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Web-Based Value Added Tax Management Application for Villa Rentals: A Study of a Villa in Bandung

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ABSTRACT

This study illustrates that image preprocessing substantially influences the precision of wrinkle identification in human skin utilizing Convolutional Neural Networks. The CLAHE methodology is the most efficacious standalone preprocessing strategy for enhancing model performance. The integration of CLAHE with sharpening achieves the highest accuracy while maintaining an optimal balance between precision, recall, and F1-score. These findings underscore that image preprocessing is an essential element of the CNN-based wrinkle detection framework, and that integrating CLAHE and sharpening is advised to improve the reliability of the wrinkle detection system.

Keywords: Value Added Tax, Villa Rental

INTRODUCTION

The progression of digitization requires the implementation of efficient information systems to facilitate diverse operations, particularly within the tax domain. The author's observations and literature analysis at a villa in Bandung revealed that the management of Value Added Tax (VAT) on villa rentals is still managed manually through physical record-keeping.

This approach results in numerous problems, including computational inaccuracies, erroneous documentation, potential data loss due to human error, and increased time demands, culminating in diminished work efficiency and tax reporting precision.

The author developed a web-based application for managing value-added tax by understanding the current system, identifying existing challenges, and designing a solution that is more efficient, precise, and organized.

Basic Concepts of Application, (Haruna et al., 2021) define an application as a ready-to-use program capable of executing a sequence of commands to address problems through data processing on a computer or smartphone, to achieve precise, consistent results that align with the application's intended purpose.

(Puspitasari et al., 2024) define an application as a subclass of computer software that directly employs a computer's functionalities to execute tasks requested by the user. Applications are developed to streamline particular functions or processes, including data application, use, and augmentation.

(Lidjang et al., 2024) characterizes an application as a software unit deliberately designed to fulfill the requirements of diverse activities or jobs, encompassing business operations, advertising, public services, gaming, and other human endeavors.

Based on these expert definitions, I deduce that an application is software designed to facilitate users in performing specific tasks or activities with greater ease, speed, and precision, whether on a computer or a smartphone. Applications are designed to streamline data processing, enhance task execution, and assist diverse human activities, encompassing business, services, and leisure.

Unified Modeling Language (UML), (Alarco & Auccahuasi, 2023) state that "UML is a language utilized to define, visualize, construct, and document various aspects (information processes generating preliminary formations for software development, whether as models, explanations, or software, including business modeling and other non-software systems)."

(Lestari et al., 2024) asserts that UML is a highly dependable tool for object-oriented system development, as it provides a visual modeling language that enables developers to produce blueprints of their concepts in a standardized, comprehensible format, along with efficient methods for sharing and communicating their designs with others.

(Lulage et al., 2023) define "Unified Modeling Language (UML) as a modeling language employed to specify, visualize, construct, and document artifacts of software systems, regardless of their design or development stage."

In conclusion, according to expert definitions, the Unified Modeling Language (UML) is a visual modeling language used to specify, visualize, design, and document various aspects of software systems, especially in object-oriented development.

Database, a database is an assemblage of systematically arranged and interrelated material that can be readily accessed. Databases are generally situated on computing devices and are autonomously administered by a Database Management System (DBMS). A database is an organized structure for storing data. Databases are crucial for systematically collecting information, data, or files.

(MUSTIKAYANI, 2023) assert that a database serves as a repository for processed data located in libraries and comprises source tools meticulously curated by specialists to facilitate successful input management.

Computerized databases significantly improve a company's operations.

A database is an assemblage of data systematically organized according to defined criteria, interconnected to consolidate files, tables, or records stored across diverse electronic media for enhanced management. This management enables users to efficiently search, store, and dispose of information (Pratiwi et al., 2022).

According to the aforementioned expert definitions, I deduce that a database is a systematically organized collection of data or information stored on a computer, governed by specific criteria, and accessible via programs to facilitate the efficient processes of data storage, retrieval, processing, and deletion.

MySQL, MySQL is a widely utilized database server. It accommodates the PHP programming language and Structured Query Language (SQL). This is attributable to the standard regulations set forth by the American National Standards Institute (ANSI) in relation to SQL operations. MySQL is a Relational Database Management System (RDBMS).

MySQL (My Structured Query Language) is one of several Database Management Systems (DBMS), including Oracle and PostgreSQL. It is utilized for database management using SQL. MySQL is open-source software, permitting users free access. PHP technology interfaces effectively with MySQL databases (Fahira et al., 2025).

