

WhereToFind: A Web-based Hardware Store Locator and Price List System

Archie Gem Cebujano, Jemarie Manallo, Kailah Kristine Sus
College of Information and Communications Technology
Sorsogon State University - Bulan Campus
Bulan, Sorsogon

Email:

kailah.sus@sorsu.edu.ph, jemarie.manallo@sorsu.edu.ph, archie.cebujano@sorsu.edu.com

1 Introduction

This chapter presents the background of the study that establishes the context of the research. This section explains why the particular research topic is essential to understanding the main aspects of the study.

1.1 Project Context

Nowadays in evolving digital landscape, technology plays a crucial role in transforming consumer shopping behaviors. The retail industry, particularly the hardware sector, has seen a shift in how customers search for products and compare prices before making purchasing decisions. Traditional methods of visiting multiple stores to inquire about product availability and pricing can be time-consuming and inefficient. As online price comparison tools become more prevalent in other industries, there is a growing need for similar innovations in the hardware retail sector to enhance accessibility, transparency, and convenience.

Shopbot [3] is initially designed for finding lowest price music CDs [4]. Nowadays, there are many different shopbots available on the internet in different country, such as Shopping.com [5], PriceGrabber [6], and Yaoota [7].

They compare the price and reviews of the products between different shops to recommend the most suitable one to consumer. In Hong Kong, we also have Price.com.hk [1] which is a price comparison website that focus on electronic products. Consumer Council Online Price Watch (CCOPW) [2] is another price comparison website that provides latest price and reviews of household product. Price-cream [8] compares the price of products in different supermarkets.

There are research works related to searching method for browsing or searching product. Chen et al. [10] improve the attractiveness of a shopbot by presenting the information of the product based on known cognitive-biases. Fan et al. [11] use visual-based searching on E-bay to find out the product. However, most of them do not consider “easy-to-buy.” Yang et al. [12] They presented a location-aware system to tell the users the nearby shops. However, their system do not have price comparison features.

The proposed system, entitled WhereToFind aims to address this need by developing a web-based platform that leverages geo-location technology and database management. The system will focus solely on providing users with the ability to locate nearby hardware stores and view real-time price lists for products, without enabling online transactions. WhereToFind seeks to improve accessibility, helping consumers make informed purchasing decisions while also providing hardware store owners with a digital space to enhance their visibility and reach.

This study is motivated by the lack of dedicated systems that focus exclusively on hardware store location and price comparison without integrating online purchasing features. By developing WhereToFind, this research aims to fill this gap and provide a solution that aligns with the needs of users who prefer in-store purchases while still benefiting from digital tools.

1.2 Purpose and Descriptions

The purpose of the study is to develop a web-based hardware store and price list system to address difficulty of users face in locating nearby stores and accessing accurate and up-to-date product price list, which often leads to inefficiency and inconvenience in purchasing decision. This project aims to improve operational efficiency in the retail hardware sector, improve customer satisfaction, and streamline the process of finding hardware stores and comparing prices. By implementing this system, it enhances the visibility of the store, simplifies product price comparisons, and improves the overall purchasing decision for hardware products.

This is a web-based store locator and price list system to improve customer satisfaction, and streamline the process of locating hardware stores and comparing prices. The system will cater three main users: customers, store owners and

administrators. The key features of this system are user registration and log-in, management profiling of the Hardware Store, integration of Geo-location mapping, store locator and admin dashboard for managing users. The system will be developed using OutSystem for low code web development. Geo-location features will be powered by Google Maps API or OpenStreetMap. This project will initially focus on a specific area targeting local hardware stores and customers. The system will be accessible via desktop and mobile browsers. This system is significance to the following:

Customer. This study will make life easier for customers by providing a tool that helps them quickly find nearby hardware stores, compare prices, and access up-to-date product information, saving them time and effort.

Hardware Store Owner. The study will benefit hardware store owner by gaining a platform to showcase their stores, reach more customers, and easily manage their product listings, helping them grow their business.

Researcher. The study will assist the researcher in enhancing their knowledge and skills in developing a practical web platform that benefits users.

Future Researchers. The study will contribute to the knowledge of future researchers through the result and findings. They will learn from the study and apply it to their future academic endeavours.

1.3 Objectives of the Study

This study delved into the development of WhereToFind: A web-based Hardware Store and Price List System as a tool to locate hardware stores and access price list of hardware products, with the following specific objectives:

- 1.To develop a management profiling of the Hardware Store.
- 2.To create a search engine for price and product information.
- 3.To integrate the Geo-location Mapping
- 4.To determine the level of usability of the proposed system using USE questionnaire based on the system:
 - 4.1 Usefulness,
 - 4.2 Satisfaction, and
 - 4.3 Ease of use.

