jml Siswa
Teknik Informatika	P1768	Publikasi 2	3	6P	6
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	M-851	Mekanika Fluida 2	2	4A	20
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	S-817	Statika Struktur	2	2A	32
	T-324	Tribologi dan Perawatan Mesin	2	6B	29
	T-324	Tribologi dan Perawatan Mesin	2	6A	18

Jumlah : 14



Jakarta, 22 Februari 2025

Dekan

Dr. Dan Mugisidi, ST., M.Si

DAFTAR NILAI MAHASISWA

Fakultas : Tekn. Industri & Informatika
Proq. Studi : Teknik Informatika
Semester : Genap 2024/2025
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DAN MUGISIDI, ST., Dr.

Nama = Fajar Abdillah Ahmad

NIM = 2103015111

Program Studi = Teknik Informatika

Mata Kuliah = Publikasi 2

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Implementation of Face Recognition, Attendance Detection, and Geolocation using TensorFlow Lite and Google ML Kit in a Mobile Attendance Application

Fajar Abdillah Ahmad, Nunik Pratiwi

Abstract

Attendance applications are increasingly needed across various sectors, including education, government, and offices. However, challenges such as identity fraud and location manipulation remain unresolved. This study aims to develop a mobile attendance system that integrates face recognition, liveness detection, geolocation, and permission features, along with push notifications via user email. Additional features such as profile updates and attendance history are also included in the mobile application in real-time. The system ensures valid attendance by utilizing TensorFlow Lite for real-time face recognition and liveness detection, and Google ML Kit to enable geolocation features for user location verification. The Waterfall method was employed in this study, covering analysis, design, implementation, testing, and finalization phases. The results of this study demonstrate the ease and convenience of using the attendance system, with successful integration of face recognition, liveness detection, and geolocation into the mobile attendance application.

Keywords

face recognition, liveness detection, geolocation, mobile application, attendance

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#4775 Summary

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Submission

Authors	Fajar Abdullah Ahmad, Nunik Pratiwi
Title	Implementation of Face Recognition, Attendance Detection, and Geolocation using TensorFlow Lite and Google ML Kit in a Mobile Attendance Application
Original file	4775-11297-1-SM.DOCX 2024-11-04
Supp. files	None
Submitter	Fajar Fajar Abdullah Ahmad
Date submitted	November 4, 2024 - 11:38 AM
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Abstract Views	476

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3. Bukti Revisi

[stmsi] Editor Decision Kotak Masuk x



Dr. Abdullah S.Si., M.Kom

<sistemasi.ftik@gmail.com>

kepada saya, Nunik ▾

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Fajar Fajar Abdillah Ahmad:

We have reached a decision regarding your submission to Sistemasi: Jurnal Sistem Informasi, "Implementasi Face Recognition, Liveness Detection, dan Geolocation Menggunakan TensorFlow Lite dan Google ML Kit Pada Aplikasi Absensi Mobile".

Our decision is: Revisions Required

Dr. Abdullah S.Si., M.Kom
Program Studi Sistem Informasi, Fakultas Teknik dan Ilmu Komputer,
Universitas Islam Indragiri, Indonesia
abdialam@gmail.com
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AI Reply

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Samsudin Sadek S.Kom., M.Kom

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kepada saya, Nunik ▾

Kam, 16 Jan, 20:36

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7 dari 11 < > ✎



Fajar Dillah

<fajardillah25@gmail.com>

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Kam, 16 Jan, 23:34

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saya mohon maaf atas keteledoran dan kekurangan telitiannya saya 🙏, izin mengirim ulang final editing yaa pak
xxx

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4. LOA

7 dari 11 < > ✎



Dr. Abdullah S.Si., M.Kom

<sistemasi.ftik@gmail.com>

kepada saya, Nunik ▾

Kam, 14 Nov 2024, 07:59

☆

Yth: Fajar Fajar Abdillah Ahmad:

Berkenaan dengan submission manuskrip ke Sistemasi: Jurnal Sistem Informasi, "Implementasi Face Recognition, Liveness Detection, dan Geolocation Menggunakan TensorFlow Lite dan Google ML Kit Pada Aplikasi Absensi Mobile".

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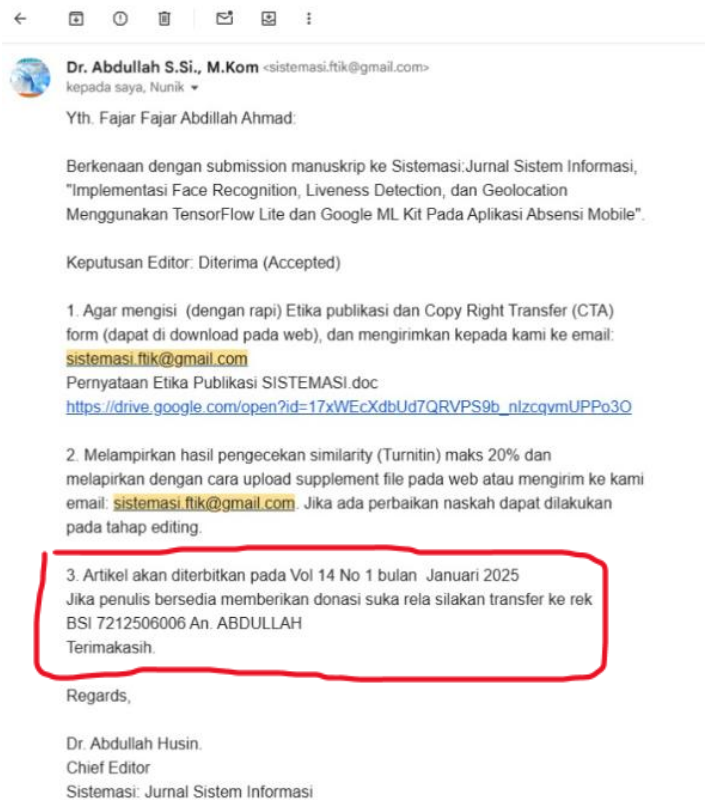
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Regards,

Dr. Abdullah Husin
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Nama : Ahmad Rijal Hermawan

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Matakuliah : Publikasi 2

1. Link jurnal Sinta 3 :

<https://jurnal.atmaluhur.ac.id/index.php/sisfokom/article/view/2341>

The screenshot displays the article page on the Jurnal Sisfokom website. The article title is "Sentiment Classification of Public Perception on LHKPN Using SVM and Naive Bayes" by Ahmad Rijal Hermawan Hermawan and Isa Faqihuddin Hanif. The article is published in Vol. 14 No. 2 (2025): MEY. The abstract describes a study on public sentiment towards the State Officials' Wealth Report (LHKPN) using SVM and Naive Bayes models. The article is licensed under a Creative Commons Attribution 4.0 International License. The page also includes a sidebar with a quick menu, a list of keywords, and a list of references. The website's header shows the journal name and navigation links. The footer includes the journal's contact information and a download template link.

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Sentiment Classification of Public Perception on LHKPN Using SVM and Naive Bayes

Ahmad Rijal Hermawan Hermawan
Department of Industrial Technology and Informatics, University of Muhammadiyah Prof. DR. HAMKA

Isa Faqihuddin Hanif
Department of Industrial Technology and Informatics, University of Muhammadiyah Prof. DR. HAMKA

DOI: <https://doi.org/10.32736/sisfokom.v14i2.2341>

Keywords: Sentiment Analysis, Support Vector Machine, Naive Bayes, LHKPN, Social Media

Abstract

The public's perception of the State Officials' Wealth Report (LHKPN) serves as a vital measure of confidence in the government's commitment to transparency and efforts to combat corruption. This research seeks to examine public sentiment as reflected on the social media platform X. A dataset comprising 1,200 tweets was gathered and processed through various text mining methods, such as case folding, data cleaning, tokenization, normalization, stemming, stopword elimination, and TF-IDF vectorization. The tweets were then manually annotated into two sentiment categories: positive and negative, with 77.3% of tweets labeled as positive and 22.7% as negative. Sentiment classification was conducted using two machine learning algorithms: Support Vector Machine (SVM) and Naive Bayes. The Naive Bayes algorithm recorded an accuracy of 86.66%, with a precision of 0.93, a recall score of 0.88, and an F1-score of 0.87. Conversely, the SVM model with a linear kernel demonstrated superior performance, achieving an accuracy rate of 93.33%, along with a precision of 0.93, recall of 0.98, and an F1-score of 0.95. To uncover frequently occurring topics, WordCloud visualizations were generated. These revealed that positive tweets often included words such as 'lapor' and 'transparan', while negative ones were more likely to contain terms like 'bohong' and 'korupsi'. These findings indicate that public sentiment toward the LHKPN initiative is largely favorable, despite persistent concerns surrounding integrity and trustworthiness in asset reporting. This study highlights the effectiveness of sentiment analysis in gauging public opinion and informing future policy improvements.

References

Section Articles

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R. Y. Oly Viana Agustine, Erlina Maria Christin Sinaga, "Politik Hukum Penguatan Kewenangan Komisi Pemberantasan Korupsi dalam Sistem Ketatanegaraan Legal Politics of the Strengthening of Authority in the Constitutional System," *Konstitusi*, vol. 16, no. 2, pp. 314-338, 2019.

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Journal SISFOKOM (Sistem Informasi dan Komputer), Volume 14, Nomor 02, PP 148-155

Sentiment Classification of Public Perception on LHKPN Using SVM and Naive Bayes

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Abstract—The public's perception of the State Official's Wealth Report (LHKPN) serves as a vital measure of confidence in the government's commitment to transparency and efforts to combat corruption. This research seeks to transfer public sentiment as reflected on the social media platform X. A dataset comprising 1,200 tweets was gathered and processed through various text mining methods, such as raw loading, data cleaning, tokenization, normalization, stemming, stop word elimination, and TF-IDF vectorization. The tweets were then manually annotated into five sentiment categories: positive and negative, with 77.5% of tweets labeled as positive and 22.5% as negative. Sentiment classification was conducted using two machine learning algorithms: Support Vector Machine (SVM) and Naive Bayes. The Naive Bayes algorithm recorded an accuracy of 84.21%, a precision of 0.93, a recall rate of 0.86, and an F1 score of 0.89. Conversely, the SVM model with a linear kernel demonstrated superior performance, achieving an accuracy rate of 92.26%, along with a precision of 0.93, recall of 0.86, and an F1 score of 0.89. To ensure frequent monitoring, hyperparameter tuning was performed. These results indicate that SVM is more likely to contain terms like "beking" and "kampung". These findings indicate that public sentiment toward the LHKPN initiative is largely favorable, despite persistent concerns surrounding integrity and transparency in asset reporting. This study highlights the effectiveness of sentiment analysis in gauging public opinion and informing better policy improvements.

Keywords—Sentiment analysis; Naive Bayes; Support Vector Machine; LHKPN; Social Media

1. INTRODUCTION

Corruption continues to pose a significant challenge to governance, particularly in developing nations such as Indonesia. In response to this persistent problem, the Indonesian government formed the Corruption Eradication Commission (KPK), granting it extensive powers to conduct investigations and bring corruption cases to justice. [1]. One of the primary transparency measures implemented by the KPK is the State Official's Wealth Report (Laporan Harta Kekayaan Penyelenggara Negara or LHKPN), which functions as a preventive mechanism to identify inconsistencies in the asset

In recent times, the emergence of digital platforms has significantly reshaped the way citizens interact with political matters and policy discussions. Platforms like X (previously known as Twitter) have evolved into arenas where individuals openly share their views regarding governmental transparency and ethical governance. These online dialogues provide a rich source of data that can be leveraged through sentiment analysis to better understand public opinions [3].

Sentiment analysis facilitates the automated categorization of public opinions based on textual data. This method has seen extensive use across multiple fields, including the analysis of political developments, policy assessments, and evaluations of public services. For example, [4] employed Support Vector Machine (SVM) to evaluate public sentiment on the issue of lobbyist need reports, achieving an accuracy rate of 84.21%. Similarly, [5] utilized SVM to analyze public responses during the 2019 presidential election, and [1] examined sentiment toward the KPK Bill, which predominantly reflected negative opinions. These findings underscore the reliability of machine learning techniques, particularly SVM, in interpreting public sentiment on political matters.

Although sentiment analysis plays a significant role in understanding public discourse, specific investigations into public sentiment regarding the LHKPN remain scarce. This research seeks to fill that gap by conducting an analysis of tweets related to the LHKPN using two machine learning algorithms: Support Vector Machine (SVM) and Naive Bayes. Through performance evaluation and comparison of these models, the study offers empirical evidence on public perceptions of asset disclosure by state officials. The results aim to contribute to enhancing policy communication, promoting greater transparency, and utilizing social media as a strategic instrument to measure public trust.

II. LITERATURE REVIEW

Various previous studies have effectively applied sentiment analysis to assess public opinion on governmental and political matters in Indonesia. These studies frequently employed machine learning algorithms such as Support Vector Machine (SVM) and Naive Bayes, recognized for their strong performance in text classification tasks. [4] Several studies have utilized Support Vector Machine (SVM) to classify sentiment on various political and governmental issues in Indonesia. For example, one study applied SVM to analyze public sentiment related to the controversy over lobbyist need reports, achieving an accuracy rate of 84.21%, thereby demonstrating SVM's effectiveness in addressing issue-specific sentiment analysis on Indonesian Twitter data. Likewise, [5] implemented SVM to examine sentiments during the 2019 presidential election, attaining an accuracy of 91.5%, further affirming SVM's reliability in mining political opinions [1].