Ramadhan and Mukhaiyar (2020) assert that MySQL is widely recognized as a database server among programmers. It uses SQL for database access and is compatible with various systems, including Windows and Linux.

Consequently, MySQL is a widely utilized open-source relational database management system (RDBMS) favored by developers. It utilizes SQL for data management, supports PHP, and operates on multiple platforms, including Windows and Linux.

XAMPP, XAMPP is an installation package that comprises Apache, a web server for hosting essential website files, and phpMyAdmin, a tool for managing MySQL databases (Hartati et al., 2024).

Adi Baskoro states that XAMPP is server software that runs on Windows, macOS, and Linux. XAMPP facilitates the operation of web applications and Content Management Systems (CMS), such as Joomla, Drupal, and WordPress (Agustina & Hartono, 2022).

XAMPP is an Apache web server application that includes a built-in MySQL server and is powered by the PHP programming language to develop dynamic websites. It is compatible with two operating systems: Windows and Linux. The installation procedure for Linux uses the command line, whereas Windows offers a

graphical interface, making it easier to use (Ilham Febri Budiman, 2025).

Based on the aforementioned definitions, XAMPP is a web server software suite comprising Apache, MySQL, PHP, and phpMyAdmin, utilized for the local development and operation of websites across diverse operating systems, including Windows and Linux. XAMPP facilitates the building of dynamic websites and accommodates several CMS platforms.

Visual Studio Code, Visual Studio Code (VSC) is a source code editor created by Microsoft for Linux, macOS, and Windows platforms. It provides functionalities including syntax highlighting, code completion, code snippets, refactoring, debugging, and Git integration. Microsoft has published the source code for Visual Studio Code on GitHub under the MIT license (Code – OSS).

(Dwi Septiani, 2023) states that Visual Studio Code is a cross-platform application compatible with Windows, Linux, and macOS. VS Code is a lightweight yet robust source code editor that accommodates a variety of programming languages, including Java, JavaScript, Go, C++, and others. The components are analogous to those utilized in Azure DevOps. Visual Studio provides a cross-platform code editor that enables users to develop or construct web applications.

(Jadidah et al., 2025) states that Visual Studio Code is a lightweight and dependable text editor developed by Microsoft, compatible with several operating systems, including Linux, Mac, and Windows. This text editor natively supports programming languages like JavaScript, TypeScript, and Node.js, and also supports other languages through plugins available in the Visual Studio Code marketplace, including C++, C#, Python, Go, Java, PHP, and more.

In conclusion, Visual Studio Code is a lightweight, free source code editor developed by Microsoft, compatible with multiple operating systems. VSC offers extensive features, including syntax highlighting, code completion, Git integration, and support for numerous programming languages via extensions, establishing it as a premier option for developers.

Laravel, (Ilham et al., 2024) assert that Laravel is a PHP application framework that adheres to the Model-View-Controller architectural paradigm. It is licensed under the MIT license and uses GitHub as a platform for code sharing. Laravel is a complimentary, open-source framework, enabling its use without any financial obligations.

Consequently, Laravel is an open-source PHP framework that follows the Model-View-Controller (MVC) paradigm and is licensed under the MIT license. It aims to streamline web development, improve software quality, and decrease development and maintenance expenses. Laravel enhances the dynamism and efficiency of website development.

This program employs the Object-Oriented Analysis and Design (OOAD) methodology to enhance organization, modularity, and ease of future development. The deployment of this information system is anticipated to streamline and improve the administration department's efficiency, facilitate tax reporting, and ensure compliance with relevant tax legislation.

METHOD

This study employs a qualitative approach that emphasizes a comprehensive investigation of the current system and user requirements. This methodology entails data collection through interviews, surveys, and direct observations at the research location, a petrol station currently using a manual recording system. Interviews will be held with employees and management to examine the difficulties they encounter in transaction processes and record-keeping. Furthermore, data will be collected via a survey to assess user satisfaction and the efficacy of the proposed system. All collected information will be scrutinized to determine user requirements and expectations for the development of a novel technology-driven solution. This methodology seeks to elucidate how the current system might be enhanced to bolster operational efficiency and service quality.

