LIVWELL: A RENTAL PROPERTY E-COMMERCE AND MANAGEMENT SYSTEM

A Thesis
Presented to the Faculty of
Computer Studies Department
College of Science
Technological University of the Philippines
Ayala Boulevard, Manila

By

Cujardo, Gwynn R.
Florendo, Cyrus Nathaniel P.
Jaime, Jewel Vaida A.
Quiambao, Aeron Justin C.
Salangsang, Arsenic M.

In Partial Fulfillment of the
Requirements for the Degree
Bachelor of Science in Information System

2024

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

The Philippines, being an archipelago of over 7,000 islands, is a home to a large number of residential dwellings. From single-family homes to high-rise condominiums, a vast variety of options are available to cater the diverse needs and preferences of the population. It is a major milestone for most people to purchase a house, and is often considered as a symbol of stability and success. However, in recent years, customers' preferences have shifted toward renting rather than buying. This transition can be linked to a variety of factors, including the increasing cost of homeownership, changing lifestyles, and the flexibility that renting provides (Statista, 2024).

As the field of information technology continues to expand, e-commerce has become a viable business opportunity, revolutionizing the way people shop. E-commerce platforms allow consumers to shop online and pay online, without the need of face-to-face interaction, through the Internet at the comfort of their home, saving time and space, particularly in enterprises, greatly enhancing transaction efficiency. Furthermore, this virtual marketplace offers a wider selection of products and services than ever before, opening new opportunities that extend beyond traditional product sales like property rentals.

Finding suitable and affordable accommodation, whether for rental or for permanent residence, is a crucial challenge for many individuals, as more people migrate to urban areas, like Manila, in search of employment and better opportunities. However, with the emergence of advanced technology, web applications and systems that facilitate property

searches can make these tasks simpler. Additionally, putting concepts like management into the digital realm facilitates communication and streamline tasks such as rent collection, requests, and lease agreements, between the property owner and potential tenant, allowing a smoother and more efficient process.

Fortunately, the proposed system has the capabilities to help individuals to locate available rental properties and help owners to promote and manage their units efficiently. With the utilization of the agile scrum methodology and quantitative research method, the researchers aim to achieve the desired outcome of the study.

In conclusion, as more people flock to urban areas in the Philippines and preferences for housing evolve, there is a growing need for innovative solutions in the rental market. This research project introduces a system that harnesses the power of e-commerce and advanced technology to make the search for tenants easier and property management smoother for property owners. By offering a user-friendly approach, this system has the potential to ease the challenges of finding the right accommodation in a competitive market, benefiting both property owners and tenants alike.

Background of the Study

The concept of renting properties in the Philippines is a process that will always be familiar to the Filipino community, as people of any stature are exposed to this process as it involves the livelihood of the people. Renting is divided into two main categories, short-term and long-term rentals, and with different uses, benefits, and drawbacks, the type of category that one will use depends on the factors surrounding that property. In terms of finding a place to live well in or grow a business wherein the space is advantageous, long

term renting with leases are usually the standard in this category. Thus, this simple and common yet flourishing concept of renting continues to play a crucial role in shaping the housing market and providing stable accommodation options for individuals and businesses in the Philippines. Unlike short-term rentals, which cater to transient needs, long-term rentals involve contractual agreements spanning months or even years, offering tenants the stability and security needed to establish their living space or sustain business operations.

As people began to recognize the value of real estate, they saw opportunities in land and housing. Many nurtured and supported this process, leading to its development into what it is today. In the context of the Philippine rental market, long-term rentals are the cornerstone of residential, commercial, and even industrial property transactions. Together with fixed leases, these rentals provide tenants a sense of permanence, allowing them to create a temporary home or establish businesses within an environment that is stable and strategic. For property owners, long-term rentals offer steady income streams and the opportunity to cultivate enduring symbiotic relationships with the property's tenants.

Real estate is essentially a tangible asset made up of the property and the land on which it sits, and while it is immovable, real estate, like other assets, is also subject to supply and demand. This means that the prices of properties and their rent, depend heavily on the law of supply and demand. Thus, more demand, prices rise; more supply, prices fall. To understand the process of renting is to learn its essential concepts, as the process of long-term renting involves parties that work together to form a sustainable and beneficial relationship. Essentially, renting is a simple process with many key steps. Beginning by first marketing your property, albeit locally or online, the times today provide various

opportunities to showcase your property no matter the distance. Potential suitors then contact the property owner through various means, creating a point of contact that is essential in determining the future of that rental property. Leading to the agreement and the formation of possible contracts or leases that decide how the renting agreement will continue on and amend issues that may arise.

Mentioned are the many factors that work together to form a successful rental property, and some of these factors are not always in a good condition. Such are the reasons why disputes and issues occur in the highly marketable rental space. In the area of property listing, many websites and platforms are created to handle long-term renting of properties yet there has been no consistent and well-known brand contrary to the space of short-term renting of properties. This has led to a more tedious and time-consuming process for both the property owner and the potential tenants. In regards to property management, there is also no real well-known service that handles long-term renting indicating a need to fill in a crucial gap that will ease the process of observing and analyzing your properties, helping property owners plan and strategize better. The management of properties can also help in allowing contact between owner and tenant, creating a consistent means of communication serving as a streamlined way of being up-to-date with matters that concern the parties' livelihood. By leveraging technology and data analytics, these platforms can provide property owners with valuable insights helping create better and optimized decision-making. Moreover, while technology has undoubtedly facilitated the rental process in many ways, it may also introduce new complexities and challenges. Combining the two concepts of listing and management will aid in making a platform that encourages customer retention and customer satisfaction.