Also, SVM is employed public reactions to the revision of the KPK Law, identifying a predominant negative sentiment (60.9%). Their findings highlighted Twitter's potential as a real-time platform for gauging public responses to controversial legislative changes. In another study, [6] compared the performance of SVM and Naive Bayes in analyzing sentiment regarding the Jakarta gubernatorial election, with results showing that SVM surpassed Naive Bayes in both accuracy and precision [10].

Examined the performance of Naive Bayes Classifier (NBC), K-Nearest Neighbors (KNN), and SVM in evaluating public sentiment toward government performance. Among these algorithms, SVM delivered the highest performance, further validating its robustness in text-based sentiment analysis. While these studies have provided meaningful insights into sentiment analysis using machine learning in the context of elections, public policies, and services, none have specifically investigated public sentiment regarding state wealth transparency through the LHKPN system. This study addresses that gap by applying SVM and Naive Bayes to assess public opinion on LHKPN, thereby contributing a novel perspective. It expands the application of sentiment analysis into the domain of institutional transparency and preventive anti-corruption efforts, an area that remains underexplored in current research.

III. RESEARCH METHODOLOGY

This study adopts a quantitative methodology by leveraging machine learning algorithms to categorize public sentiment toward the State Official's Wealth Report (LHKPN) as expressed on the social media platform X. The methodological stages include data collection, preprocessing, annotation, feature extraction, classification, and evaluation.

1) Data Collection

A total of 1,200 tweets related to LHKPN were collected using the X API v2 (formerly Twitter API). Keywords such as "LHKPN", "lapor harta", and "transparansi pejabat" were used

Figure 1. Conceptual Framework

The conceptual framework outlines the process of data acquisition, preprocessing, sentiment labeling, classification, and evaluation used in this study.

A. Sentiment Analysis

Sentiment analysis is a method within Natural Language Processing (NLP) that focuses on detecting and categorizing the sentiments or emotional tones present in textual data. It is commonly employed to gain insights into public attitudes toward various entities, policies, or occurrences. When applied to social media, sentiment analysis enables the transformation of vast amounts of unstructured data into meaningful and actionable information [6].

B. Naive Bayes Classifier

Naive Bayes is a classification technique grounded in Bayes' Theorem, operating under the strong assumption that each feature—such as individual words in a document—is independent of one another. Despite this assumption, the method has demonstrated high effectiveness in text analysis tasks, valued for its simplicity and strong performance in classification accuracy [7].

C. Support Vector Machine (SVM)

Support Vector Machine (SVM) is a machine learning technique known for its strong performance in handling high-dimensional datasets, such as textual data. It operates by identifying the optimal hyperplane that effectively separates data points into distinct classes. The advantage of SVM is its ability to handle irregular and complex data efficiently [8].

D. State Official's Wealth Report (LHKPN)

The LHKPN is a wealth disclosure system administered by Indonesia's Corruption Eradication Commission (KPK), designed as a mechanism for public oversight to deter corruption and enhance accountability in the activities of public

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Figure 7 illustrates a portion of the TF-IDF matrix, showing values importance across sample documents. This figure is designed to provide insight into how unstructured text is quantitatively represented for machine learning processes.

Figure 8 displays the proportion and count of training and test data points per sentiment category. This figure aims to explain how the dataset was divided to ensure robust evaluation of model performance.

Figure 9 illustrates a portion of the TF-IDF matrix, showing values importance across sample documents. This figure is designed to provide insight into how unstructured text is quantitatively represented for machine learning processes.

Figure 10 presents the overall sentiment analysis result. This pie chart is a communication of the sentiment classification, showing the proportion of tweets categorized as positive and negative after the model prediction.

Figure 11 displays the classification report for the Naïve Bayes algorithm, highlighting key performance indicators such as accuracy, precision, recall, and F1-score. This report provides a detailed overview of how well the model performs across various sentiment categories.

Figure 12 displays the classification report for the SVM model, which demonstrated superior performance compared to Naïve Bayes across all evaluation metrics. This figure provides a comprehensive summary of the SVM model's effectiveness in performing the sentiment classification task.

Figure 13 displays the classification report for the SVM model, which demonstrated superior performance compared to Naïve Bayes across all evaluation metrics. This figure provides a comprehensive summary of the SVM model's effectiveness in performing the sentiment classification task.

Figure 14 displays the classification report for the SVM model, which demonstrated superior performance compared to Naïve Bayes across all evaluation metrics. This figure provides a comprehensive summary of the SVM model's effectiveness in performing the sentiment classification task.

Figure 15 illustrates the WordCloud for positive sentiment.

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Sentiment Classification of Public Perception on LHKPN Using SVM and Naive Bayes

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Abstract: The public's perception of the State Official's Work Report (LHKPN) serves as a vital measure of confidence in the government's commitment to transparency and efforts to combat corruption. This research aims to analyze public sentiment related to the 2019 presidential election. A dataset comprising 1,200 tweets was gathered and processed through various text mining methods, such as one-hot encoding, stemming, normalization, removing stop words, and TF-IDF vectorization. The results were then analyzed using two machine learning models: Support Vector Machine (SVM) and Naive Bayes. The SVM model achieved an accuracy of 84.5%, while the Naive Bayes model achieved an accuracy of 82.1%. The SVM model consistently outperformed the Naive Bayes model across all metrics, including precision, recall, and F1 score. These findings indicate that the SVM model is more effective in classifying public sentiment on LHKPN. The research also highlights the importance of public opinion and its influence on government policy implementation.

Keywords: Sentiment Analysis; Public Opinion; Support Vector Machine (SVM); Naive Bayes

Introduction: The public's perception of the State Official's Work Report (LHKPN) serves as a vital measure of confidence in the government's commitment to transparency and efforts to combat corruption. This research aims to analyze public sentiment related to the 2019 presidential election. A dataset comprising 1,200 tweets was gathered and processed through various text mining methods, such as one-hot encoding, stemming, normalization, removing stop words, and TF-IDF vectorization. The results were then analyzed using two machine learning models: Support Vector Machine (SVM) and Naive Bayes. The SVM model achieved an accuracy of 84.5%, while the Naive Bayes model achieved an accuracy of 82.1%. The SVM model consistently outperformed the Naive Bayes model across all metrics, including precision, recall, and F1 score. These findings indicate that the SVM model is more effective in classifying public sentiment on LHKPN. The research also highlights the importance of public opinion and its influence on government policy implementation.

Conclusion: The SVM model consistently outperformed the Naive Bayes model across all metrics, including precision, recall, and F1 score. These findings indicate that the SVM model is more effective in classifying public sentiment on LHKPN. The research also highlights the importance of public opinion and its influence on government policy implementation.

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Sentiment Classification of Public Perception on LHKPN Using SVM and Naive Bayes

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Conclusion: The SVM model consistently outperformed the Naive Bayes model across all metrics, including precision, recall, and F1 score. These findings indicate that the SVM model is more effective in classifying public sentiment on LHKPN. The research also highlights the importance of public opinion and its influence on government policy implementation.

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Figure 6 Distribution of Sentiment Data Labeling

Figure 6 presents a bar chart for visualizing the initial count of positive and negative sentiment (observed in the dataset). The chart serves as a quick and intuitive overview of the sentiment distribution resulting from the manual annotation process.

As depicted, the positive sentiment category significantly outnumbers the negative one, with 75% of the dataset classified as positive and 25% as negative. This distribution of sentiment reflects the general tone of public discourse on Twitter regarding the LRPNP. Such visual representation supports further analysis and model training by confirming the class imbalance, which is subsequently addressed using techniques like SMOTE.

Figure 7 Data Preprocessing Results

Figure 7 illustrates a snapshot of the TF-IDF matrix, showing term frequency across various documents. This figure is designed to provide insight into how sentiment features are quantitatively represented for machine learning.

By analyzing the data into a matrix format, this research implemented the Term Frequency-Inverse Document Frequency (TF-IDF) technique. This approach assigns a weight to each word based on how often it appears in a particular document (term frequency) and how rare it is across all documents in the dataset (inverse document frequency). Words that are frequently used in an individual

text but rarely appear in the overall corpus are given greater importance, making them more influential in the classification process.

In contrast to Count Vectorization, the TF-IDF method addresses the issue of identifying significant terms while effectively reducing the influence of frequently occurring, less-informative words. In this study, the preprocessing steps combined with the TF-IDF transformation generated 2211 distinct features, which served as input for the classification algorithm.

This method was chosen due to its computational efficiency and strong performance in prior sentiment analysis studies. The resulting TF-IDF matrix provided a high-dimensional sparse representation of text content, allowing SVM and Naive Bayes to learn sentiment-related patterns effectively.

Figure 8 Data Cleaning Results

Figure 8 displays the proportion and count of training and test data points per sentiment category. This figure aims to explain how the dataset was divided to ensure robustness.

An 80:20 data split is a widely adopted approach in machine learning, enabling the model to learn on the bulk of the dataset while assessing its ability to generalize using the remaining unseen portion. The accompanying visualization demonstrates how the data is distributed across classes in both sets, providing clarity and transparency.

Figure 9 Data Splitting Results

Figure 9 displays the proportion and count of training and test data points per sentiment category. This figure aims to explain how the dataset was divided to ensure robustness.

An 80:20 data split is a widely adopted approach in machine learning, enabling the model to learn on the bulk of the dataset while assessing its ability to generalize using the remaining unseen portion. The accompanying visualization demonstrates how the data is distributed across classes in both sets, providing clarity and transparency.

Figure 9 Data Splitting Results

Figure 9 provides a visual explanation of the SMOTE process and how synthetic samples are generated. This technique is applied to balance the dataset by oversampling the minority class.

The visualization demonstrates how SMOTE operates conceptually by generating synthetic samples along the lines connecting minority class samples with their nearest neighbors. By introducing these artificial instances, the dataset becomes more balanced, which in turn improves the model's classification accuracy—especially in correctly identifying samples belonging to the minority class, such as those representing negative sentiment.

Figure 10 Sentiment Classification Results

Figure 10 presents the overall sentiment analysis results. This chart is a visualization of the sentiment classification, showing the proportion of results categorized as positive and negative after the model's predictions.

The distribution of positive sentiment in the chart reflects the dominance of public perception in favor of the LRPNP. This visual also validates the earlier manual sentiment distribution and supports the interpretation that the public tends to support transparency initiatives.

Figure 11 Naive Bayes Model Performance Evaluation Report

Figure 11 displays the classification report for the Naive Bayes algorithm, highlighting key performance indicators such as accuracy, precision, recall, and F1-score. This report provides a detailed overview of how well the model performs across various sentiment categories.

The precision metric reflects the model's capability to distinguish between positive and negative sentiments. Accuracy indicates the proportion of correct predictions (overall), while precision and recall are key low-level metrics. The model identifies each sentiment type. The F1-score, which combines precision and recall into a single measure, proves especially useful in scenarios with imbalanced sentiment distributions.

Figure 12 SVM Model Performance Evaluation Report

Figure 12 displays the classification report for the SVM model, which demonstrated superior performance compared to Naive Bayes across all evaluation metrics. This figure provides a comprehensive overview of the SVM model's effectiveness in performing the sentiment classification task.

The higher values in precision, recall, and F1-score (compared to the Naive Bayes model) suggest that SVM is more robust, especially in identifying minority class sentiments. This supports the selection of SVM as the preferred model for the particular sentiment analysis task.