1.4 Scope and Limitations of the Study

The project titled WhereToFind aims to develop a web-based system designed to assist users in locating hardware stores and accessing detailed product information and price lists. The scope of the system includes the following features: user registration and log in, profiles of the hardware store, search engine for price information, admin dashboard and API integration to locate nearby hardware stores. It will develop a management profiling system for hardware stores, allowing store owners to register and create detailed profiles. These profiles will include essential information such as store name, address, product catalogs, and price lists. Store owners will have access to a dedicated dashboard to manage and update product information, ensuring that customers always have access to accurate and up-to-date data.

The system will include a search engine for price and product information, enabling users to search and filter products based on specific product prices across multiple stores, ensuring they find the best deals. The search engine will display product details and store-specific pricing in a easy to use interface, making it easy for users to make informed purchasing decisions.

The system will integrate geo-location mapping using APIs like Google Maps or OpenStreetMap. This feature will allow users to search for hardware stores based on their current location or a specified area. The store locations will be displayed on an interactive map, complete with distance calculations and route navigation. Users will have access to directions, estimated travel times and distances to their chosen stores, ensuring that they can easily locate the nearest stores and plan their visits efficiently.

The project will evaluate the level of usability of the proposed system using the USE questionnaire, which measures three key dimensions: usefulness, satisfaction, and ease of use. The usefulness of the system will be assessed based on how effectively it meets user needs, such as finding stores, comparing prices, and accessing product information. Satisfaction will be evaluated by measuring the user's contentment with the system's features and overall performance. The ease of use will focus on the user-friendly design and intuitive navigation of the system.

The system will be developed using OutSystem for low code web development and Geo-location features will be powered by Google Maps API or OpenStreetMap. This project will initially focus on a specific area targeting local hardware stores and customers. The system will be accessible via desktop and mobile browsers.

The system is designed with specific limitation to ensure a focused and manageable scope. Features limited in the system are payment processing or e-commerce functionality, as users will need to visit physical stores or use external platforms to complete purchases. Additionally, a dedicated mobile application will

not be developed; instead, the system will be web-based and optimized for mobile browsers. The system will not support automatic synchronization with external pricing systems or databases, meaning store owners are responsible for updating their product prices. Advanced security features, such as two-factor authentication or biometric login, will not be included. Only registered store owners will have the ability to update their store profiles and product listings, ensuring data accuracy. Users must have an internet connection and a compatible device to access the system, as offline functionality will not be supported.

Participation is limited to hardware stores that voluntarily register and maintain their profiles, as the project team will not input or update the store data. The system's Geolocation accuracy will depend on external APIs, such as Google Maps or OpenStreetMap, and the capabilities of the user's device, meaning that the project team is not responsible for external inaccuracies.

2 Review Related System

2.1 Introduction

This section reviews related systems based on these core objectives. It includes an analysis of existing price comparison and store locator systems, their functionalities, usability, and the information they provide. The following systems have been gathered from various sources, including websites and applications, to offer insights into how similar technologies function.

The following themes presented in this chapter will help readers understand how this capstone project is structured. A review, discussion, and description of related systems will focus on their functionalities, characteristics, and usability,, evaluating the advantages and limitations of both existing and proposed systems.

2.2 THEME 1: Implementing E-Commerce Price Comparison in WhereToFind

Both the idealo online shopping product and price comparison app and the Smart Mobile Shopping Android App (SAGO) are designed to enhance the shopping experience by enabling users to search for specific products, check specifications, track price history, and compare the latest deals to secure the cheapest prices[10]. While idealo supports the entire shopping journey with comprehensive features, SAGO focuses on localized price comparisons, using a Smart Filtering Algorithm to retrieve and display accurate product listings and

prices from nearby stores. Both apps efficiently help users save time and money by providing smartly filtered, relevant price comparisons across multiple retailers, empowering consumers to make informed purchasing decisions.[11]

Moreover, E-Commerce Price Comparison Website Using Web Scraping is a web-based system that focuses on online price comparison by gathering data from multiple e-commerce platforms using web scraping techniques. This system enables users to compare prices across various retailers, ensuring they find the best deals.[12]

WhereToFind: A Web-Based Hardware Store Locator and Price List System, shares several similarities with the existing systems mentioned. Like SAGO and the E-Commerce Price Comparison Website, your WhereToFind focuses on helping users make informed purchasing decisions by providing price comparisons. All three systems aims to save users time and money by aggregating product prices from multiple sources—whether local stores or online platforms. WhereToFind is focusing exclusively on hardware stores, offering a niche solution for users seeking tools, equipment, and materials. Unlike SAGO and idealo, which cater to general products, WhereToFind features a powerful search engine, product information and advanced filtering options for price and location availability. This specialized approach, combined with precise filtering and comprehensive product details, makes WhereToFind a more tailored and efficient tool for hardware consumers.