System Development Methodology, this study employs the Object-Oriented Analysis and Design (OOAD) methodology, which analyzes system requirements through the lens of classes and objects relevant to the domain of the issue. Object-Oriented Analysis and Design (OOAD) is intended to guide software architecture by managing objects within the system or its subsystems. This methodology prioritizes the representation of classes and objects based on real-world notions, offering a novel perspective for conceptualizing problems through models that mirror actual realities. The cornerstone of this system design is the object, which integrates data structures and activities into a single entity. Utilizing OOAD is anticipated to yield more innovative and effective solutions while enabling adaptation to future evolving requirements. This method emphasizes technical elements while also being equipped to address the dynamics of daily gas station operations, thereby improving overall system performance.

RESULTS and DISCUSSION

Design, Use Case Diagram, a Use Case Diagram is a UML diagram that illustrates the interactions between actors (users or other systems) and the system under development. The following is a detailed account of the business events and the manner in which users will engage with the

system.

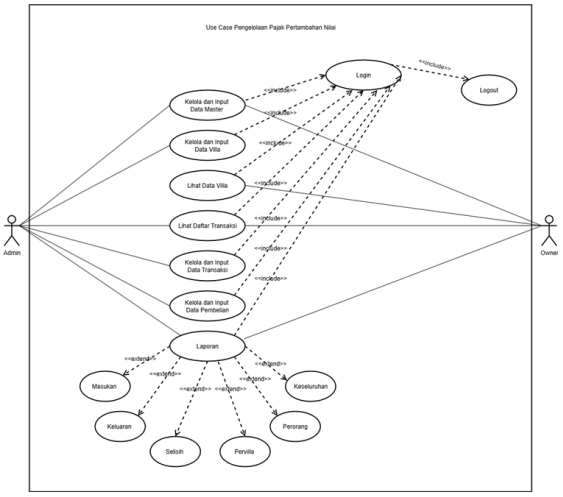


Figure 1. Use Case Diagram

Definition of Actor, the Use Case Diagram for administering Value Added Tax (VAT) on villa rentals delineates two principal actors inside the system: the Admin and the Owner. In this environment, each participant possesses unique roles and access privileges. The table below delineates the definitions of the stakeholders or system users directly associated with the planned system.

Table 1. Definition of Actor

No	Actor	Description
1.	Admin	The administrator is the individual entirely accountable for overseeing the system. Their responsibilities include entering villa information, rental transactions, and tenant details, as well as ensuring VAT computations are automated. The administrator can manage reports, print transaction receipts, and update essential system information.
2.	Owner	Owners are users with restricted access to view data and reports. They are unable to add or modify data, except for master data; nonetheless, they can oversee transactions, view input and output VAT reports, and assess business performance based on the data in the system.

Definition of Use Case, This table defines the Use Case Diagram for the designed system, serving as a visual depiction of the interactions between actors (users or other systems) and the system's primary functions.

These definitions lay the foundation for understanding the system's operation from the user's perspective and facilitate a comprehensive analysis and design process. For additional clarity, the definitions are located in the subsequent tables:

Table 2. Use Case Definition

No	Use Case	Description
1.	Login	Allows actors to log in and access system services.
2.	Manage and Input Master Data	This is a prevalent method for administering program user data, including administrators and proprietors. Administrators and

		proprietors with the capability to add, alter, or remove users, in addition to assigning responsibilities. This feature facilitates the management of user access rights in accordance with their responsibilities.
3.	Manage and Input Villa Data	This is a comprehensive framework for managing villas, encompassing the addition, modification, and deletion of villa data, including villa name, available stock, initial stock, weekday prices, weekend prices, descriptions, discounts, and photographs, all administered by the administrator.
4.	View Villa data	This is a general form of villa data that has been input.
5.	View Transaction List	This is a general form of transaction data that has been input.
6.	Manage and Input Transactions	This is a standardized template for documenting villa rental transactions. The input data comprises the rented villa, the tenant's identity, the check-in and check-out dates and times. At the same time, the system autonomously computes the total price and VAT depending on the rental price and duration. It also oversees transaction data (additions, modifications, and deletions) by the administrator and facilitates the download of transaction proof.
7.	Manage and Input Purchase Data	This denotes a standard format for documenting the acquisition of goods/services subject to VAT (e.g., villa equipment). The Administrator enters the item name, quantity, and price, while the input VAT is computed automatically. This data is used to calculate input VAT in reports and to manage purchase information, including the addition, modification, and removal of entries.
8.	Report	This delineates a standard framework for accessing and printing VAT reports, encompassing both input and output, inconsistencies, etc., with filters for month, year, or overall data. Furthermore, it facilitates PDF

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		exportation and printing.
9.	Logout	Allows actors to exit the system.