Naive Bayes Accuracy: 0.8075, precision: 0.91, recall: 0.90, F1 score: 0.90

SVM Accuracy: 0.92, precision: 0.95, recall: 0.90, F1 score: 0.92

Figure 13 Confusion Matrix Naive Bayes

Confusion Matrix: Naive Bayes
(Y: 0: Pos, 1: Neg)

	Actual Pos	Actual Neg
Predicted Pos	18	7
Predicted Neg	3	12

Figure 14 Confusion Matrix SVM

Confusion Matrix: SVM
(Y: 0: Pos, 1: Neg)

	Actual Pos	Actual Neg
Predicted Pos	19	6
Predicted Neg	2	13

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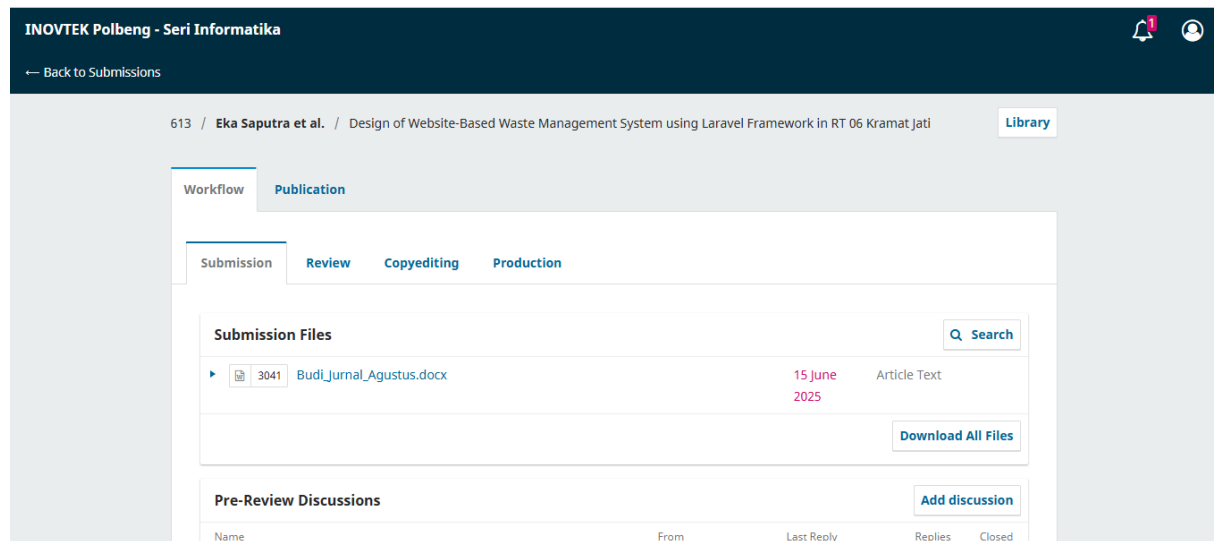
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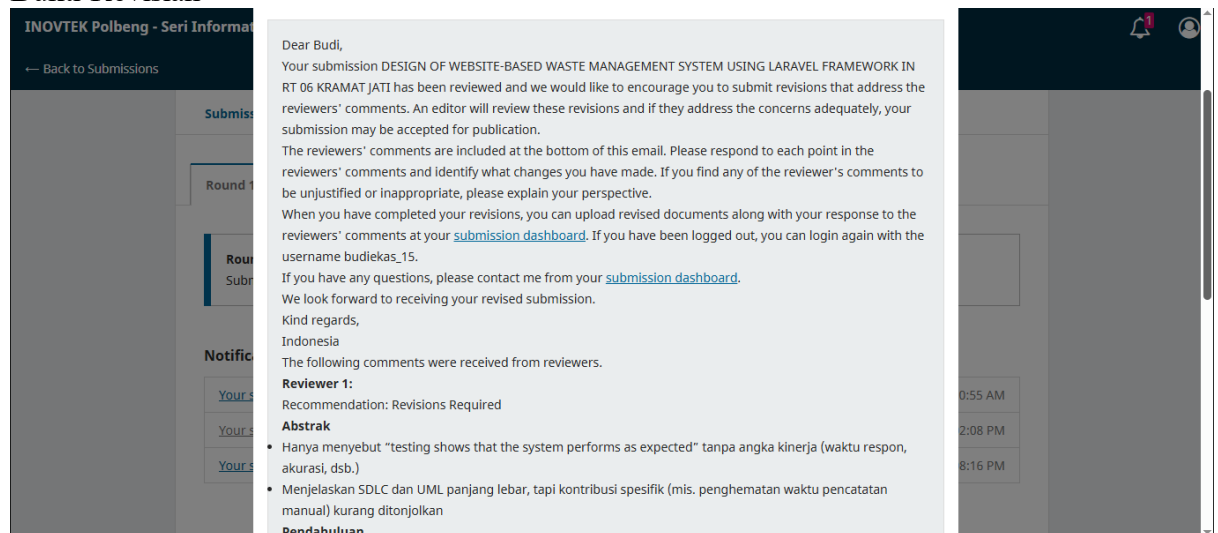
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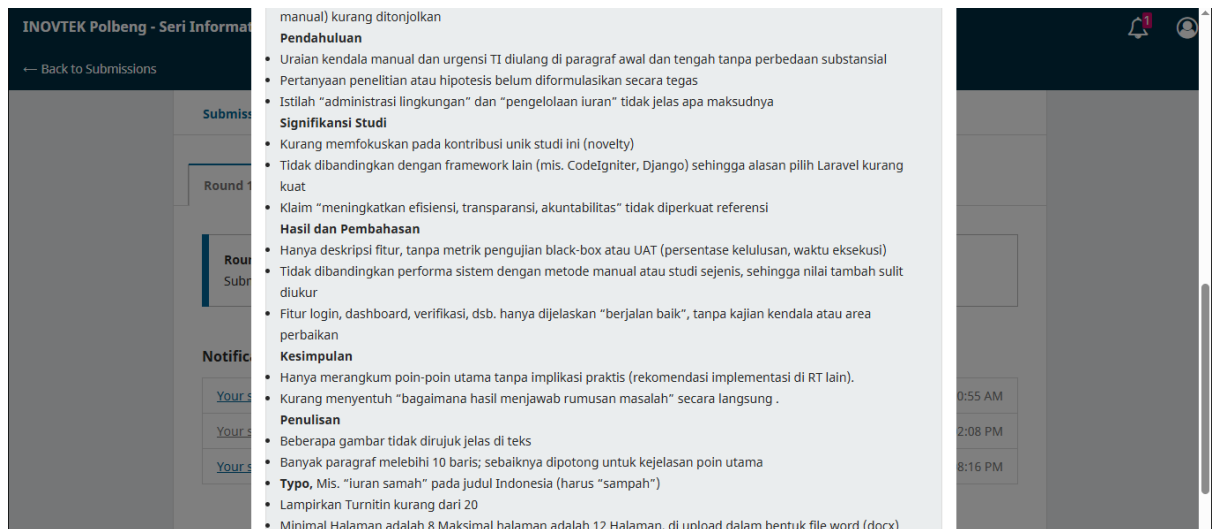
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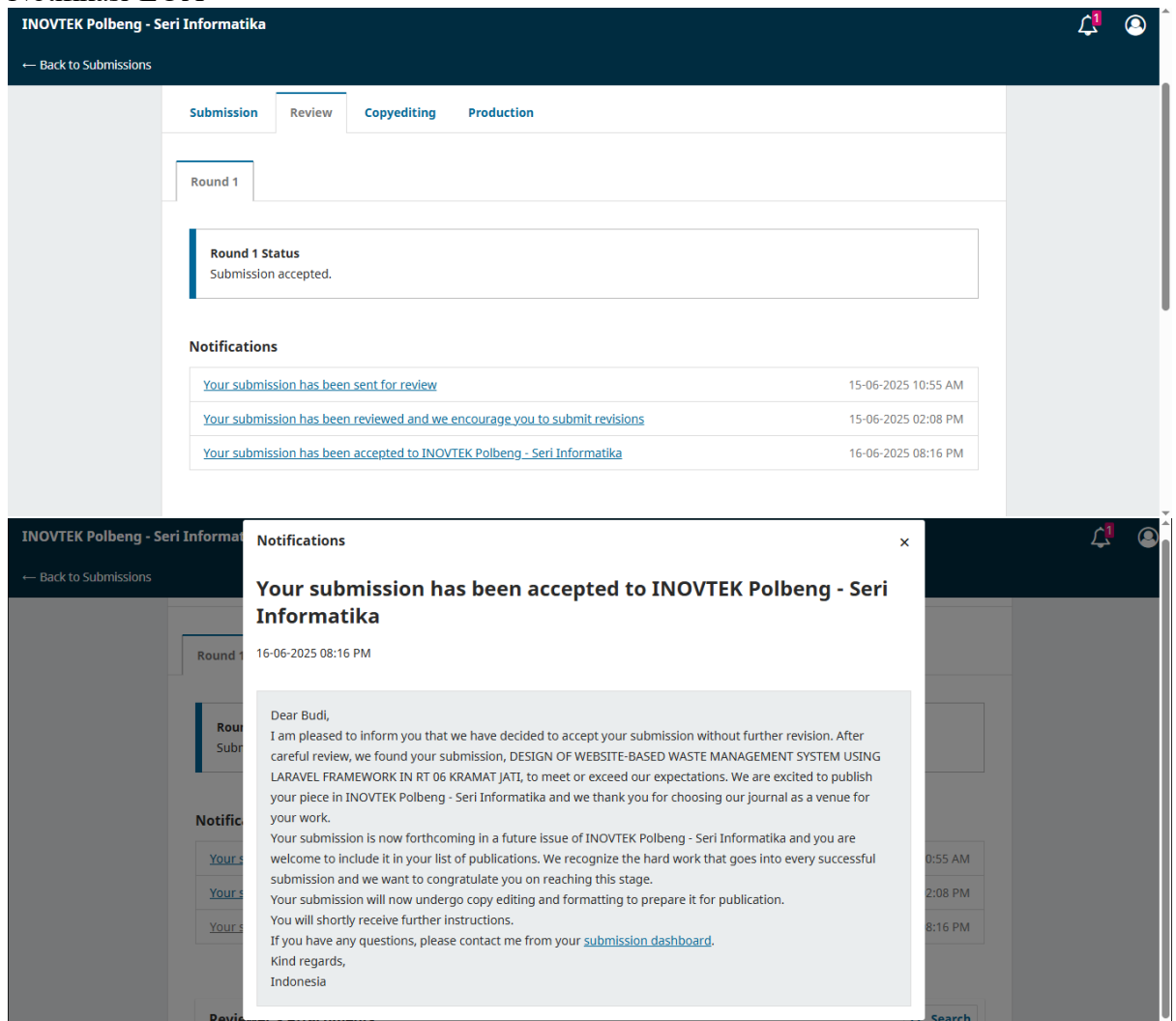


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DESIGN OF WEBSITE-BASED WASTE MANAGEMENT SYSTEM USING LARAVEL FRAMEWORK IN RT 06 KRAMAT JATI

PERANCANGAN SISTEM PENGELOLAAN IURAN SAMPAH BERBASIS WEBSITE MENGGUNAKAN FRAMEWORK LARAVEL DI RT 06 KRAMAT JATI

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Abstract - Waste management fees at the Neighborhood Association (RT) level often experience obstacles such as recording errors, late payments, and lack of information transparency. This has an impact on low service efficiency and citizen participation. The purpose of this research is to build a web-based information system that can support the waste management process, using the Laravel framework as the main tool to improve efficiency, transparency, and administrative accountability in RT 006 RW 010, Kramat Jati, East Jakarta. The study was conducted on 10 residents and RT administrators as respondents, selected based on their activeness in every resident activity from February to May 2025. The system allows RT administrators to manage data digitally, while residents can monitor payment status in real-time. For residents who are not familiar with technology, admins can enter data manually. The test results show that all features in the system run smoothly and support the administration process effectively. This system has been proven to significantly reduce manual recording and recap time, as well as increase citizen involvement in the payment process. In the future, this system has the potential to be further developed with the integration of digital payments such as QRIS and mobile applications, to expand reach and improve service convenience.

Keywords – Framework, Laravel, SDLC, web-based system, Information System.

Abstrak – Pengelolaan iuran sampah di tingkat Rukun Tetangga (RT) sering mengalami kendala seperti kesalahan pencatatan, keterlambatan pembayaran, dan kurangnya transparansi informasi. Hal ini berdampak pada rendahnya efisiensi layanan dan partisipasi warga. Tujuan dari penelitian ini adalah untuk membangun sebuah sistem informasi berbasis web yang dapat mendukung proses pengelolaan iuran sampah, menggunakan framework Laravel sebagai alat bantu utama guna meningkatkan efisiensi, transparansi, dan akuntabilitas administrasi di RT 006 RW 010, Kramat Jati, Jakarta Timur. Penelitian dilakukan terhadap 10 warga dan pengurus RT sebagai responden, dipilih berdasarkan keaktifan dalam setiap kegiatan warga pada bulan Februari hingga Mei 2025. Sistem memungkinkan pengurus RT mengelola data secara digital, sementara warga dapat memantau status pembayaran secara real-time. Bagi warga yang belum akrab dengan teknologi, admin dapat memasukkan data secara manual. Hasil pengujian menunjukkan bahwa semua fitur dalam sistem berjalan dengan lancar dan mendukung proses administrasi secara efektif. Sistem ini terbukti dapat mengurangi waktu pencatatan dan rekap manual secara signifikan, serta meningkatkan keterlibatan warga dalam proses pembayaran. Ke depannya, sistem ini berpotensi dikembangkan lebih lanjut dengan integrasi pembayaran digital seperti QRIS dan aplikasi mobile, untuk memperluas jangkauan serta meningkatkan kenyamanan layanan.

Kata Kunci – Framework, Laravel, SDLC, Sistem Berbasis Website, Sistem Informasi.

I. PENDAHULUAN

Layanan publik yang efisien, akuntabel, dan transparan merupakan fondasi utama dalam menjaga keberlangsungan tatanan sosial yang harmonis, khususnya pada era digital yang menuntut responsivitas dan kemudahan akses informasi. Di tingkat komunitas lokal seperti Rukun Tetangga (RT) dan Rukun Warga (RW), peran administratif menjadi sangat vital, termasuk dalam pengelolaan iuran kebersihan seperti iuran sampah. Namun, realita di lapangan menunjukkan bahwa proses pengelolaan masih mengandalkan pencatatan manual yang tidak hanya rentan terhadap kesalahan input, keterlambatan, dan redundansi data, tetapi juga minim transparansi. Kondisi ini berpotensi menurunkan partisipasi aktif warga serta menghambat akuntabilitas keuangan [1] [2] [3].