In conclusion, the rental market in the Philippines presents significant opportunities for innovation and growth. With the increasing urbanization and economic development in the country, demand for quality rental properties is on the rise, presenting an opportunity for services to capitalize and develop integrated rental platforms that streamline the entire rental process, from property listing and accessibility to lease and complaint management. By providing sustainable and accessible solutions, fostering innovation and collaborative relationships, the proper platform can unlock and begin the potential of the rental space, contributing to a better experience for everyone involved.

Objectives of the Study

General Objective

The main objective of the study is to develop a rental property e-commerce and management system through the development of a website application catering to both property owners and tenants. The platform allows property owners to list and manage their rental properties and allows tenants to explore available rentals.

Specific Objectives

The following are the specific objectives of the study:

1. Create and design the system with the following characteristics:
    a. A platform for property owners to list their properties that are available for rent.
    b. A platform for property owners to manage their rental properties.

c. A platform for prospective tenants to easily find properties that align with their preferences.
d. A platform for tenants to file a complaint about the property or report issues to the property owner.
e. To locate the specific location of the available property on the map, the system will use the Google Maps API.
f. The system will use data analytics to help property owners gain valuable insights.

2. Create the website application using the following software development tools and scripting language:
    a. Front-end tools
        - HTML
        - JS
        - CSS
        - Vue
    b. Back-end tools
        - Python
    c. Framework
        - Django
    d. Database Management System
        - MySQL
    e. Version Control
        - GitHub

f. IDE

- Visual Studio Code

g. User-Interface Tools

- Adobe XD

3. Test and improve the website application based on functional suitability and reliability
4. Evaluate the acceptability of the website application by gathering multiple users to operate the system. The tool that will be used to evaluate the application is ISO25010, which will evaluate the application's acceptability in terms of sustainability, timely, accuracy, and maintainability.

Significance of the Study

Renting various types of properties has become an essential solution for individuals and businesses seeking flexible and convenient living and working arrangements.

For property owners, the web-based system will offer a platform to list and manage their properties efficiently, thereby modernizing their operations. For tenants, the system will provide a practical tool to easily find available rental properties, making the search process more efficient and providing access to comprehensive resources and information about the properties.

Finally, this capstone project will be valuable for future researchers. It can serve as a reference to enhance future studies with similar objectives, and future researchers can build

upon the data and features introduced in this study, thereby solidifying and expanding the work initiated by the current researchers.

Scope and Limitations

This study centers on the development of an e-commerce and management system website dedicated to showcasing properties in the Philippines. It endeavors to provide property owners with a robust platform to exhibit their rental properties, enabling them to effectively connect with potential tenants. Through a user-friendly interface, property owners will have the flexibility to create, update, customize, and remove their listings within the system, ensuring accurate representation and efficient management of their properties.

In addition to serving property owners, this study strives to address the pressing needs of tenants, particularly students or individuals seeking suitable accommodations in close proximity to their educational institutions or workplaces. By facilitating easier access to rental options, this initiative aims to enhance convenience and streamline the property search process for prospective tenants, thereby fostering a more seamless transition into their new living arrangements or commercial spaces.

This study's overarching goal is to foster mutual benefits for both tenants and property owners alike. By leveraging advanced search functionalities and customizable filters, tenants can pinpoint properties that align closely with their preferences, budgetary constraints, and lifestyle requirements. Simultaneously, property owners stand to gain

increased visibility and exposure for their rental properties, thereby maximizing their potential for occupancy and revenue generation.

The e-commerce and management system website is meticulously crafted using a diverse array of cutting-edge web development technologies and frameworks, including but not limited to Python, HTML, JS, CSS, Vue.js, Django, MySQL, GitHub, Visual Studio Code, and Adobe XD. By harnessing the power of these tools, the platform offers unparalleled scalability, reliability, and performance, ensuring a seamless user experience across various devices and browsers.

Moreover, the system's web-based architecture eliminates the need for cumbersome downloads or installations, providing users with instant access to its full suite of features and functionalities directly through popular web browsers such as Chrome, Safari, Firefox, Opera, and Edge. By implementing stringent security measures and encryption protocols, the platform safeguards sensitive user data and ensures uncompromising privacy and data integrity.

Users are encouraged to create personalized accounts to unlock exclusive access to premium features and detailed insights into the listed properties within the system. Property owners, in particular, can leverage their accounts to showcase their rental properties to a broader audience, while also gaining invaluable insights into market trends, demand dynamics, and competitive pricing strategies.

Furthermore, the platform adopts a seamless user experience design, allowing users to seamlessly transition between different roles and functionalities with minimal friction. Whether users are property owners seeking to list their properties or tenants searching for

their next ideal rental, the platform offers intuitive navigation and robust backend support, empowering users to achieve their respective objectives with ease and efficiency.

Chapter 2

CONCEPTUAL FRAMEWORK

This chapter presents the related literature, studies, and systems, a synthesis of the whole literature review, the conceptual model of the study, and the operational definition of terms relevant to LivWell: A Rental Property E-Commerce and Management System.

Review of Related Literature

This part contains related literature of the LivWell: A Rental Property E-Commerce and Management System.

Renting

Renting is to allow someone to use and occupy something in exchange for regular payments (Merriam-Webster, n.d.). Similarly, Santander (n.d.) defines renting as the long-term leasing of fixed assets such as vehicles, office equipment, or computer systems. These contracts have a fixed term with set installments that remain consistent throughout the lease. Additionally, these agreements typically include costs for maintenance, insurance, and other related expenses. Rental housing may be only a partial answer to urban housing problems, but it is an important housing option (Khan and Scholtz, 2011).