Activity Diagram, an activity diagram is a representation in the Unified Modeling Language (UML) that illustrates the progression of activities or processes within a system, encompassing the entire sequence from initiation to completion, together with decision-making and process branching. Refer to the subsequent photos for an activity diagram with additional details.

Activity Diagram Login, this picture depicts the functionality of a designated action, specifically the Login action. Additional information is available in the image below.

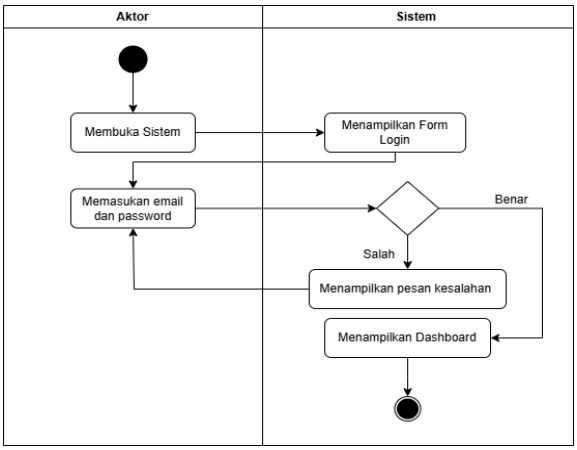


Figure 2. Login Activity Diagram

Admin Activity Diagram, this outlines the procedures the Administrator follows to enter and oversee villa rental transactions. The procedure entails documenting the renter's details, selecting the villa, setting the rental dates, automatically calculating the price and 12% VAT, specifying the payment method (down payment or full payment), and downloading or printing the rental transaction receipt. For more clarity, please refer to the illustration below.

Figure 3. Activity Diagram of Villa Rental Transactions (Villa Rental Admin)

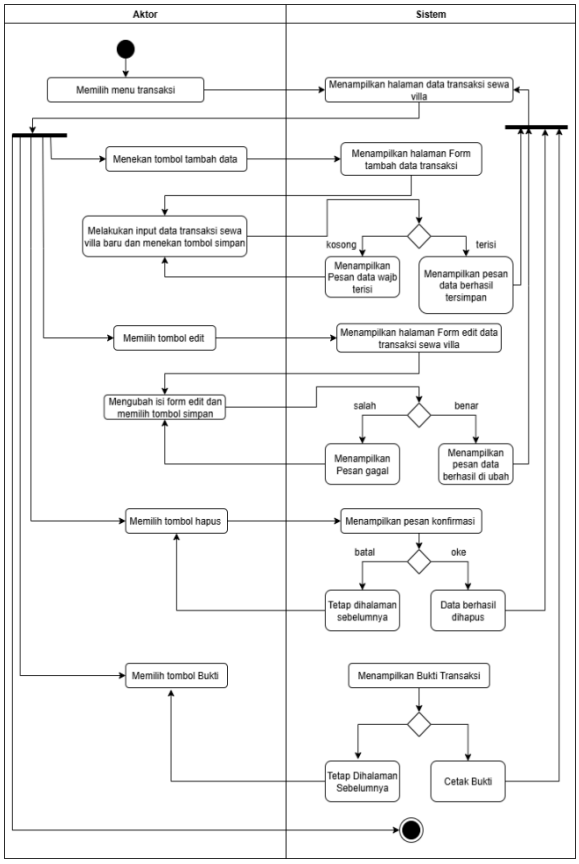


Figure 3. Activity Diagram of Villa Rental Transactions (Villa Rental Admin)

Activity Diagram Owner, this figure depicts the procedure the Owner follows when accessing the transaction list.

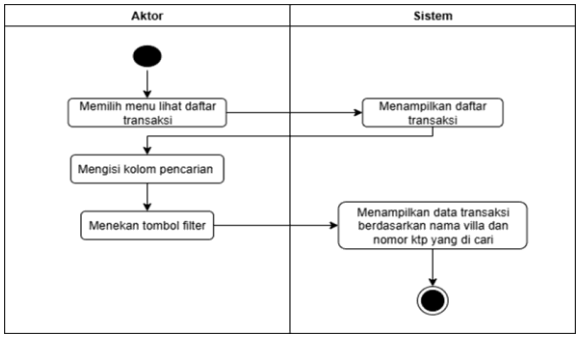


Figure 4. Activity Diagram View Transaction List (Owner)

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Vol 6, No. 1, June, 1 – 13
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Sequence Diagram, a Sequence Diagram is a UML diagram that depicts the chronological sequence of interactions between objects in a system, illustrating the flow of messages transmitted and received over time. For more understanding, the Sequence Diagram is illustrated in the subsequent figures. The following is the sequence diagram for the login procedure of the VAT management application:

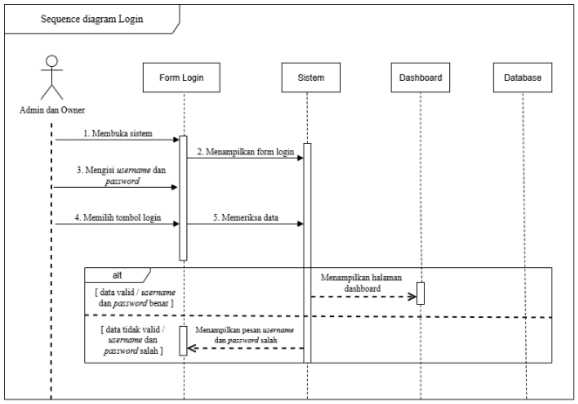


Figure 5. Login Sequence Diagram

Class Diagram, a Class Diagram is a phase in the creation of a visual representation that depicts the structure of the established system. The Class Diagram illustrates the configuration of classes, attributes, methods, and interrelationships in an Object-Oriented Programming (OOP) framework.

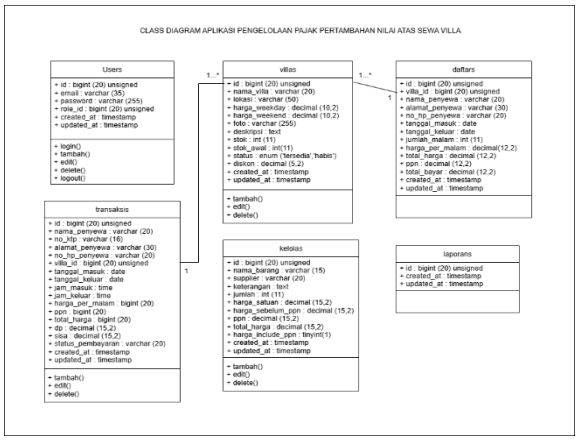


Figure 6. Class Diagram

Database Implementation, a Class Diagram is a phase in the creation of a visual representation that depicts the structure of the established system. The Class Diagram illustrates the configuration of classes, attributes, methods, and interrelations among classes in an Object-Oriented Programming (OOP) framework.

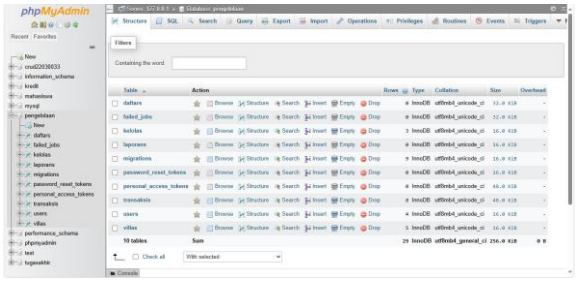


Figure 7. Database Table

Interface Implementation, a Class Diagram is a phase in the creation of a visual representation that depicts the structure of the established system. The Class Diagram illustrates the configuration of classes, attributes, methods, and interrelations among classes in an Object-Oriented Programming (OOP) framework.

Login Page, the login page functions as the primary access point to the VAT management program. Users must provide a valid email and password that correspond to the information registered in the system. Access to this program is restricted to those who have an account and designated permissions.

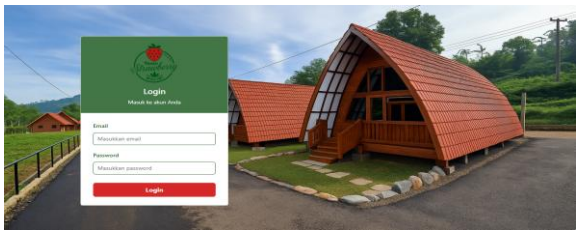


Figure 8. Admin and Owner Login Page

Acman: Accounting and Management Journal
Vol 6, No. 1, June, 1 – 13
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Dashboard Page, this perspective illustrates the dashboard interface within the system. This page facilitates visualization of the booking calendar and input and output VAT graphs, and provides a summary of available villa inventory.