Untuk menjawab tantangan tersebut, penelitian ini merancang dan mengembangkan sebuah sistem informasi pengelolaan iuran sampah berbasis web menggunakan framework Laravel. Fokus penerapannya adalah lingkungan RT 006 RW 010, Kelurahan Kramat Jati, Jakarta Timur, dengan tujuan utama meningkatkan efisiensi administrasi, memperluas akses informasi bagi warga, serta memperkuat kepercayaan publik melalui transparansi data keuangan [5] [6]. Laravel dipilih sebagai platform pengembangan karena keunggulannya dalam menyediakan arsitektur Model-View-Controller (MVC), kemudahan integrasi database, fitur keamanan bawaan, serta dokumentasi yang komprehensif dan komunitas pengembang yang aktif [4] [7] [8].

Sistem yang dikembangkan dirancang untuk mendukung dua jenis pengguna. Pertama, warga yang memiliki literasi digital dapat memantau dan melakukan pembayaran secara daring melalui dashboard pengguna. Kedua, warga yang belum familiar dengan teknologi, khususnya lansia, tetap dapat dilayani melalui pencatatan manual oleh pengurus RT yang bertindak sebagai admin sistem [5]. Penelitian ini mengadopsi pendekatan System Development Life Cycle (SDLC) model Waterfall yang dinilai cocok untuk proyek sistem yang terstruktur dan memiliki kebutuhan yang relatif stabil [9] [1] yang meliputi analisis kebutuhan, desain, implementasi, pengujian, hingga pemeliharaan. Hasil sistem ini diharapkan mampu menjadi solusi konkret dalam mewujudkan tata kelola iuran yang lebih transparan dan modern.

Pertanyaan penelitian yang diajukan dalam studi ini adalah: Bagaimana sistem informasi berbasis web dapat meningkatkan efisiensi, transparansi, dan partisipasi warga dalam pengelolaan iuran sampah di lingkungan RT?

Dengan pendekatan inklusif dan adaptif terhadap kondisi masyarakat, sistem ini diharapkan dapat menjadi solusi praktis dalam digitalisasi layanan RT yang berkelanjutan dan ramah pengguna.

II. SIGNIFIKASI STUDI

A. Penelitian Terdahulu

Penelitian ini relevan dengan tren pengembangan sistem informasi berbasis web dalam meningkatkan efisiensi dan akuntabilitas administrasi masyarakat. Berbagai studi sebelumnya telah mengembangkan sistem digital untuk mencatat dan mengelola iuran lingkungan, menggantikan proses manual yang rentan terhadap kesalahan pencatatan dan keterlambatan informasi [4]. Secara umum, sistem yang dirancang bertujuan untuk memudahkan pengurus

mencatat transaksi, menyimpan data terpusat, serta menyediakan akses informasi kepada warga secara real-time dan akurat [5].

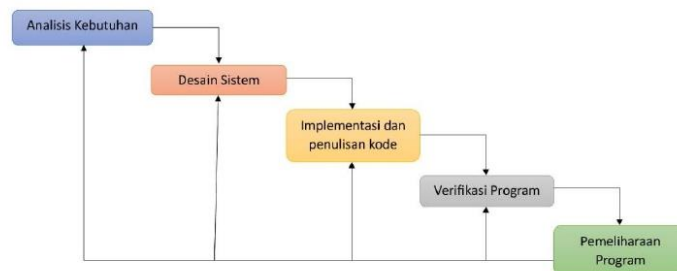
Framework Laravel sering menjadi pilihan utama karena menawarkan struktur pengembangan yang bersih, keamanan tinggi, integrasi database yang kuat, serta komunitas dan dokumentasi yang aktif [7] [8]. Meskipun framework lain seperti CodeIgniter atau Django juga populer, Laravel unggul dalam hal arsitektur berbasis MVC, blade templating engine, dan fitur built-in seperti autentikasi, validasi, serta routing yang efisien [7] [10]. Hal ini menjadikan Laravel ideal untuk pengembangan sistem yang skalabel dan mudah dikelola oleh tim kecil seperti pengurus RT.

1 Studi terdahulu juga menunjukkan bahwa penerapan sistem informasi berbasis web dapat meningkatkan efisiensi operasional, menyediakan transparansi data pembayaran, dan meningkatkan akuntabilitas pengelolaan keuangan warga [5] [6] [1]. Meskipun demikian, sebagian besar sistem masih berfokus pada penggunaan daring (online) tanpa memperhatikan kebutuhan pengguna lanjut usia atau warga yang belum familier dengan teknologi.

Karena itu, kontribusi utama dari penelitian ini adalah pendekatannya yang inklusif, yaitu menyediakan mekanisme input manual oleh admin sebagai solusi untuk menjembatani kesenjangan literasi digital. Dengan mengadaptasi praktik terbaik dari studi sebelumnya, Sistem yang dirancang dalam studi ini diharapkan dapat memperbaiki mutu pelayanan di tingkat Rukun Tetangga secara menyeluruh dan mendorong kepercayaan warga terhadap pengelolaan administrasi yang lebih terbuka dan efisien.

3 B. Metode Penelitian

Sistem dirancang menggunakan metode penelitian yang digunakan adalah System Development Life Cycle (SDLC) dengan model Waterfall. Model ini dipilih karena alurnya yang sistematis dan terstruktur [10]. Referensi [4] Metode Waterfall memiliki alur yang sangat jelas, pembuatan sistem sangat detail, Semakin detail perencanaan dan pembagian tugas dalam proses pengembangan sistem, maka semakin kecil pula peluang terjadinya kesalahan selama implementasi, maka dari itu metode Waterfall ini sangat tepat digunakan dalam penelitian ini. Sistem diterapkan untuk memudahkan pembayaran iuran sampah online dan membantu petugas mengelola data pembayaran secara otomatis, meningkatkan efisiensi dan akurasi [4] [5].



Gambar 1. Metode Waterfall [11]

1. Analisis Kebutuhan

Proses ini bertujuan untuk memahami permasalahan dan kebutuhan pengguna sistem melalui observasi dan wawancara. Tahap ini merupakan proses menghimpun kebutuhan, baik dalam bentuk dokumen maupun antarmuka, untuk menganalisis dan merumuskan spesifikasi kebutuhan perangkat lunak. Tujuannya adalah agar kebutuhan pengguna dapat dipahami secara menyeluruh, sehingga solusi perangkat lunak yang tepat dapat ditentukan untuk mendukung proses komputerisasi sistem [3]. Hasil analisis

menunjukkan bahwa warga RT 006 RW 010 Kelurahan Kramat Jati mengalami berbagai kendala, seperti pencatatan iuran yang kurang akurat, sulitnya memantau data pembayaran, serta keterbatasan kemampuan teknologi sebagian besar warga. Oleh karena itu, sistem dirancang agar dapat digunakan oleh dua tipe pengguna: warga yang paham teknologi bisa melakukan pembayaran melalui transfer bank, sedangkan bagi yang tidak, data akan dicatat oleh pengurus RT selaku admin [4] [10] [11].

2. Desain Sistem

Desain sistem mencakup perencanaan struktur, alur data, serta tampilan antarmuka pengguna berdasarkan hasil analisis kebutuhan. Digunakan diagram seperti ERD, DFD, dan Use Case untuk menggambarkan relasi data, alur proses, dan interaksi antar pengguna. Desain UI/UX disesuaikan dengan kondisi warga yang sebagian besar berusia lanjut dan belum terbiasa menggunakan aplikasi digital, sehingga sistem dirancang dengan tampilan yang sederhana, mudah dipahami, dan meminimalkan kesalahan penggunaan.

3. Implementasi dan Penulisan Kode

Pada tahap ini, peneliti mulai merealisasikan rancangan yang telah dibuat ke dalam bentuk implementasi kode program, mencakup pembuatan antarmuka login hingga fitur pencetakan laporan. Proses implementasi ini merupakan langkah mengubah rancangan sistem menjadi kode-kode yang dapat dijalankan menggunakan bahasa pemrograman tertentu [9]. Tahap ini merupakan proses penerjemahan desain sistem ke dalam kode program menggunakan framework Laravel dan desain tampilan menggunakan bootstrap. Laravel dipilih karena mendukung pengembangan aplikasi web dengan struktur yang terorganisir dan efisien. Pengembangan dilakukan secara bertahap, dimulai dari fitur login admin, input data warga, pencatatan pembayaran iuran, hingga pembuatan laporan dan fitur cetak. Semua fitur disesuaikan dengan kebutuhan pengguna dan mendukung pengelolaan data yang lebih terstruktur.

4. Verifikasi Program

Verifikasi program dilakukan guna memastikan bahwa semua fitur berfungsi secara tepat dan mengacu pada spesifikasi yang telah dirumuskan sebelumnya, proses pengujian pun dilaksanakan secara menyeluruh, mulai dari unit testing untuk setiap fitur, integration testing untuk memastikan hubungan antar fitur, hingga system testing untuk pengujian keseluruhan aplikasi. Selain itu, dilakukan pula user acceptance testing (UAT) bersama admin RT menggunakan blackbox testing guna memastikan sistem sudah memenuhi kebutuhan pengguna dan siap digunakan secara nyata [12].

5. Pemeliharaan Program

Pada tahap ini dilakukan pelatihan bagi admin dan penyediaan dokumentasi penggunaan. Tahap ini juga mencakup pemantauan awal terhadap kinerja sistem dan respons pengguna. Jika ditemukan masalah atau kebutuhan baru, dilakukan perbaikan atau penyesuaian. Pemeliharaan ini penting untuk memastikan sistem tetap berjalan optimal dan dapat berkembang sesuai kebutuhan pengguna di masa mendatang [13].

III. HASIL DAN PEMBAHASAN

A. Perancangan Sistem

Dalam penelitian ini, UML (Unified Modeling Language) dimanfaatkan sebagai media perancangan dan visualisasi sistem yang akan dibangun. UML dipilih karena mampu

9 menggambarkan struktur, alur proses, serta interaksi antara pengguna dan sistem secara jelas dan terstruktur.

6 1. Use Case Diagram

Diagram Use Case merepresentasikan interaksi antara pengguna sistem dan sistem itu sendiri, serta menjelaskan peran serta aktivitas utama yang dapat dilakukan oleh masing-masing pengguna. Dalam aplikasi ini, terdapat dua peran penting, yaitu Pengurus(Admin) dan Warga(User).

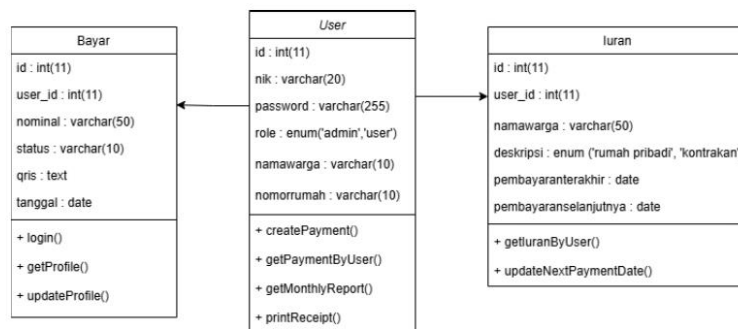


Gambar 2. Use Case Diagram

8

2. Class Diagram

Pada sistem informasi pengelolaan iuran sampah berbasis web ini, terdapat beberapa entitas utama seperti User, Iuran, dan Bayar, yang masing-masing direpresentasikan dalam bentuk kelas.

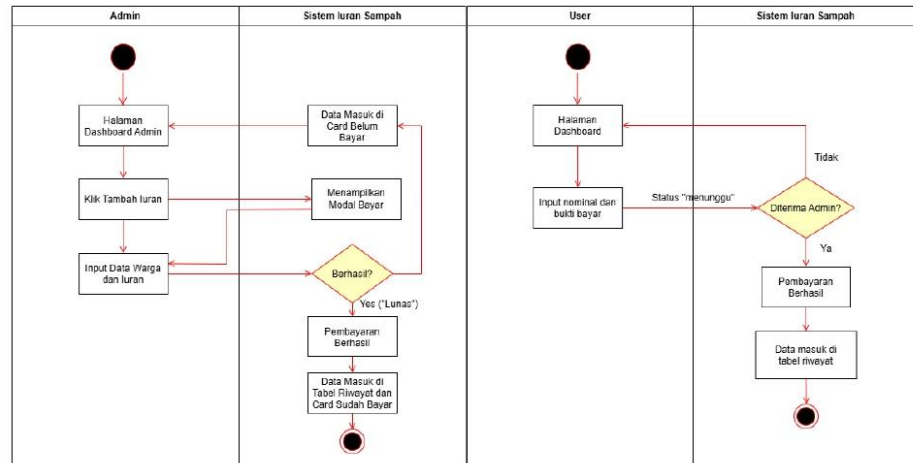


Gambar 3. Class Diagram

3. Activity Diagram

1. Dashboard Tambah Iuran

Menunjukkan tampilan dan navigasi awal yang berbeda antara admin dan user, termasuk akses fitur yang tersedia. Tampilan dashboard dirancang untuk menyajikan informasi penting secara ringkas dan mudah dipahami.