Renting a property offers several advantages, particularly for businesses and individuals looking for flexibility and cost efficiency. According to Khan and Scholtz (2011), renting provides mobility, allowing individuals to relocate easily for job opportunities without being tied down to a specific location or regular renting payments.

This flexibility extends to managing budgets, enabling people to move to more affordable space during tough times or upgrade when their financial situation improves. As mentioned by Majaski (2024), when you rent, your monthly expenses are clearly defined in your lease agreement, allowing you to budget with certainty. Lastly, renting is particularly advantageous during transitional periods of life, such as when individuals are not ready to settle in one place (Khan and Scholtz, 2011).

In conclusion, renting emerges as a versatile solution not only for residential accommodations but also for commercial spaces, offering businesses and individuals alike the flexibility to adapt to changing needs and seize new opportunities. Its significance extends beyond mere shelter, providing a vital avenue for mobility, budget management, and transitional support in an ever-changing urban landscape.

Rental Property as an Income

Operating rental property is considered a business when undertaken to generate profit and consistently dedicating time and effort to its management (Fisherman, 2019). According to Caltabanis (2019), rental properties are designed to make money through tenants' rent payments, and they're also a popular investment choice because they provide steady rental income and the chance for the property's value to increase. As a solution to the rising demand for both residential and commercial spaces in urban areas, many individuals utilize their properties by offering them for rent, effectively establishing rental businesses in both sectors.

The current study aims to collaborate with property owners to list their available properties for rent on the website, allowing tenants to easily search and access comprehensive details of the properties available for rent.

Different Types of Rental

Rental properties vary in their characteristics, encompassing different property classes distinguished by location, structure, size, and management type (What types of residential properties are there?, 2022). This classification is further supported by "The Many Types of Rental Properties" (2022). Examples of rental properties encompass various types of real estate (Caltabanis, 2019). The types of real estate include:

- Single-family homes: dwellings that do not share walls or land with another dwelling and have their own entrance and exit.
- Multi-family homes: single buildings divided into multiple housing units, containing between two and four rental units.
- Commercial Properties: properties used for business activities, encompassing everything from office and industrial spaces to retail and apartment buildings.
- Specialized Properties: short-term rental properties rented temporarily to tourists, vacationers, or students. Examples include housing, senior living communities, and vacation homes.

The current study has considered and understood the different types of rental properties. The current study will apply this understanding in filtering the search, which will assist tenants in finding the right property for them.

Web-based System

In an article written by (Senthil, 2024), in the past, web-based applications had limited functionality, but improvements in technology, security, and internet speed have significantly expanded the possibilities for web-based systems. A web-based system is an application that you access using HTTP, typically describing applications that operate within a web browser. a web-based system is an application that you access using HTTP. Typically, it's used to describe applications that work in a web browser. Web-based systems are accessible anywhere and have lower development costs, increased efficiency, and reduced hardware costs.

The current study proposed an e-commerce and managing system that is web-based because of its accessibility, that can be accessed as long as there is an internet connection and browser.

Data Analytics

Based on an article by The Investopedia Team (2024), data analytics is the science of examining raw data to draw conclusions. Shao et al. (2022) added that data analytics involves estimation, statistics, organization, user experience, and computing technologies, encompassing various theoretical and statistical methods and trends. According to Ghasemaghaei (2019), data analytics use refers to how much companies use technologies designed to efficiently get useful information from large amounts of different types of data. Moreover, data analytics tools help share and improve knowledge. Finally, using advanced data analytics tools is key to better decision-making.

The current study will employ data analytics in a web-based system to assist property owners by providing valuable insights and improving various aspects of property management.

Google Maps API

Google Maps API are open-source codes in the Google Maps Developer Console, which are used in map-based solutions for different purposes (Basarsoft, 2023). Similarly, Juviler (2022) mentioned that the Google Maps API enables developers to utilize Google Maps data and features in their projects. Moreover, according to Muñoz-Villamizar et al. (2021), Google Maps API is a free web mapping tool that provides access to up-to-date and precise geographical information and spatial analysis. Additionally, it allows developers to embed interactive maps on their websites and customize them according to their needs.

The current study will employ the Google Maps API in the web-based system. It will play a pivotal role in enhancing the user experience for prospective tenants. By integrating the Google Maps API into the system, tenants will have the visualization of the precise locations of available properties.

Adobe XD

Adobe XD is a tool that uses vector graphics to help user experience (UX) designers and user interface (UI) designers make realistic, interactive digital interfaces for websites and mobile apps. It was designed to offer features that are specifically useful for interface design (Myre, 2022). According to The Upwork Team (2022), Adobe XD has many

features and uses, making it an essential tool for any UX and UI designer. In addition, an article entitled "What is Adobe XD?" (2024), mentioned that Adobe XD not only aids in the design process but also fosters collaboration among design teams and others through integration with platforms like Slack and Microsoft Teams.

The current study will employ Adobe XD in the user interface design phase to create and test interactive prototypes. This approach aims to streamline the design process, enhance collaboration among team members, and ensure that the final product meets user expectations. By leveraging Adobe XD's robust set of tools and its integration capabilities with collaboration platforms, the study seeks to demonstrate the effectiveness of this software in producing high-quality, user-centered designs while facilitating seamless communication and cooperation within the design team.

Visual Studio Code

Visual Studio Code, often abbreviated as VS Code, is a free, lightweight, yet powerful source code editor available for Windows, macOS, Linux, and Raspberry Pi OS, running on both desktop and web platforms (Heller, 2022). According to Chris (2023), VS Code is similar to Sublime Text and Atom, offering a rich text editing experience akin to a miniature version of Visual Studio. VS Code provides developers with a customizable environment through various plugins, making it versatile and adaptable to different programming needs (Your Ultimate Guide To Visual Studio vs Visual Studio Code, n.d.). Lastly, Heller (2022) mentioned that VS Code has built-in support for JavaScript, TypeScript, and Node.js, along with a vast ecosystem of extensions for other languages, runtimes, environments, and clouds, catering to a wide range of development tasks.