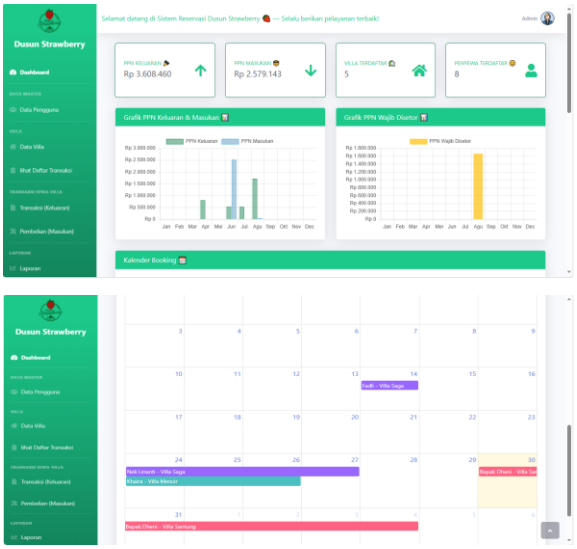


Figure 9. Dashboard page

User Data Page, this perspective illustrates the page that presents user data within the system. The Admin and the Owner have access permissions to manage this data, including adding, modifying, or deleting user information. The controlled data comprises usernames, email addresses, passwords, and corresponding responsibilities. This page streamlines account administration and the establishment of user access privileges within the VAT management system for villa rentals.



Figure 10. User Data Page

Villa Data Page, this view illustrates the page that offers villa information within the system. Only the Administrator has the access rights to administer this data, encompassing the addition, modification, or deletion of villa information. The curated data encompasses the villa's name, price, images, location, and further details.

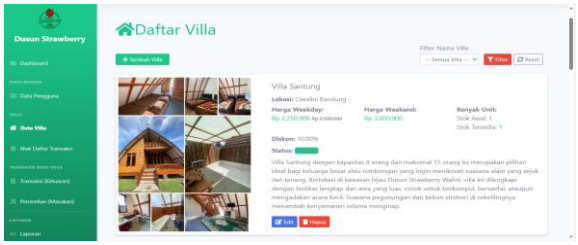


Figure 11. Villa Data Page

Villa Rental Transaction Page, this view shows the page that displays transaction data in the system. Only the Administrator has access permissions to control this data, including the addition, modification, or deletion of transaction information. The controlled data comprises the renter's name, address, identification number, the villa's name for rental, total price calculation, and the automatically created VAT within the system, among other particulars. This website facilitates management and input, and provides transaction receipts that can be printed or downloaded as PDFs.



Figure 12. Villa Rental Transaction Page

Villa Purchase Page

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This view illustrates the page that presents purchase data within the system. Only the Administrator has access permissions to control this data, including the addition, modification, or deletion of purchase information. This page streamlines the administration of acquisitions and the calculation of input VAT on villa rentals.

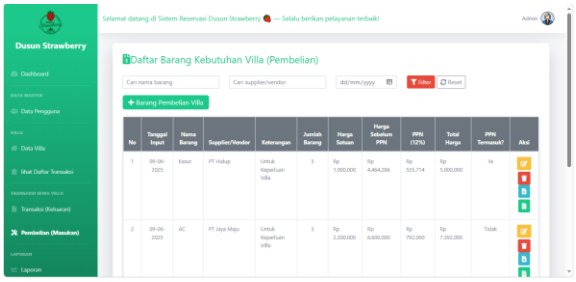


Figure 13. Villa Operational Purchase Page

CONCLUSION

The research findings indicate that a web-based Value Added Tax (VAT) management application for villa rentals in Bandung has been successfully designed and developed to facilitate the structured and efficient recording and management of villa rental transactions. This technology can supplant the hitherto employed manual procedures, reducing recording inaccuracies and accelerating staff workflows. The system can automatically calculate 12% VAT, thereby minimizing calculation errors, expediting tax data processing, and improving accuracy and compliance with relevant tax legislation.

The tool mitigates reliance on specific individuals by featuring a user-friendly interface comprehensible to all staff members. Upon completion of basic training, all personnel are capable of operating the system autonomously, provided they have their superiors' approval.

The author presents many recommendations to guarantee that this VAT management program for villa rentals maintains its best advantages and can be further enhanced. The organization should implement frequent training for all employees to enhance their understanding of system use, thereby reducing reliance on certain personnel for transaction and tax administration. The system can be augmented with additional functionalities, including the management of supplementary services (food, transportation, ancillary facilities), interfacing with online tax systems (e-Faktur or DJP Online), and notification capabilities for monthly tax reporting. Additionally, the organization must routinely assess the system from both technical and user-experience perspectives to ensure its relevance, security, and alignment with evolving operational requirements and forthcoming tax legislation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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