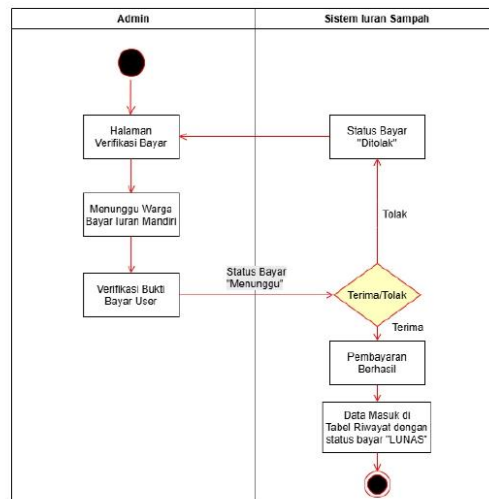
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Gambar 4. (a)Activity Diagram Tambah Data Iuran admin (b) Activity Diagram Tambah Data Iuran User

Berdasarkan alur gambar 4 (a) menggambarkan aktivitas tambah data dari role admin yang digunakan untuk lansia yang tidak melek akan teknologi, dan gambar 4 (b) menggambarkan tambah data iuran secara mandiri dan tetap akan di cek kembali bukti bayarnya oleh admin pada halaman verifikasi bayar.

2. Verifikasi Bayar

Memperlihatkan proses verifikasi oleh admin atas data pembayaran yang telah dikirimkan atau diinput, untuk menghindari kesalahan pencatatan. Diagram ini penting untuk menggambarkan kontrol internal sistem terhadap keakuratan data keuangan.



Gambar 5. Activity Diagram Verifikasi Pembayaran

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Enhancing seawater desalination performance using a vortex generator in a modified window air conditioner

Nurkholid Nurkholid, Dan Mugsidi, Widodo Widodo, Oktarina Heriyani, Ibnu Sulistiono

Abstract

The growing demand for air conditioning systems has driven research into alternative applications, such as seawater desalination. This study evaluates the performance of a modified window air conditioner (WAC) integrated with a vortex generator for desalination. Experiments were conducted using R410A refrigerant under four conditions: closed container (CC), without vortex (WV), connected vortex (CV), and separated vortex (SV). Seawater was heated via the condenser to 55–60°C, controlled by a thermostat, and data was collected every five minutes over eight hours. The thermodynamic properties of R410A were analyzed using Refprop software to determine refrigeration effect (RE), compression work (CW), and coefficient of performance (COP). Results indicate that the SV configuration achieved the highest evaporation rate (5.01 kg) but led to a lower COP (3.91) due to increased condenser temperature and compressor workload. Conversely, CC yielded the highest COP (5.08) by stabilizing the evaporator air temperature and reducing compressor effort. These findings suggest that vortex generators enhance evaporation rates but reduce system efficiency. Further research is needed to optimize vortex generator configurations to improve desalination efficiency while minimizing COP reduction.

Keywords

Window air conditioner, Vortex generator, Desalination, Refprop, COP

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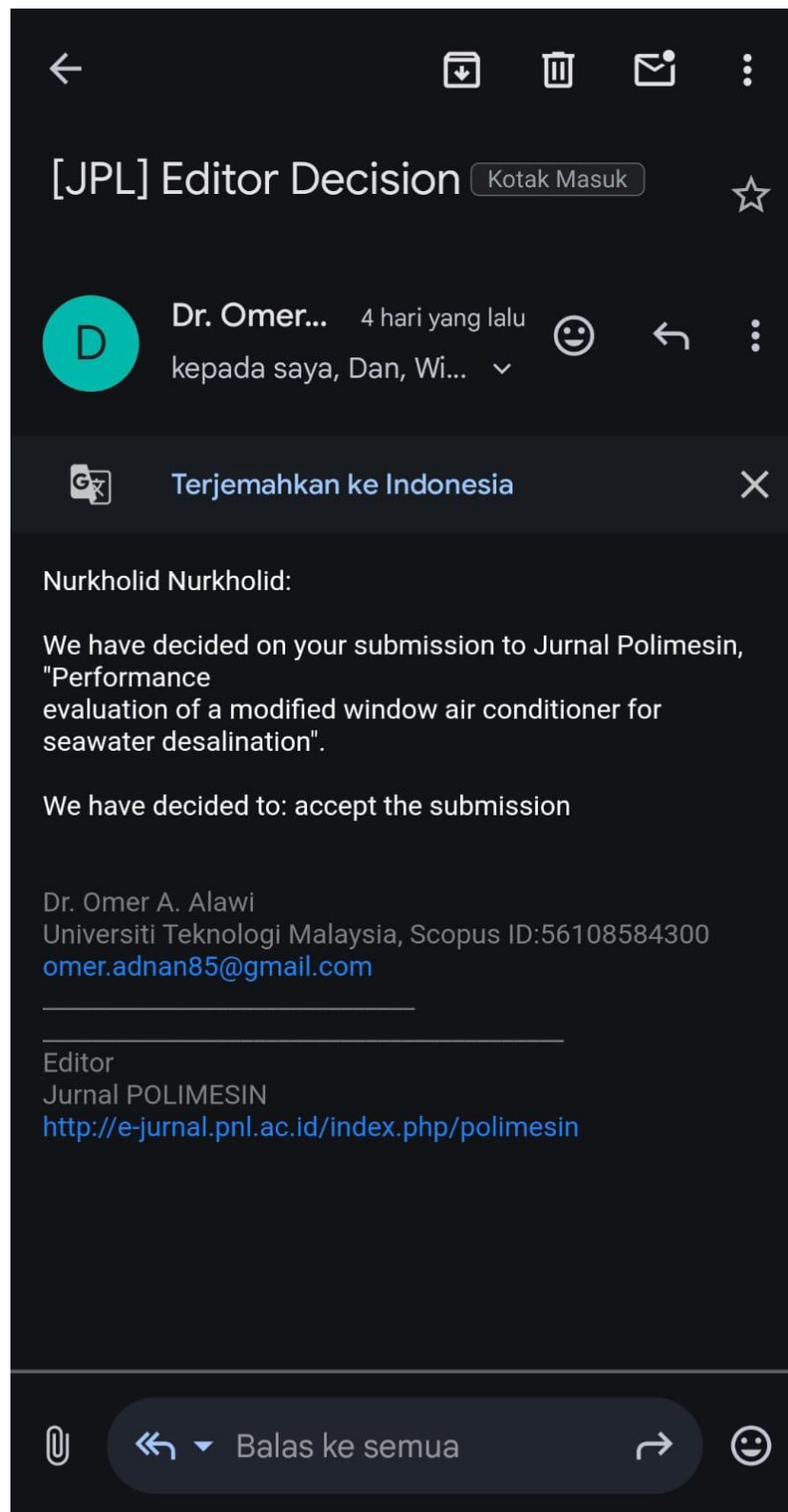
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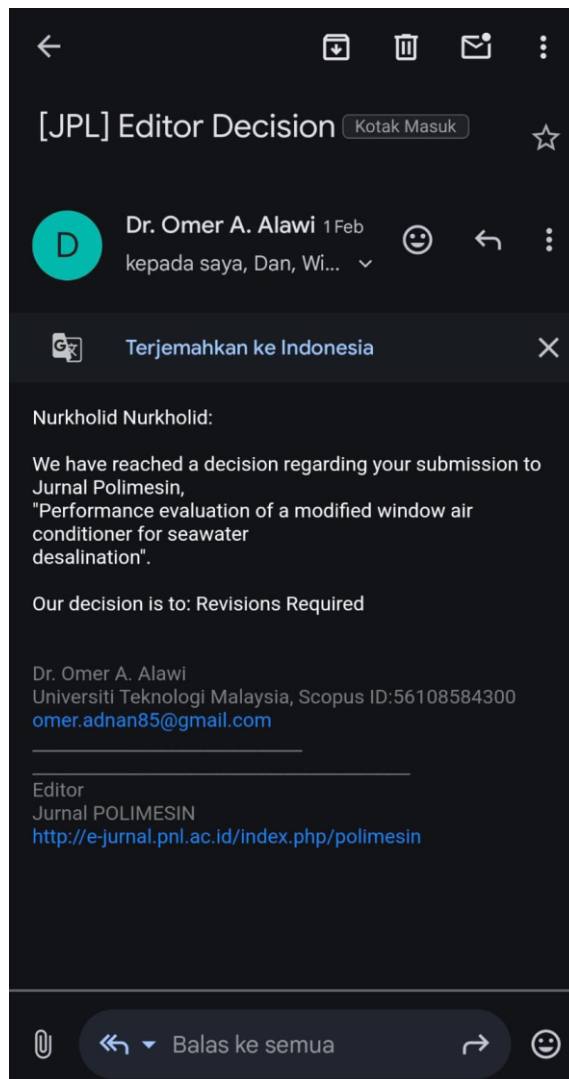
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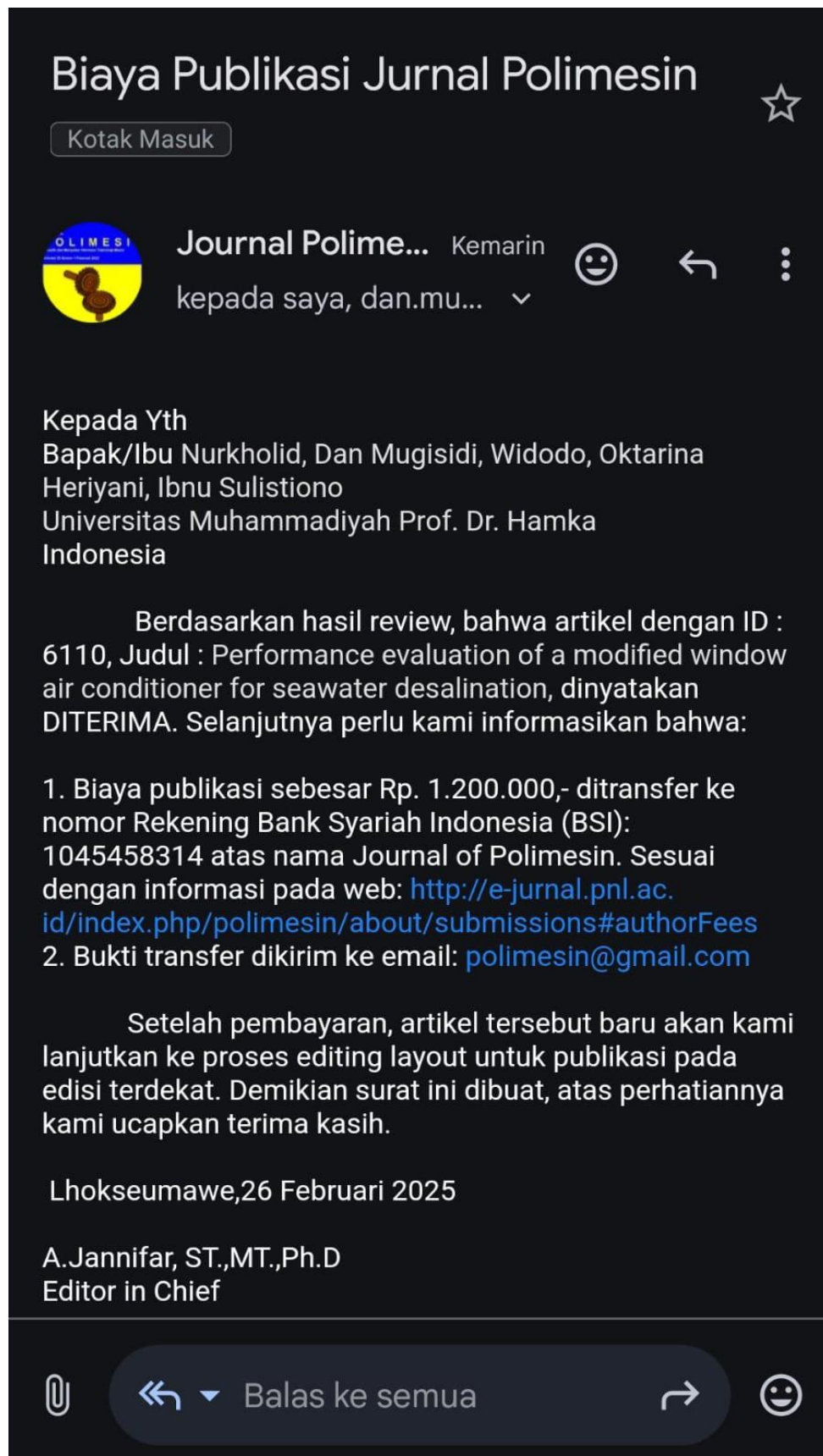
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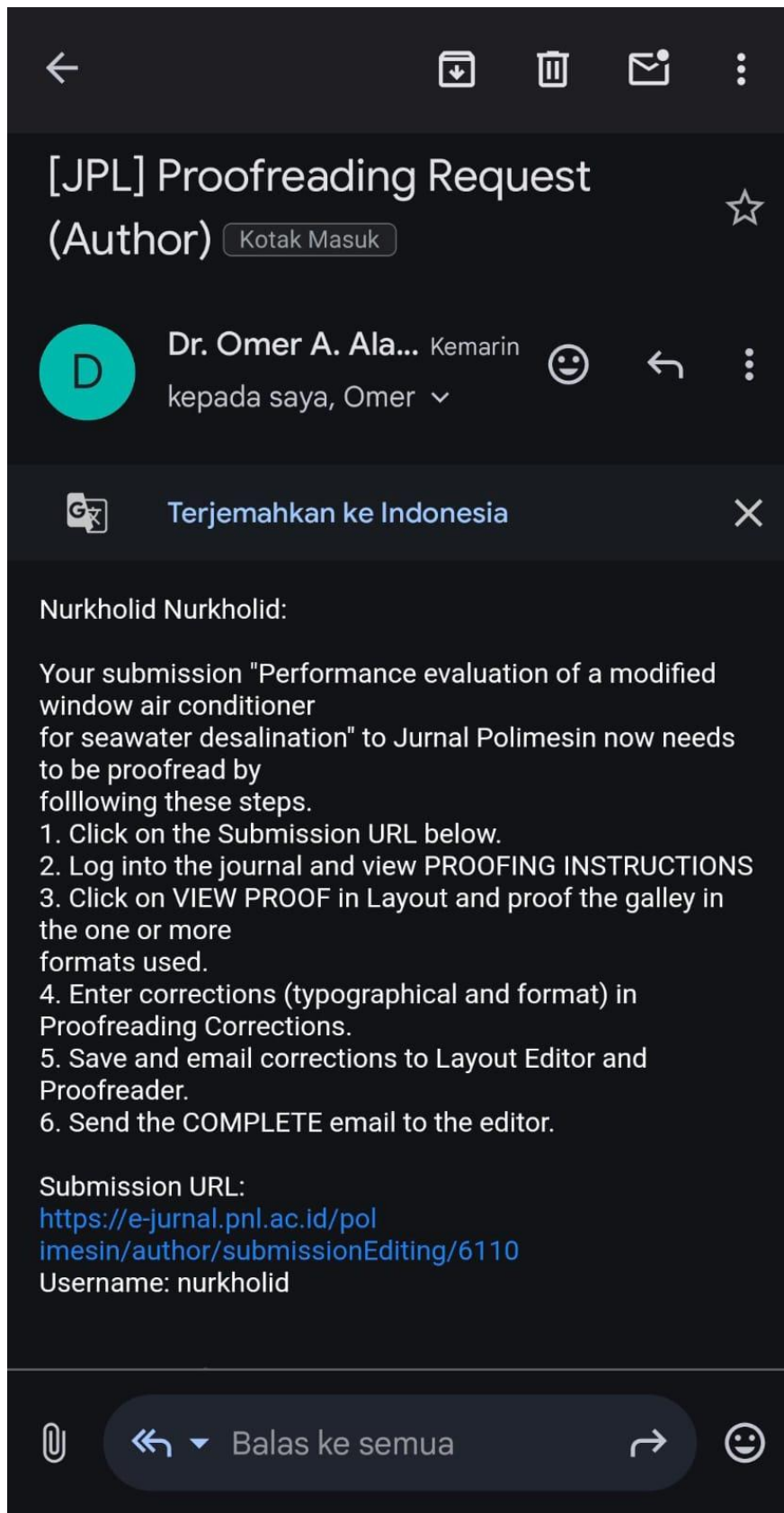
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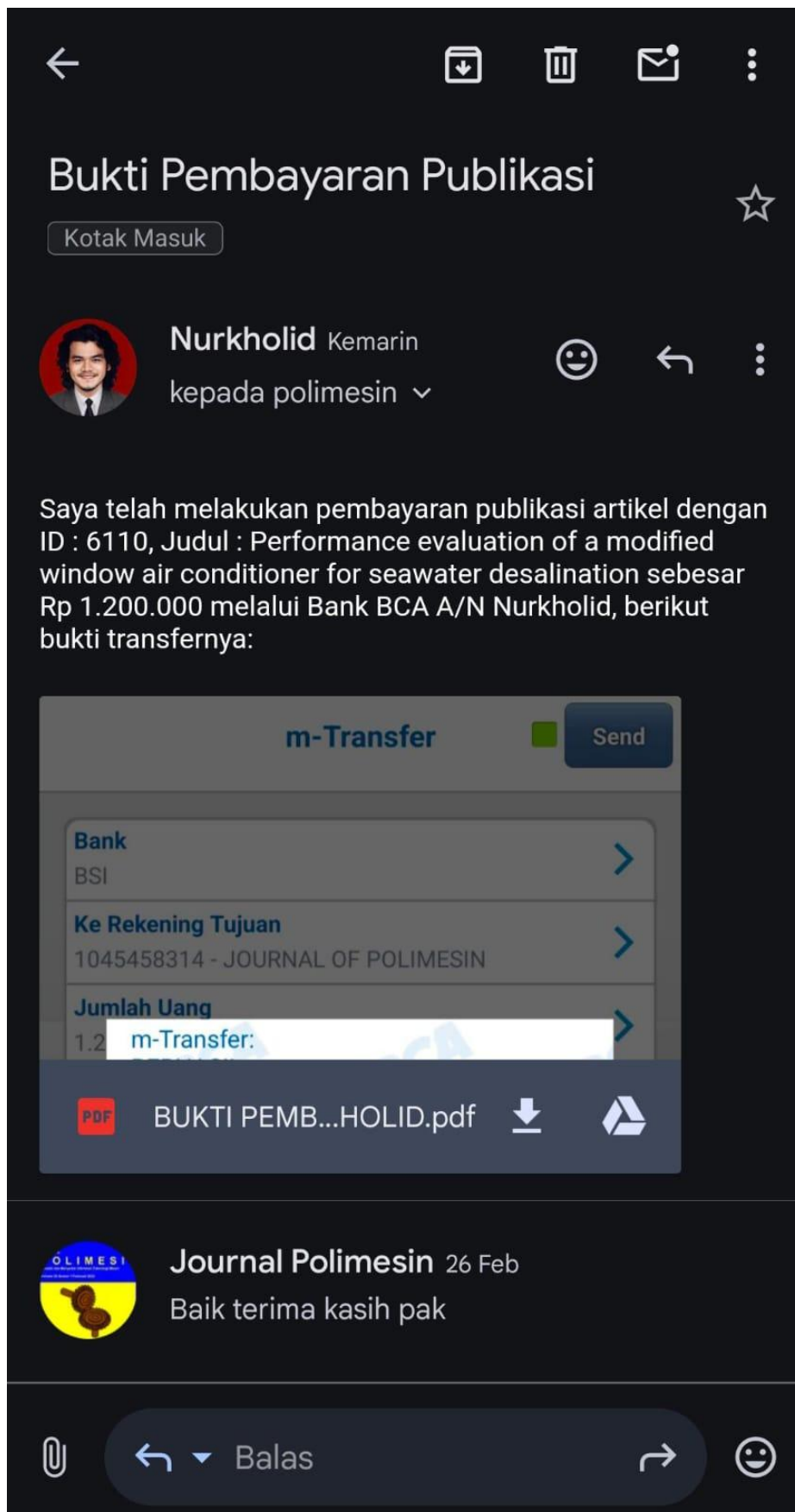
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Enhancing Seawater desalination performance using a vortex generator in a modified window air conditioner