2.3 Theme 2: Integrating Geo-location Mapping in WhereToFind

E-Locate: Room for Rent Locator and OTO Direct: Auto Repair Shop Locator are both location-based platforms designed to help users find specific services in their area. E-Locate is a web-based system that enables users to search for rental accommodations, such as rooms, boarding houses, and apartments, based on preferences like location and budget. It provides real-time availability updates and allows property owners to list their rentals while clients can compare rates and book directly[13]. Similarly, OTO Direct is an Android app that helps users locate nearby auto repair shops using GPS, displaying shop profiles, services, contact details, and customer reviews[14]. Both platforms feature booking functionalities—E-Locate for room rentals and OTO Direct for service appointments—and are designed to streamline user interactions through intuitive, use-case-based interfaces. While E-Locate focuses on housing, OTO Direct targets automotive services, but both leverage location-based technology to enhance convenience for their users. Also, Application for Searching Product Nearby Location is a web-based and mobile application aimed at helping users find products in nearby stores. It relies on geo-location values using GPS for mobile apps and Geocoding for web apps, mapping both the user’s current location and the store’s coordinates. The system allows users to view real-time product availability. The

app updates store databases every 10 minutes and incorporates MongoDB for fast, scalable data handling. It features five key modules: shopkeeper registration, user authentication, search engine, and geocoding for mapping.[15]

In addition, Where2Buy: A Location-Based Shopping App is a mobile application designed to help users search for products in nearby stores. It uses distance-based searching combined with GPS technology to identify shops that sell desired products, showing both the price and location. Where2Buy offers product-wise searching, allowing users to search for items by text or voice input, with results displayed on a navigation map. The system consists of a smartphone app for users and vendors, a web-based admin tool for product management, and a backend server that processes and stores data. [16]

WhereToFind shares key features with the four systems, such as using location-based services (LBS) like GPS and geocoding to map user locations and nearby stores, similar to Application for Searching Product Nearby Location and Where2Buy. It also provides real-time updates, aligning with E-Locate and OTO Direct, ensuring users access accurate information. Like Where2Buy, WhereToFind includes a search engine for quick product discovery. These common functionalities—location-based searching, real-time updates, and user-friendly interfaces—highlight the shared focus on convenience and efficiency across all systems. Unlike other systems, it integrates geo-location mapping via APIs like Google Maps or OpenStreetMap, displaying store locations on an interactive map with distance calculations, route navigation, and travel times. This ensures users can easily find and plan visits to nearby stores.

2.4 Theme 3: Adopting OutSystem in Developing WhereToFind

Siemens Teamcenter is a leading Product Lifecycle Management (PLM) software solution, recognized by Forrester Research and G2 as a top choice in the industry, offering scalable cloud-based and on-premise options to manage products and processes throughout their lifecycle. Siemens Teamcenter Implemented OutSystems to streamline various enterprise processes and enhance productivity[17], Also, Bosch is one of the most prominent engineering and technology organizations in the world, adopted the OutSystems platform to empower the business and scale app delivery. Used the platform to develop applications for their manufacturing processes and internal communications[18]. Furthermore, AXA is one of the largest growing insurance companies in the country. It use OutSystem to create a customer portal that integrates various services, enhancing customer experience and engagement.[19]

Siemens TeamCenter, Bosch, and AXA—along with the capstone project WhereToFind, all leverage the low-code OutSystems platform to streamline

processes and enhance productivity. Siemens TeamCenter uses OutSystems to optimize enterprise processes, while Bosch employs it to develop applications for manufacturing and internal communications. Similarly, AXA utilizes the platform to create a customer portal that integrates various services, improving customer experience and engagement. The project, WhereToFind, aligns with these systems in its use of OutSystems to develop a web-based hardware store locator and price list system. Siemens TeamCenter and Bosch focus on internal process optimization and manufacturing, while AXA prioritizes customer engagement through a portal. In contrast, WhereToFind is designed to serve end-users by helping them locate hardware stores and compare prices, making it more consumer-oriented. The system will be developed using OutSystems for low-code application development

3 Technical Background

This chapter introduces the technical background of the system. It discusses the hardware and software specifications that will be use in the development, the specification requirements for users, and the definitions of the technical terms applied in this section.

3.1 System’s Development Specification

This section presents the hardware, software and service specification of the system that will be use by the developers in developing the project.