In the current study, Visual Studio Code, or VS Code, will serve as the IDE (Integrated Development Environment) due to its compatibility with various programming languages required for the development of the web-based system. Additionally, its rich ecosystem of extensions can aid in debugging tasks. Lastly, the researchers' familiarity with VS Code further supports its selection as the preferred IDE.

GitHub

GitHub, an online interface, facilitates real-time collaboration among users (Coursera, 2023). According to Lutkevich and Courtemanche (2023), it serves as a web-based version control and collaboration platform primarily targeted at software developers. The platform's expansive features redefine the collaborative landscape for software development projects, extending beyond mere code storage to encompass version control, issue tracking, and code review functionalities, all crucial components in contemporary software development processes (Webb, 2024).

GitHub claims that it is utilized by over four million organizations and more than one hundred million developers (GitHub, n.d.). Webb (2024) notes that GitHub's popularity among software developers stems from its comprehensive feature set, which supports every aspect of the development process, fostering collaboration without boundaries. Additionally, its user-friendly interface simplifies code management for users of all skill levels. Furthermore, GitHub integrates seamlessly with many development tools and automates tasks through GitHub Actions, enhancing efficiency, productivity, and code security with automated fixes.

Given GitHub's robust collaboration features and widespread adoption, the current study will primarily utilize it to enhance collaboration among researchers. Leveraging its real-time collaborative capabilities, version control system, and issue tracking functionalities, the study aims to streamline project management processes and facilitate seamless collaboration on code development and review tasks.

Python

Python, as Lukaszewski (2019) notes, is a versatile programming language suitable for any modern computer operating system. Similarly, Coursera (2024) describes Python as a general-purpose language that isn't specialized for any specific problems. In addition, Miller (2023) stated that Python's versatility enables it to be used in a wide range of applications across various industries. According to a study by Statista, Python ranks as the third most popular programming language worldwide among developers.

In web development, Python plays a significant role in back-end development, handling server-side tasks like interacting with databases and APIs, as outlined by Miller (2023). Coursera (2024) supports this by highlighting Python's back-end development capabilities, including data processing, database communication, URL routing, and security measures.

The current study will employ Python due to its simplicity, extensive libraries, security capabilities, and strong community support. Python also easily integrates with various databases, web services, and other programming languages, making it flexible and powerful in terms of developing a robust, scalable, and maintainable web application. Python ensures that both the development and operational aspects of the system are efficient and effective.

Django

Django, a Python-based web framework, earns the moniker 'batteries included web framework' for its abundance of built-in features, enabling the rapid development of efficient web applications (GeekforGeeks, 2024). It encompasses everything from the Django Admin Interface to default databases like SQLlite3. Moreover, an article on Django Introduction (2024) emphasizes its high-level nature, facilitating the creation of secure and easy-to-manage websites.

Additionally, Noble Desktop (2024) stated that Django is currently among the top ten (10) frameworks used by web developers as it offers many attractive attributes, including:

- Robust - it automatically comes with a wide range of extra features capable of handling common web development tasks.
- Fast - it simplifies the creation of web applications from conception to completion to reduce the amount of time and expertise required for development.
- Simple - it benefits from being built on Python with a reputation for being relatively simple and accessible
- Secure - it includes many default features that help protect your application and its users, making it one of the most secure frameworks around
- Scalable - it comes equipped with various components that can be easily unplugged and replaced for effortless scalability
- Versatile - it can be customized to fit applications of virtually any type, size, or scope
- Well-Supported - it is well supported both by the official governing body and the programmers who regularly utilize the framework

Django, the framework that the current study will employ, provides many benefits in terms of creating the apartment e-commerce and management web application. Django's built-in features and modular design makes it a proper choice for this system. Django also has full support towards MySQL, ensuring that the web application's queries are done in a clean and powerful manner.

Hyper Text Markup Language (HTML)

HTML, or Hyper Text Markup Language, serves as the foundational language for constructing web pages (Astari S., 2023). It enables the creation and organization of webpage elements such as sections, paragraphs, and links using tags and attributes. Lutkevich (2020) highlights HTML's role as a text-based method for defining content structure within HTML files, guiding web browsers in rendering text, images, and multimedia elements on webpages.

Additionally, Lutkevich (2020) underscores HTML's widespread adoption, accessibility across all browsers, ease of learning, clean source code, open-source nature, and compatibility with backend programming languages. Meanwhile, Adetunji (2023) emphasizes HTML's significance as a standard markup language for developing websites and applications and highlights that it lacks aesthetics and functionality.

The current study will use HTML, justified by its fundamental role in web development, ability to structure content effectively, widespread adoption, ease of learning, open-source nature, compatibility with backend languages, and status as the standard markup language for web development.

Cascading Style Sheets (CSS)

CSS, short for Cascading Style Sheets, is a language developed in the 1990s to style web documents, which has become crucial for web developers and plays a vital role in enhancing the user experience online, working alongside various markup languages (BasuMallick, 2022). According to (Domantas G., 2023), it is used to style elements written in markup languages like HTML, which forms the foundation of websites, while CSS focuses on the visual aesthetics of the entire site. Unlike programming languages such as C++ or JavaScript, CSS is specifically designed for styling web pages and is not considered a programming language (Eygi, 2019).

The current study will use CSS to enhance user experience, separate content from presentation, and provide specific styling capabilities. By using CSS, it will enable the creation of visually appealing, user-friendly, and consistently styled web pages that are easier to maintain and perform efficiently across different platforms and devices.