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Abstract

The growing demand for air conditioning systems has driven research into alternative applications, such as seawater desalination. This study evaluates the performance of a modified Window Air Conditioner (WAC) integrated with a vortex generator for desalination. Experiments were conducted using R410A refrigerant under four conditions: Closed Container (CC), Without Vortex (WV), Connected Vortex (CV), and Separated Vortex (SV). Seawater was heated via the condenser to 55-60°C, controlled by a thermostat, and data was collected every five minutes over eight hours. The thermodynamic properties of R410A were analysed using Refprop™ software to determine the Refrigeration Effect (RE), Compression Work (CW), and Coefficient of Performance (COP). Results indicate that the SV configuration achieved the highest evaporation rate (5.01 kg) but led to a lower COP (3.91) due to increased condenser temperature and compressor workload. Conversely, CC yielded the highest COP (5.08) by stabilizing the evaporator air temperature and reducing compressor effort. These findings suggest that vortex generators enhance evaporation rates but reduce system efficiency. Further research is needed to optimize vortex generator configurations to improve desalination efficiency while minimizing COP reduction.

Keywords:

Window air conditioner, vortex generator, desalination, Refprop™, COP

1 Introduction

Along with the improvement of the quality of life and the need for comfort, the use of air conditioning systems is increasing in daily life [1], [2]. Air conditioning systems also help remove moisture and airborne particles from the room [3]. Therefore, the use of air conditioners is no longer just part of a lifestyle but rather aims to provide comfort when moving or doing activities indoors [4]. One of the most common types is the Window Air Conditioner (WAC), which uses a vapor compression cycle to take heat from the air inside and expel it outside through condensation [5]. This condensation water is usually disposed of as waste but can be used to make clean water under certain conditions [6]. The high demand for clean water around the world, as well as environmental issues such as drought and limited availability of clean water resources, are major challenges that need to be addressed [7], [8], [9]. The use of a modified WAC as a desalination device is an option to consider. This modification allows the WAC to function as both an air conditioning unit and a system to separate salt from saltwater.

Evaluating the performance of the WAC as a desalination device is essential to ensure the effectiveness of this system in removing salt from seawater.

Desalination systems, such as reverse osmosis (RO), are currently available [10]. However, such technologies consume much energy [11], especially on a large scale, making it inefficient for households or places with limited energy resources. On the other hand, WAC is a device that is widely used in many homes [12] and operates according to the principles that allow it to be used in desalination processes. The main problem is how to modify the WAC without compromising its cooling efficiency and ensuring optimal system performance during its switch to desalination function.

Research on the use of air conditioning for desalination processes is still in its infancy. Some of the research that has been conducted includes the integration of a split air conditioning system with a Humidification-Dehumidification (HDH) desalination unit utilizing solar energy, the utilization of solar heating to improve the performance of a hybrid desiccant air conditioning system coupled with an HDH desalination unit, numerical analysis of a hybrid air conditioning system supported by solar energy and integrated with an HDH desalination system, and modified window air conditioner to produce potable water through humidification-dehumidification desalination process [13], [14], [15], [16]. These experiments show that combining an air conditioning system with a desalination unit can produce clean water. Nevertheless, these studies have not investigated the impact of vortex generators on desalination effectiveness, particularly in enhancing the evaporation rate. Multiple studies have investigated the application of vortex generators in desalination to enhance the evaporation rate [17], [18], given that vortex generators influence the convection heat transfer coefficient [19]. Previous research has not examined the performance of WAC modified with a vortex generator as a desalination tool against seawater evaporation. Desalination itself is the process of separating salt and minerals from seawater to produce freshwater [20]. Cooling system performance can be determined by assessing the Refrigeration Effect (RE), Compression Work (CW), and Coefficient of Performance (COP) [21].

Therefore, this study aims to determine the performance of the modified WAC as a desalination device against seawater evaporation. This research has analysed the impact of various tested variables on the evaporation of seawater at a given temperature. The desalination mechanism focuses on the evaporation process, where seawater is evaporated using the modified WAC. The performance assessment of this system uses the parameters RE, CW, and COP, which are the main indicators in assessing the ability of the device as a desalination system. It is hoped that this research can provide a deep insight into the potential of WAC modification to produce a more effective and efficient desalination system.

2 Method

This study used a WAC to compare its performance as a desalination device. The experimental setup used in this study is presented in Fig. 1. The working fluid of the air conditioning system is R410A refrigerant [22] with the specifications shown in Table 1. This research was conducted at the Mechanical Engineering Laboratory, Faculty of Industrial Technology and Informatics, Universitas Muhammadiyah Prof. Dr. Hamka. In addition, the measurement tools used are listed in Table 2. Tests on the utilization of WAC as a desalination tool were carried out with variables of Closed Container (CC), Without Vortex (WV), Connected Vortex (CV), and Separate Vortex (SV) (Fig. 2).

Refprop™ software version 10.0.0.9b is used to determine the properties of the refrigerant at enthalpy at each point based on the cooling system performance data by analyzing the saturation pressure, temperature, enthalpy, entropy, and density of the refrigerant [24], [25]. System performance is analyzed using

pressure and temperature obtained through calculations on R410A refrigerant using Refprop™ software [26]. The effectiveness of an air conditioner is evaluated by determining the refrigeration effect, which is the difference in refrigerant enthalpy between the evaporator's inlet and outlet, and the compression work, which is the enthalpy difference between the compressor's outlet and inlet. The values of RE, CW, and Coefficient of COP are determined based on the obtained enthalpy results [27].

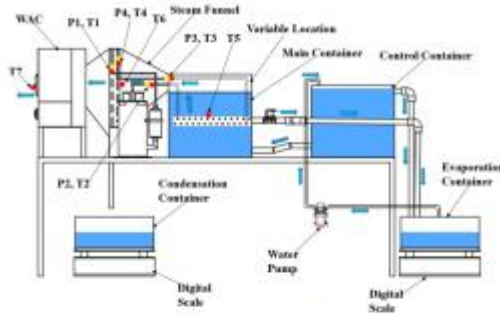


Fig. 1. Experimental setup

Table 1. Refrigeration unit specifications

Dimension	Specification
Model WAC	Uchida MP - W9M
Voltage	1 Fase 220V - 50 Hz
PK Power	1 PK
Cooling Capacity	8600 BTU/h
Electrical power	840 W
Current	4.0 A
EER	10.01 BTU/hW
Refrigerant R410A	360 g
Size	500×345×465 mm

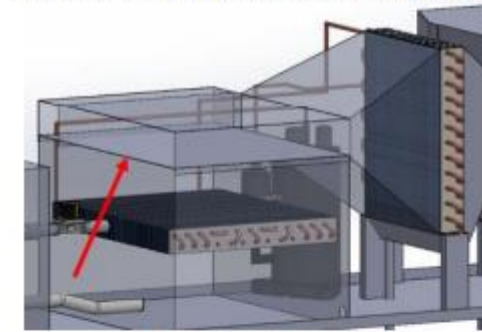
Table 2. Measurement tools

Tools	Function	Specification
Thermostat XH-W3001	Water temperature	-50°C - 110°C, ±0.1°C
Digital thermometer	Temperature	-50°C - 110°C, ±0.1°C
Manifold Gauge	Pressure	0 - 500 psi, 5 psi
Digital scale 30 kg	Water Mass	0 - 30 kg, 0.005 kg

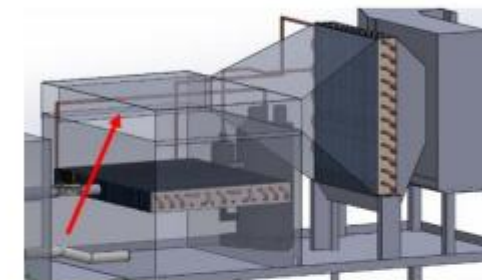
In this experiment, the seawater in the evaporation container is transferred to the control container via a pump. This step aims to deliver the water to the main container, where it will be heated using a condenser until the temperature reaches about 55-60°C, which is regulated by a thermostat. As the water evaporates, the resulting vapor is directed upwards through the steam funnel before finally entering the evaporator.

The main container has an overflow mechanism that delivers water to the evaporation container to maintain the temperature in the range of 55-60°C. In addition, the control container is also equipped with an overflow system for the evaporation container to ensure the water level remains stable. This system allows the control container's water level to remain constant while the evaporation container's water level drops due to the evaporation process [23]. The evaporation rate was determined by the mass of water in the evaporation container, which was measured with a digital scale to confirm the amount of water lost owing to evaporation. In Fig. 1 data was collected at P₁, T₁, P₂, T₂, P₃, T₃, P₄, T₄, T₅, T₆, T₇. Where P₁, T₁ is the compressor inlet pressure, temperature, P₂, T₂ is the compressor outlet pressure, temperature, P₃, T₃ is the expansion inlet pressure, temperature, P₄, T₄ is the expansion outlet pressure, temperature, T₅ is the condenser temperature, T₆ is the evaporator temperature, T₇ is the evaporator outlet air temperature, and the

variable location is used for a closed container by placing a plate on top of the container, a container without vortex, vortex connected, and vortex separated. Figs 3-4 shows the vortex used in this study.



(a) Closed container (CC) location



(b) Without vortex (WV) location



(c) Connected vortex (CV) location



(d) Separated vortex (SV) location

Fig. 2. Variable location

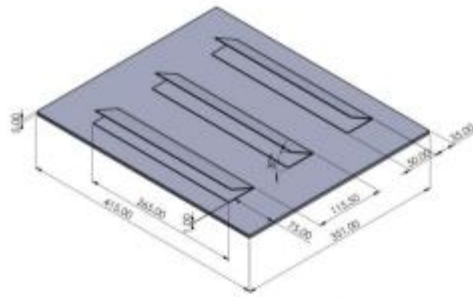


Fig. 3. Connected vortex (CV)

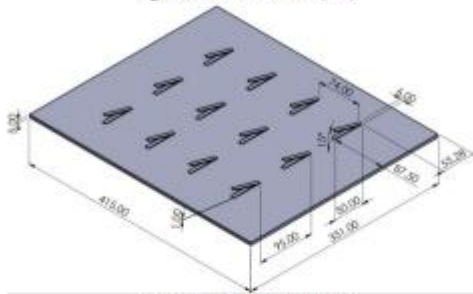


Fig. 4. Separated vortex (SV)

Refprop™ software version 10.0.0.9b is used to determine the properties of the refrigerant at enthalpy at each point based on the cooling system performance data by analyzing the saturation pressure, temperature, enthalpy, entropy, and density of the refrigerant [24], [25]. System performance is analysed using pressure and temperature obtained through calculations on R410A refrigerant using Refprop™ software [26]. The effectiveness of an air conditioner is evaluated by determining the refrigeration effect, which is the difference in refrigerant enthalpy between the evaporator's inlet and outlet, and the compression work, which is the enthalpy difference between the compressor's outlet and inlet. The values of RE, CW, and COP are determined based on the obtained enthalpy results [27]. The RE, CW, COP are determined using Eqs(1-3) [28]. Where: h_1 is enthalpy at the compressor inlet, h_2 is Enthalpy at the compressor outlet, and h_4 is enthalpy at the Evaporator inlet.

$$RE = h_1 - h_4 \quad (1)$$

$$CW = h_2 - h_1 \quad (2)$$

$$COP = \frac{RE}{CW} = \frac{h_1 - h_4}{h_2 - h_1} \quad (3)$$

3 Results and Discussion

This study examines the performance of WAC for utilization as a desalination tool with four variables: CC, WV, CV, and SV. Fig. 5 shows the data collection process. At points 1 to 4, data of P_1 , T_1 , P_2 , T_2 , P_3 , T_3 , P_4 , and T_4 are collected sequentially. The digital scale at point 5 is used to measure the mass of water in the evaporation container to determine the decrease in mass due to evaporation. The seawater in the main container was heated by a condenser controlled by a thermostat to maintain a temperature between 55-60°C. Data was collected every 5 minutes for 8 hours. The system performance is greatly affected by the evaporation rate, which impacts the COP value of the WAC. In addition, this process demonstrates how the integration of vortex generators can improve desalination efficiency.

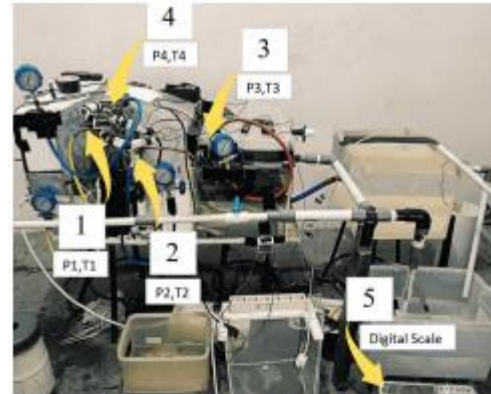


Fig. 5. WAC as a desalination devices

Fig. 6 shows the pressure-enthalpy (P-h) diagram for R410A refrigerant at various variables, namely CC, WV, CV, and SV. The enthalpy values are obtained from the calculation results using Refprop™ software, with input data in the form of pressure and temperature at each point: P_1 , T_1 , P_2 , T_2 , P_3 , T_3 , P_4 , and T_4 . The average evaporator exit air temperature for each variable is 17.8°C, 18.6°C, 18.7°C, and 18.9°C, respectively. Meanwhile, the condenser exit air temperatures were 55.7°C, 56.3°C, 56.9°C, and 57.1°C, respectively. Based on the enthalpy values obtained, the performance of the WAC system can be calculated, including the RE, CW, and COP values.

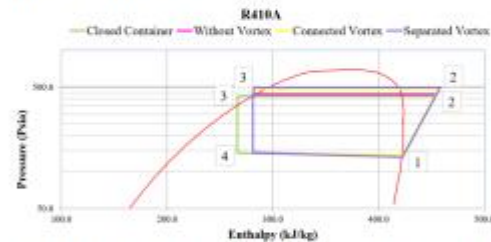


Fig. 6. P-h diagram for R410A with a closed container, without vortex, connected vortex, and separated vortex

In a refrigeration system, efficiency is crucial to consider. One concept that plays a role in measuring the efficiency of a refrigeration system is the RE, which is the amount of heat absorbed by the refrigerant in the evaporator for each unit mass of cooling, which occurs in the process from 4 to 1 [29], [30]. By calculating using Eq. 1, the RE of R410A for various CC, WV, CV, and SV variables in the desalination process is shown in Fig. 7. The results show a decrease in RE; a lower refrigeration effect can lower COP [31]. The latent heat of vaporization in the Air Conditioning (AC) system comes from the evaporation of refrigerant [32]. The closed container of R410A has the highest RE value. The high RE value is due to the latent heat of vaporization [33] and high enthalpy compared to the other variable, R410A. As a result, the desalination process using closed-container R410A yields better cooling capacity than the other variable, R410A.

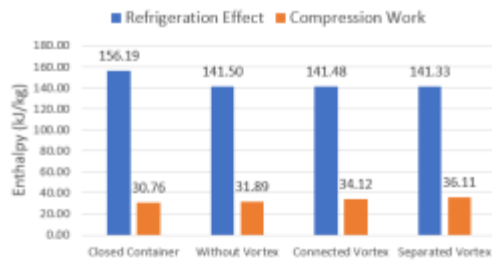


Fig. 7. Refrigeration effect and compression work with closed container, without vortex, connected vortex, and separated vortex.

Meanwhile, the CW of R410A for various variables, the CW value in the figure is calculated using Eq.2. Unlike RE, CW has a constant increase. This is due to the increase in compressor pressure, the refrigerant temperature [34], and enthalpy. An increase in refrigerant pressure can increase compressor work, thus decreasing the COP value [35]. CW of the closed container R410A is lower than that of the other variable R410A. This indicates that the R410A refrigerant in the sealed container has a lower temperature, so the compressor workload is lighter [36].

The COP is calculated using Eq. 3, and Fig. 8 shows that the COP value decreases as the evaporation increases. The use of a vortex increases the evaporation rate and efficiency in the desalination unit, resulting in faster evaporation [37], [38]. CV and SV have different geometry so it can affect the characteristics of airflow. CV has fewer and connected, while SV with more separated numbers produces better evaporation and increased effectiveness [39].

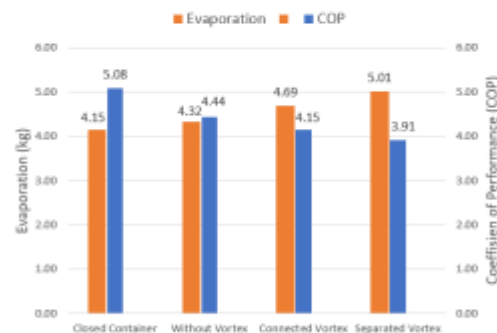


Fig. 8. Evaporation and COP with closed container, without vortex, connected vortex, and separated vortex.

On the other hand, an increase in refrigerant in the refrigeration machine can lead to an increase in temperature in the condenser, which requires greater compression effort [40]. The condenser located inside the main container helps to heat the water and increase evaporation as the temperature rises. The increased evaporation temperature from the condenser is then transferred to the evaporator through a steam funnel designed to direct the incoming air to the evaporator. The CC is secured with plates to prevent evaporation in the condenser from affecting the temperature of the air entering the evaporator. This causes a high refrigeration effect and reduces compression work, resulting in an optimal COP.

4 Conclusion

This study demonstrates that incorporating a vortex generator into a modified WAC significantly impacts seawater evaporation

rates in desalination. The SV configuration produced the highest evaporation rate (5.01 kg) but reduced system efficiency by increasing compressor workload, leading to a lower COP (3.91). Conversely, the CC condition achieved the highest COP (5.08) by minimizing heat loss and stabilizing air temperature entering the evaporator. These findings highlight the trade-off between evaporation enhancement and system efficiency.

Future research should explore alternative vortex configurations, large scale testing, and environmental variations to optimize WAC-based desalination systems.

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Enhancing Seawater desalination performance using a vortex generator in a modified window air conditioner

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Abstract

The growing demand for air conditioning systems has driven research into alternative applications, such as seawater desalination. This study evaluates the performance of a modified Window Air Conditioner (WAC) integrated with a vortex generator for desalination. Experiments were conducted using R410A refrigerant under four conditions: Closed Container (CC), Without Vortex (WV), Connected Vortex (CV), and Separated Vortex (SV). Seawater was heated via the condenser to 55-60°C, controlled by a thermostat, and data was collected every five minutes over eight hours. The thermodynamic properties of R410A were analysed using Refprop™ software to determine the Refrigeration Effect (RE), Compression Work (CW), and Coefficient of Performance (COP). Results indicate that the SV configuration achieved the highest evaporation rate (5.01 kg) but led to a lower COP (3.91) due to increased condenser temperature and compressor workload. Conversely, CC yielded the highest COP (5.08) by stabilizing the evaporator air temperature and reducing compressor effort. These findings suggest that vortex generators enhance evaporation rates but reduce system efficiency. Further research is needed to optimize vortex generator configurations to improve desalination efficiency while minimizing COP reduction.