JavaScript

JavaScript, a dynamic programming language, offers various functionalities such as performing math calculations, dynamically modifying HTML content in the DOM, generating dynamic style declarations, fetching content from other websites, and more (Megida, 2021). According to Jordana (2024), JavaScript, recognized as a scripting language, enhances web pages by adding interactive elements like dropdown menus and animated graphics, thus improving user engagement. In addition, GeekforGeeks (2024) further emphasizes its lightweight, cross-platform nature, known for its versatility in web development and its application beyond web browsers. JavaScript's dynamic nature

enables its utilization not only in web development but also in web applications and game development, facilitating the implementation of dynamic features not achievable with HTML and CSS alone. Lastly, developers often pair JavaScript with HTML and CSS to enhance websites with interactivity, and they may leverage third-party libraries to incorporate advanced features into their projects without coding them from scratch (Jordana, 2024).

The current study will use JavaScript because of its ability to provide dynamic functionality, enhance user engagement, offer versatility and cross-platform capabilities, enable the implementation of dynamic features, complement HTML and CSS, and allow the use of third-party libraries for advanced features. Additionally, JavaScript is essential for creating responsive and interactive user interfaces and is widely supported by modern web browsers. Its extensive ecosystem, including frameworks and tools, further extends its applicability in both front-end and back-end development. JavaScript's large developer community and extensive documentation make it easier to find resources and support, facilitating a smoother development process.

Vue.js

Vue.js offers several advantages, including its speed, simplicity, and strong support from both libraries and its community (Kugell, 2022). According to Simplilearn (2022), its features encompass a range of functionalities such as virtual DOM, data binding, components, event handling, transitions, computed properties, templates, directives, and routing. In addition, combining Angular-influenced approaches with streamlined features, Vue.js focuses on front-end interfacing and application development. Its core library

emphasizes the view layer and is designed for incremental adoption into projects (Corbo, 2022). These features make Vue.js a popular choice for building user interfaces and single-page applications, offering developers the flexibility and efficiency they need for modern web development projects.

As Vue.js is a versatile and efficient framework that simplifies the development of modern web applications, the current study will employ this technology. Vue.js provides developers with a comprehensive set of tools and features that streamline the development process and enable the creation of highly interactive and responsive user interfaces. Additionally, Vue.js has a rich ecosystem that will provide the researchers access to a wealth of resources, enabling them to extend its functionality, solve common development challenges, and accelerate the development process.

MySQL

MySQL is an open-source Relational Database Management System (RDBMS) that enables users to efficiently store, manage, and retrieve structured data. It is widely utilized across various applications, ranging from small-scale projects to large-scale websites and enterprise-level solutions (Domantas, 2024). Similarly, Wallen (2021) mentioned that as a relational database, MySQL recognizes relationships among stored items of information, enhancing data management capabilities. Additionally, functioning as a tool to manage databases, MySQL operates based on the SQL language, facilitating tasks such as adding, accessing, and managing content within databases. Its flexibility and power make it suitable for applications of all sizes, providing multi-user access to numerous databases

simultaneously while maintaining high performance, even with large datasets (Buenning, 2024).

According to Domantas (2024), MySQL is among the most popular relational database management systems (RDBMS) available. Its popularity is due to several factors, including its open-source nature, which allows anyone to use and modify it for free, making it a cost-effective option. Additionally, MySQL is highly scalable and capable of efficiently managing increasing workloads (Buenning, 2024).

MySQL as mentioned, is a proven relational database management system (RDBMS), and is the database that the current study will employ, it is efficient in query handling as browsing through properties and sorting through tenants is optimized. For security, MySQL is a great choice as it allows for permissions and roles to be strictly set, together with its support for data encryption. In the aspect of recovery and costs, MySQL allows for backups to be set and it being open-source means it can be used without incurring licensing fees. Another great point is the support for MySQL with other mentioned properties of the system, such as its support for Python, Django, and Vue.

Overall, MySQL ensures that the data is structured, consistent, and easily manageable, which is crucial for the complex data relationships and transactions in such a system.

ISO 25010

ISO 25010, known as "Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE) – System and software quality models," is a standard that focuses on defining and assessing quality requirements and models for both systems and software (Britton, 2021). As outlined by Obrenović (2021), this standard

serves as a set of guidelines and suggestions for assessing the quality of software products. It forms a component of the ISO/IEC 25000 series, which comprises various international standards in the realm of software engineering.

According to ISO 25000, ISO/IEC 25010 comprises nine quality characteristics, and these are:

Functional Suitability pertains to the extent to which a product or system can deliver that satisfies both stated and implied requirements. This characteristic is composed of the following sub-characteristics:

- **Functional Completeness** pertains to the range of functions encompassing all specified tasks and user objectives.
- **Functional Correctness** pertains to the accuracy and precision with which a product or system delivers the required results.
- **Functional Appropriateness** pertains to how effectively functions fulfill designated tasks and objectives.

Performance Efficiency pertains to how effectively resources are utilized in relation to performance. This characteristic is composed of the following sub-characteristics:

- **Time Behavior** pertains to the speed of response, processing times, and throughput rates of a product or system during its operation.
- **Resource Utilization** pertains to the quantity and types of resources consumed by a product or system during its operation.
- **Capacity** pertains to the maximum limits of a parameter within a product or system.

Compatibility pertains to the ability of a product, system, or component to effectively exchange information and fulfill its intended functions within a shared hardware or software environment. This characteristic is composed of the following sub-characteristics:

- **Co-existence** pertains to the ability of a product to efficiently fulfill its functions within a shared environment alongside other products, without causing adverse effects on them.
- **Interoperability** pertains to the proficiency of two or more systems, products, or components to communicate and utilize exchanged information effectively.

Interaction Capability pertains to the extent to which a product or system allows designated users to exchange information through its user interface to accomplish specific tasks across various usage scenarios. This characteristic is composed of the following sub-characteristics:

- **Appropriateness recognizability** pertains to the extent to which users can determine if a product or system is suitable for their requirements.
- **Learnability** pertains to the extent to which users can learn the functions of a product or system to use it within a specified timeframe.
- **Operability** pertains to the extent to which a product or system possesses attributes that make it simple to operate and manage.
- **User error protection** pertains to the extent to which a system safeguards users against operational errors.
- **User engagement** pertains to the extent to which a user interface presents functions and information in an inviting manner, encouraging ongoing interaction.

- **Inclusivity** pertains to the extent to which a product or system is accessible to individuals from diverse backgrounds.
- **User assistance** pertains to the extent to which a product accommodates users with a wide range of characteristics and capabilities to achieve specific goals in a defined context of use
- **Self-descriptiveness** pertains to the extent to which a product provides necessary information to users, making its capabilities and usage immediately understandable without excessive reliance on additional resources,

Reliability pertains to the ability of a system, product, or component to execute designated functions under predefined circumstances. This characteristic is composed of the following sub-characteristics:

- **Faultlessness** pertains to the extent to which a system, product, or component performs designated functions without errors during regular operation
- **Availability** pertains to the extent to which a system, product, or component is operational and available for use when needed.
- **Fault tolerance** pertains to the extent to which a system, product, or component continues to function as intended despite the presence of hardware or software faults.
- **Recoverability** pertains to the extent to which a product or system can recover affected data and restore the desired system state in the event of an interruption or failure.

Security pertains to the level at which a product or system safeguards information and data against potential security threats or vulnerabilities. This characteristic is composed of the following sub-characteristics:

- **Confidentiality** pertains to the extent to which a product or system ensures that data is accessible only to authorized individuals.
- **Integrity** pertains to the extent to which a system, product, or component ensures that its state and data are safeguarded from unauthorized modification or deletion, whether due to malicious actions or computer errors.
- **Non-repudiation** pertains to the extent to which actions or events can be verified to have occurred, preventing denial of these events or actions afterward.
- **Accountability** pertains to the extent to which the actions of an entity can be uniquely linked back to that entity.
- **Authenticity** pertains to the extent to which the identity of a subject or resource can be verified to be as claimed.
- **Resistance** pertains to the extent to which a product or system can continue operating despite being targeted by malicious actors.

Maintainability pertains to the degree of ease with which a product or system can be altered for enhancements, corrections, or adjustments to suit evolving environmental conditions and needs. This characteristic is composed of the following sub-characteristics:

- **Modularity** pertains to the extent to which a system or computer program is constructed from separate components, allowing changes to one component with minimal impact on others.

- **Reusability** pertains to the extent to which a product can serve as an asset in multiple systems or in the construction of other assets.
- **Analysability** pertains to the effectiveness and efficiency of assessing the impact of changes on a product or system, diagnosing deficiencies or failures, or identifying parts for modification.
- **Modifiability** pertains to the ease and efficiency with which a product or system can be modified without introducing defects or diminishing existing quality.
- **Testability** pertains to the effectiveness and efficiency of establishing test criteria for a system, product, or component, and conducting tests to verify if those criteria are met.

Flexibility pertains to the extent to which a product or system can adjust to alterations in its requirements, usage contexts, or system environment. This characteristic is composed of the following sub-characteristics:

- **Adaptability** pertains to the extent to which a product or system can be efficiently adjusted for or moved to various hardware, software, or operational environments.
- **Scalability** pertains to the extent to which a product can manage increasing or decreasing workloads or adjust its capacity to handle fluctuations effectively.
- **Installability** pertains to the effectiveness and efficiency with which a product or system can be installed and/or uninstalled in a specific environment.
- **Replaceability** pertains to the extent to which a product can substitute another specified software product for the same purpose within the same environment.

Safety pertains to the extent to which a product or system can prevent endangerment to human life, health, property, or the environment under specified conditions. This characteristic is composed of the following sub-characteristics:

- **Operational Constraint** pertains to the extent to which a product or system limits its operation within safe parameters or states when faced with operational hazards.
- **Risk Identification** pertains to the extent to which a product can recognize events or operations that may pose unacceptable risks to life, property, or the environment.
- **Fail Safe** pertains to the extent to which a product can automatically switch to a safe operating mode or return to a safe condition in case of failure.
- **Hazard Warning** pertains to the extent to which a product or system provides alerts about unacceptable risks to operations or internal controls, enabling timely reactions to maintain safe operations.
- **Safe Integration** pertains to the extent to which a product can ensure safety during and after integration with other components.

The current study will employ ISO 25010 in testing and evaluating the developed system. It is an ideal choice as it provides a comprehensive framework that encompasses not only functional aspects but also non-functional characteristics. ISO 25010 offers a structured approach to assess these critical aspects, ensuring that the system meets basic functional requirements and performs optimally and reliably under various conditions, enhancing user satisfaction and system effectiveness.

Synthesis of Review of Related Literature

Based on the information gathered by the researchers, renting involves allowing an individual or business to use an asset in exchange for regular payments, with fixed terms and inclusive costs. Renting is one of the principal housing options because it provides mobility, budget flexibility, and transitional support. Additionally, renting is not limited to residential properties, but it also encompasses commercial properties, offering adaptability in an evolving urban landscape. Furthermore, operating rental properties as a business can offer property owners a reliable source of income through regular rental payments, while also presenting opportunities for long-term investments as property values appreciate over time.