Keywords:

Window air conditioner, vortex generator, desalination, Refprop™, COP

1 Introduction

Along with the improvement of the quality of life and the need for comfort, the use of air conditioning systems is increasing in daily life [1], [2]. Air conditioning systems also help remove moisture and airborne particles from the room [3]. Therefore, the use of air conditioners is no longer just part of a lifestyle but rather aims to provide comfort when moving or doing activities indoors [4]. One of the most common types is the Window Air Conditioner (WAC), which uses a vapor compression cycle to take heat from the air inside and expel it outside through condensation [5]. This condensation water is usually disposed of as waste but can be used to make clean water under certain conditions [6]. The high demand for clean water around the world, as well as environmental issues such as drought and limited availability of clean water resources, are major challenges that need to be addressed [7], [8], [9]. The use of a modified WAC as a desalination device is an option to consider. This modification allows the WAC to function as both an air conditioning unit and a system to separate salt from saltwater.

Evaluating the performance of the WAC as a desalination device is essential to ensure the effectiveness of this system in removing salt from seawater.

Desalination systems, such as reverse osmosis (RO), are currently available [10]. However, such technologies consume much energy [11], especially on a large scale, making it inefficient for households or places with limited energy resources. On the other hand, WAC is a device that is widely used in many homes [12] and operates according to the principles that allow it to be used in desalination processes. The main problem is how to modify the WAC without compromising its cooling efficiency and ensuring optimal system performance during its switch to desalination function.

Research on the use of air conditioning for desalination processes is still in its infancy. Some of the research that has been conducted includes the integration of a split air conditioning system with a Humidification-Dehumidification (HDH) desalination unit utilizing solar energy, the utilization of solar heating to improve the performance of a hybrid desiccant air conditioning system coupled with an HDH desalination unit, numerical analysis of a hybrid air conditioning system supported by solar energy and integrated with an HDH desalination system, and modified window air conditioner to produce potable water through humidification-dehumidification desalination process [13], [14], [15], [16]. These experiments show that combining an air conditioning system with a desalination unit can produce clean water. Nevertheless, these studies have not investigated the impact of vortex generators on desalination effectiveness, particularly in enhancing the evaporation rate. Multiple studies have investigated the application of vortex generators in desalination to enhance the evaporation rate [17], [18], given that vortex generators influence the convection heat transfer coefficient [19]. Previous research has not examined the performance of WAC modified with a vortex generator as a desalination tool against seawater evaporation. Desalination itself is the process of separating salt and minerals from seawater to produce freshwater [20]. Cooling system performance can be determined by assessing the Refrigeration Effect (RE), Compression Work (CW), and Coefficient of Performance (COP) [21].

Therefore, this study aims to determine the performance of the modified WAC as a desalination device against seawater evaporation. This research has analysed the impact of various tested variables on the evaporation of seawater at a given temperature. The desalination mechanism focuses on the evaporation process, where seawater is evaporated using the modified WAC. The performance assessment of this system uses the parameters RE, CW, and COP, which are the main indicators in assessing the ability of the device as a desalination system. It is hoped that this research can provide a deep insight into the potential of WAC modification to produce a more effective and efficient desalination system.

2 Method

This study used a WAC to compare its performance as a desalination device. The experimental setup used in this study is presented in Fig. 1. The working fluid of the air conditioning system is R410A refrigerant [22] with the specifications shown in Table 1. This research was conducted at the Mechanical Engineering Laboratory, Faculty of Industrial Technology and Informatics, Universitas Muhammadiyah Prof. Dr. Hamka. In addition, the measurement tools used are listed in Table 2. Tests on the utilization of WAC as a desalination tool were carried out with variables of Closed Container (CC), Without Vortex (WV), Connected Vortex (CV), and Separate Vortex (SV) (Fig. 2).

Refprop™ software version 10.0.0.9b is used to determine the properties of the refrigerant at enthalpy at each point based on the cooling system performance data by analyzing the saturation pressure, temperature, enthalpy, entropy, and density of the refrigerant [24], [25]. System performance is analyzed using

pressure and temperature obtained through calculations on R410A refrigerant using Refprop software [26]. The effectiveness of an air conditioner is evaluated by determining the refrigeration effect, which is the difference in refrigerant enthalpy between the evaporator's inlet and outlet, and the compression work, which is the enthalpy difference between the compressor's outlet and inlet. The values of RE, CW, and Coefficient of COP are determined based on the obtained enthalpy results [27].

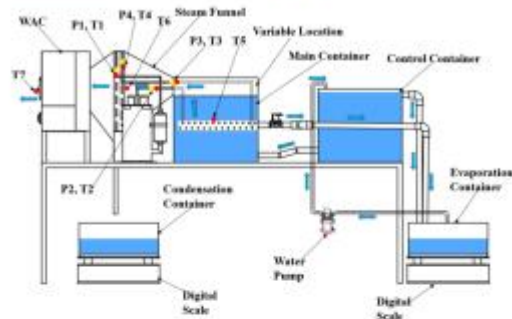


Fig. 1. Experimental setup

Table 1. Refrigeration unit specifications

Dimension	Specification
Model WAC	Uchida MP – W9M
Voltage	1 Fase 220V – 50 Hz
PK Power	1 PK
Cooling Capacity	8600 BTU/h
Electrical power	840 W
Current	4.0 A
EER	10.01 BTU/hW
Refrigerant R410A	360 g
Size	500×345×465 mm

Table 2. Measurement tools

Tools	Function	Specification
Thermostat XH-W3001	Water temperature	-50°C -110°C, ±0.1°C.
Digital thermometer	Temperature	-50°C -110°C, ±0.1°C.
Manifold Gauge	Pressure	0 – 500 psi, 5 psi
Digital scale 30 kg	Water Mass	0 – 30 kg, 0.005 kg

In this experiment, the seawater in the evaporation container is transferred to the control container via a pump. This step aims to deliver the water to the main container, where it will be heated using a condenser until the temperature reaches about 55-60°C, which is regulated by a thermostat. As the water evaporates, the resulting vapor is directed upwards through the steam funnel before finally entering the evaporator.

The main container has an overflow mechanism that delivers water to the evaporation container to maintain the temperature in the range of 55-60°C. In addition, the control container is also equipped with an overflow system for the evaporation container to ensure the water level remains stable. This system allows the control container's water level to remain constant while the evaporation container's water level drops due to the evaporation process [23]. The

evaporation rate was determined by the mass of water in the evaporation container, which was measured with a digital scale to confirm the amount of water lost owing to evaporation. In Fig. 1

data was collected at P₁, T₁, P₂, T₂, P₃, T₃, P₄, T₄, T₅, T₆, T₇. Where

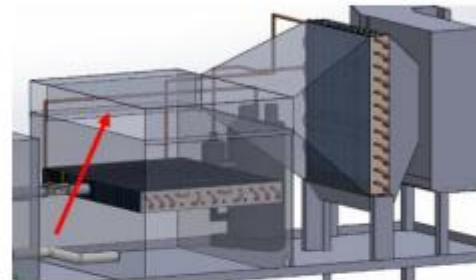
P₁, T₁ is the compressor inlet pressure, temperature, P₂, T₂ is the compressor outlet pressure, temperature, P₃, T₃ is the expansion inlet pressure, temperature, P₄, T₄ is the expansion outlet pressure,

temperature, T₅ is the condenser temperature, T₆ is the evaporator temperature, T₇ is the evaporator outlet air temperature, and the

variable location is used for a closed container by placing a plate on top of the container, a container without vortex, vortex connected, and vortex separated. Figs 3-4 shows the vortex used in this study.



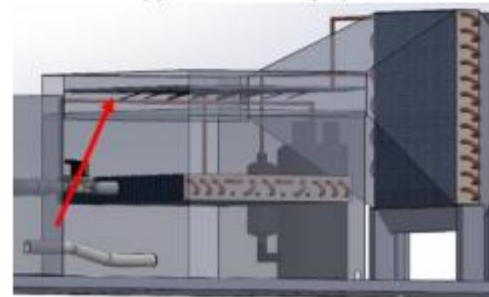
(a) Closed container (CC) location



(b) Without vortex (WV) location

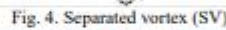
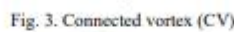


(c) Connected vortex (CV) location



(d) Separated vortex (SV) location

Fig. 2. Variable location


$$\begin{aligned} \text{RE} &= h_1 - h_3 & (1) \\ \text{CW} &= h_2 - h_1 & (2) \\ \text{COP} &= \frac{\text{RE}}{\text{CW}} = \frac{h_1 - h_3}{h_2 - h_1} & (3) \end{aligned}$$

This study examines the performance of WAC for utilization as a desalination tool with four variables: CC, WV, CV, and SV. Fig. 5 shows the data collection process. At points 1 to 4, data of P_1 , T_1 , P_2 , T_2 , P_3 , T_3 , P_4 , and T_4 are collected sequentially. The digital scale at point 5 is used to measure the mass of water in the evaporation container to determine the decrease in mass due to evaporation. The seawater in the main container was heated by a condenser controlled by a thermostat to maintain a temperature between 55–60°C. Data was collected every 5 minutes for 8 hours. The system performance is greatly affected by the evaporation rate, which impacts the COP value of the WAC. In addition, this process demonstrates how the integration of vortex generators can improve desalination efficiency.



In a refrigeration system, efficiency is crucial to consider. One concept that plays a role in measuring the efficiency of a refrigeration system is the RE, which is the amount of heat absorbed by the refrigerant in the evaporator for each unit mass of cooling, which occurs in the process from 4 to 1 [29], [30]. By calculating using Eq. 1, the RE of R410A for various CC, WV, CV, and SV variables in the desalination process is shown in Fig. 7. The results show a decrease in RE; a lower refrigeration effect can lower COP [31]. The latent heat of vaporization in the Air Conditioning (AC) system comes from the evaporation of refrigerant [32]. The closed container of R410A has the highest RE value. The high RE value is due to the latent heat of vaporization [33] and high enthalpy compared to the other variable, R410A. As a result, the desalination process using closed-container R410A yields better cooling capacity than the other variable, R410A.

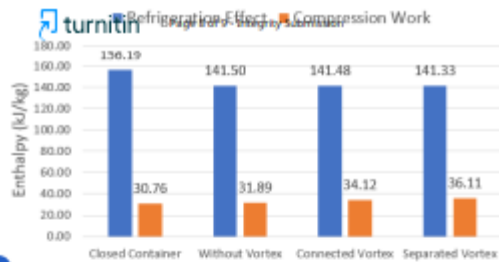


Fig. 7. Refrigeration effect and compression work with closed container, without vortex, connected vortex, and separated vortex.

Meanwhile, the CW of R410A for various variables, the CW value in the figure is calculated using Eq.2. Unlike RE, CW has a constant increase. This is due to the increase in compressor pressure, the refrigerant temperature [34], and enthalpy. An increase in refrigerant pressure can increase compressor work, thus decreasing the COP value [35]. CW of the closed container R410A is lower than that of the other variable R410A. This indicates that the R410A refrigerant in the sealed container has a lower temperature, so the compressor workload is lighter [36].

The COP is calculated using Eq. 3, and Fig. 8 shows that the COP value decreases as the evaporation increases. The use of a vortex increases the evaporation rate and efficiency in the desalination unit, resulting in faster evaporation [37], [38]. CV and SV have different geometry so it can affect the characteristics of airflow. CV has fewer and connected, while SV with more separated numbers produces better evaporation and increased effectiveness [39].

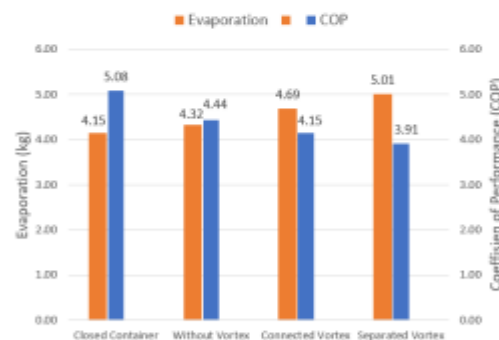


Fig. 8. Evaporation and COP with closed container, without vortex, connected vortex, and separated vortex.

On the other hand, an increase in refrigerant in the refrigeration machine can lead to an increase in temperature in the condenser, which requires greater compression effort [40]. The condenser located inside the main container helps to heat the water and increase evaporation as the temperature rises. The increased evaporation temperature from the condenser is then transferred to the evaporator through a steam funnel designed to direct the incoming air to the evaporator. The CC is secured with plates to prevent evaporation in the condenser from affecting the temperature of the air entering the evaporator. This causes a high refrigeration effect and reduces compression work, resulting in an optimal COP.

4 Conclusion

This study demonstrates that incorporating a vortex generator into a modified WAC significantly impacts seawater evaporation

rates in desalination. The SV configuration produced the highest evaporation rate (5.01 kg) but reduced system efficiency by increasing compressor workload, leading to a lower COP (3.91). Conversely, the CC condition achieved the highest COP (5.08) by minimizing heat loss and stabilizing air temperature entering the evaporator. These findings highlight the trade-off between evaporation enhancement and system efficiency.

Future research should explore alternative vortex configurations, large scale testing, and environmental variations to optimize WAC-based desalination systems.

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