Additionally, rental properties encompass various types, from single-family homes to multi-family dwellings and commercial spaces. These options cater to diverse needs and preferences, providing unique accommodations tailored to specific demographics. Recognizing this diversity, the researchers aim to develop a web-based e-commerce and management system tailored for rental properties. By leveraging web-based technology, the system will prioritize accessibility and ease of use for both property managers and tenants, enhancing the overall rental experience.

Moreover, the system will incorporate data analytics to offer valuable insights for decision-making. Furthermore, the system will utilize the Google Maps API, known for its accuracy and interactivity to enhance the user experience by providing precise property locations. These integrations aim to improve property management processes, provide

actionable insights for property owners, and streamline property searches for prospective tenants, making the process more efficient and user-friendly.

The web-based system will be developed using a suite of integrated tools to ensure efficiency and effectiveness throughout its creation and operation. User interface design will be facilitated by Adobe XD, a powerful UX/UI design tool, which will streamline collaboration and the design process by enabling the creation of interactive prototypes, ensuring user-centered designs, and seamless communication within the design team. Version control will be managed through GitHub, serving as a collaborative platform for efficient project management, facilitating version control and issue tracking to streamline collaboration among researchers and developers, and ensuring an organized and transparent development process. Visual Studio Code will serve as the Integrated Development Environment (IDE), offering versatility and compatibility with various programming languages, supported by an extensive ecosystem of extensions for efficient development and debugging tasks. Database management will be handled by MySQL, an open-source RDBMS, which will efficiently manage structured data with scalability and security, ensuring that the system's data is well-structured and manageable. Django, a Python-based framework, will simplify web application development, providing built-in features and scalability to create a robust and secure e-commerce and management system. Both backend and frontend development will be supported by HTML, JavaScript, CSS, and Vue.js, with HTML forming the foundation of web pages, JavaScript adding interactivity and dynamic functionality, CSS enhancing user experience through styling capabilities, and Vue.js simplifying frontend development by enabling the creation of highly interactive and responsive user interfaces. Python will power the system's backend,

known for its simplicity and versatility, ensuring efficient development and operation through its compatibility with databases and web services. Lastly, after the system is developed, it will undergo testing and evaluation using ISO 25010 as an assessment tool.

Review of Related Studies

This part contains related studies and works that have already been conducted on the topic of rental property listing systems and management systems.

A capstone project by Setty (2022) entitled "Management System for an Apartment" successfully aimed to create a standard web-based online platform that will benefit both renters and homeowners. The author developed a system wherein the homeowners can list their properties that are for rent, and the renters will be able to see the available properties.

A similar work was conducted by Monteverde et al. (2023) entitled "A Web-Based Rental House Smart Finder using Rapid Application Development Basis for Evaluation of ISO 20501". The authors developed a system that provides necessary information on specific rental properties and aids prospective tenants in finding affordable variations of rental houses. Its goals are to simplify the process of looking for a rental home, lessen the time consumed in finding rental homes, and quickly access the information about it.

In addition, several other works have developed systems with similar features aimed at improving the rental process for both renters and homeowners. These include works by Voumick et al. (2021), Paul (2022), Rathore et al. (2021), and Rastogi et al. (2023). Each of these studies focused on creating platforms that list rental properties, provide essential

information, simplify the search process, reduce the time required to find rental homes, and offer quick access to detailed property information.

Moreover, some studies have integrated an additional payment feature into their system. For example, Ikuomola and Asefon (2022) and Misyam and Selamat (2021) developed a system that not only lists rental properties and provides essential information but also integrates an online payment system. This feature allows renters to make rental payments directly through the platform, thereby streamlining the rental process even further and providing a comprehensive solution for both property listings and financial transactions.

Focusing on a different aspect of the rental market, Hamzah et al. (2022) addressed the specific needs of boarding house tenants, particularly students. According to their study, there is a significant lack of information about the availability of boarding houses, which makes it challenging for prospective tenants to find suitable accommodations. To address this issue, the authors developed an Android-based Boarding House Rental Location Search System Application. This application helps tenants easily find the location and details of boarding houses, while also enabling boarding house owners to provide updated information about their properties.

While the aforementioned studies have primarily focused on listing and searching for rental properties, there are also works that delve into property management systems, offering solutions beyond mere property discovery. Several studies have explored similar themes in residential management systems, each addressing specific needs within the realm of property management and tenant interaction.

In a study entitled "Vista Angkasa Apartment Management System," Thevaraju et al. (2019) developed a comprehensive computer-based solution tailored for metropolitan societies. Their system encompasses tenant management, complaint handling, maintenance requests, and resolution processes.

Similarly, Mokshin et al. (2020) introduced a mobile application designed to streamline communication and information sharing in high-residential settings in Malaysia. Their platform facilitates billing summaries, complaint management, and information dissemination through an integrated information board.

Meanwhile, Rathod and Kumar (2022) focused on enhancing efficiency and interactivity in apartment management through their system. Their platform enables bill payment, streamlined complaint submissions, and seamless user information updates, surpassing the limitations of existing systems.

Lastly, Iu and Salikon (2022) devised a room renting management system emphasizing property and tenant list management. Their dashboard offers a comprehensive overview of rentals, bills, transactions, and historical data visualization using line graphs.

These studies collectively showcase the evolution of residential management systems, introducing innovative features to streamline property management processes and enhance tenant satisfaction.

The current study will develop a platform that caters to property listing and property management systems. By integrating features from previous research, it will offer a comprehensive solution for renters and property owners alike. LivWell aims to streamline the rental process. Leveraging insights from the authors, the current study aspires to address

existing gaps in the market and provide an all-encompassing, user-friendly platform for the modern rental ecosystem.

Conceptual Model of the Study

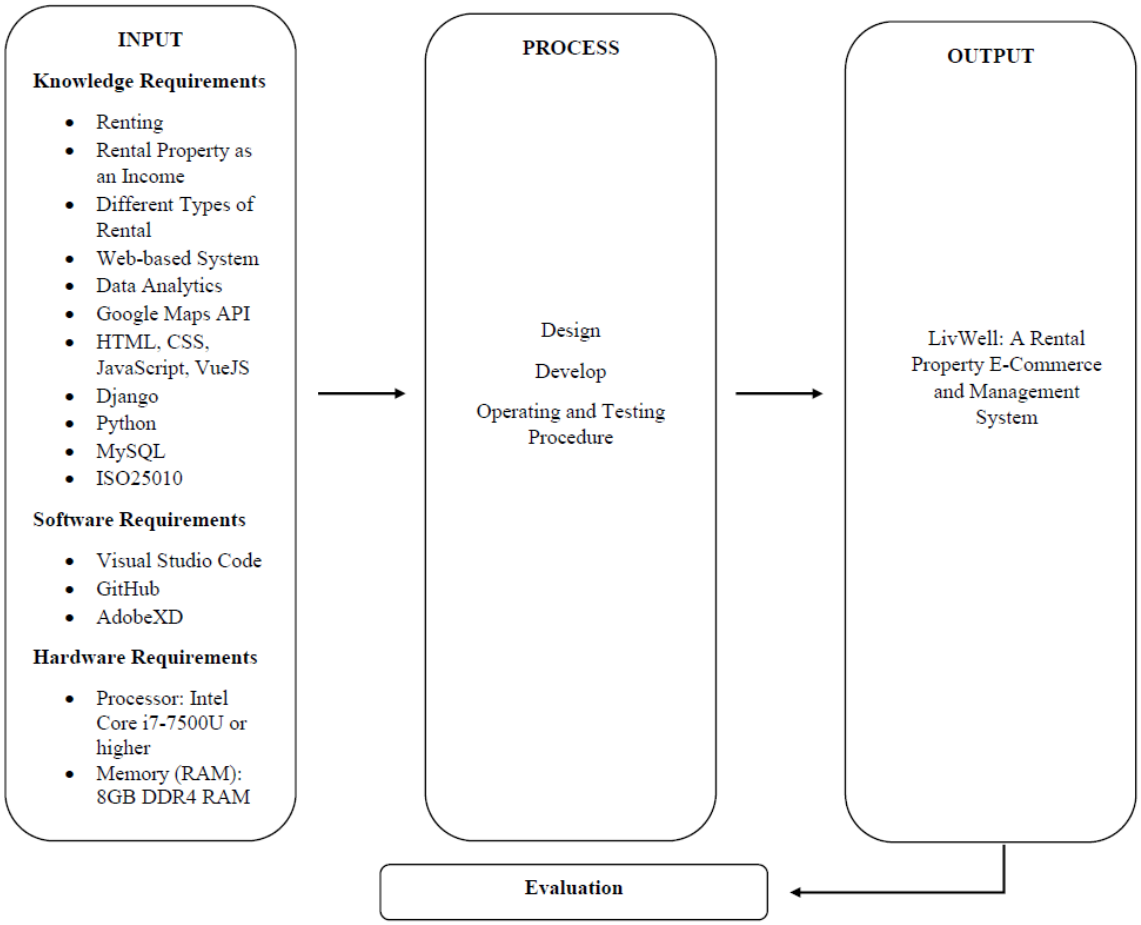

Figure 1. Conceptual Model of the Study

The figure above shows the conceptual model of the study, which depicts the overview of the flow and the whole concept of the study.

Input

The content of the input phase is the three (3) major requirements of the system. First is the knowledge requirements under this requirement, the knowledge the researchers should understand to establish a foundation for the study. It consists of renting, rental property as an income, different types of rental, web-based system, data analytics, Google Maps API, HTML, CSS, JavaScript, Vue.js, Django, Python, MySQL, and ISO25010. Second, the software requirements needed to develop the system. It consists of Visual Studio Code, GitHub, and Adobe XD. Lastly, the hardware requirements to access the system. It consists of a Processor: Intel Core i7-7500U or higher, and Memory (RAM): 8GB DDR4 RAM.

Process

The content of the process phase outlines how the system will be developed. This phase involves tasks such as designing, developing, operating, and testing procedures.

Design: In this phase, the researchers should create an entity relationship diagram, use case diagram, system flowchart, module hierarchy, data flow diagram, and architecture diagram. These diagrams help visualize and summarize the specifics of the system.

Develop: In this phase, the researchers will develop LivWell using front-end tools, back-end tools, frameworks, a database management system, version control, and an IDE.

Operating and Testing Procedures: After development, the system will undergo testing to assess its functionality.

Output

The developed system, LivWell: A Rental Property E-Commerce and Management System.

Evaluation

The developed system will be evaluated using ISO 25010, an assessment tool to examine the system's applicability, efficiency, compatibility, usability, dependability, security, maintainability, and portability.

Operational Definition of Terms

For better understanding of the study, the researchers gave several terms that were defined operationally used in the study.

API refers to Application Programming Interface. A tool that collects and processes a response, then returns with that response.

Current Study refers to the study of the researchers in developing the e-commerce and management system.

LivWell refers to the e-commerce and management system.

Open Source refers to the source code that is accessible to the public.

Property Manager refers to the house owner or landlord that oversees the property.

Tenant refers to the prospective individual that will rent a property for a period of time.

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