3.1.1 Hardware Specification

Table 1: Developer’s Hardware Specification

HARDWARE	DESCRIPTION
Memory	8 GB, 3200 MHz
System Type	64-bit operating system, x64-based processor
Storage	20GB SSD
Processor	11th Gen Intel(R) Core(TM) i3-1115G4 @ 3.00GHz 3.00 GHz
Display	14.0-inch, FHD (1920 x 1080)

The hardware specifications listed in Table 1 support the developers during the project’s development. The processor delivers the required processing power with an Intel Core i3-1115G4 to run the system’s software components. Therefore, this processor supports the execution of hardware store locator and price comparison.

Additionally, an 8 GB RAM with a speed of 3200 MHz efficiently handles the data processing and analysis tasks needed for integrating geolocation mapping and price listing while ensuring smooth user experiences for both internal and external users.

Furthermore, the Full HD display offers users detailed views of the system interface, enabling them to interact with various features and functionalities, including data visualization and report generation displays in WehereToFind.

3.1.2 Software Specification

The Software specification will include key software elements important to the efficiency of the system from two views: development and operation. The Software specification will ensure that the system will be able to meet the desired performance, reliability, and scalability requirements.

Table 2:	Developer's Software Specification
SOFTWARE	DESCRIPTION
Operating System	Windows 11
Development language	HTML, CSS, Python
Development Platform	OutSystems
Database	MySQL
Browser	Google Chrome v. 135.0.7049.42
Prototype and Wireframe	Figma
Geo-location Integration	Google maps API or OpenStreetMap
Documents	LaTeX Overleaf
Diagrams	Draw.io

The system will be developed on a Windows 11, ensuring compatibility and stability across all functionalities. MySQL will serve as the database management system, enabling efficient data storage and management for profiles of registered stores, product catalogs, and price lists. OutSystems will act as the core development platform, facilitating the creation and deployment of the web-based application. As a low-code platform, OutSystems will allow for rapid system development and deployment.

Furthermore, HTML,CSS,Python is important for building the core structure, styling, and interactivity of web application. Draw.io will be utilized for diagram creation, while Figma will play a key role in prototyping and wireframing, offering an intuitive platform for visualizing the system's user interface and interactions. Finally, LaTeX Overleaf will streamline document preparation, ensuring professional and polished reports through its advanced typesetting capabilities.

3.1.3 Service Specification

The service specification provides a detailed description of the services that the WhereToFind will be using.

Table 3: Developer’s Service Specification

SERVICE	PROVIDER
Integration Platform as a Service	Outsystems Integration Hub
API integration	Google Maps or OpenStreetMap
Internet Connection	Converge/PLDT

The system will utilize Google Maps API or OpenStreetMap as its geo-location service provider to enable users to locate nearby hardware stores efficiently. These APIs will provide interactive maps, distance calculations, and route navigation, ensuring users can easily find stores and plan their visits. Additionally, the OutSystems Integration Hub will be employed to streamline the integration of these external services, allowing seamless data flow between the web-based platform and the geo-location APIs.

3.2 User’s System Specification Requirements

This section outlines the minimum and recommended hardware and software specifications required for the system. Defining these specifications is essential to ensure optimal performance and compatibility within the intended operating environment.

The hardware requirements will provide a structured approach to ensuring the user’s computing system aligns with the necessary components for optimal operation. From processors to memory, display, and storage, the specifications will outline both minimum functionality and recommended performance. Any processor for the system will suffice as it will be platform-independent, but the recommendation of an 11th Gen Intel Core i3-1115G4 will be more suitable since it will undergo proper testing for system compatibility. With sufficient memory (8 GB RAM), the system will efficiently process large datasets and execute calculations without slowdowns, which will be crucial for analysis. A high-quality display with a resolution of 1920 x 1080 will ensure that users can clearly view shipment details and notifications, enhancing usability and decision-making.

Additionally, a free space of 18 GB will meet the minimum storage requirement for the system. However, 20 GB or more of free space will be recommended to ensure that data and system components can be stored without limitations, supporting WhereToFind effectively. Windows 10 Home 64-bit software

Table 4: Users’ Hardware Software Recommended Specification

List of Computer Hardware	Minimum Requirements	Recommended Requirements
Processor	Any processor	11th Gen Intel(R) Core(TM)i3-1115G4 3.00GHz
Memory	4GB of RAM	4GB or Higher
Display	15.6-inch,FHD (1280x720)	15.6-inch,FHD (1280x1080)
Storage	18GB	20GB
List of Computer Software		
Operating System	Windows 10 home 64-bit	Windows 11 Home 64-bit
Browser	Google Chrome v. 135.0.7049.42	Google Chrome v. 135.0.7049.42 or newer
Internet	5-10mbps	15-20mbps

will provide a stable environment for running and integrating the system’s components with external services. Compatibility with web browsers, including but not limited to Google Chrome version 120.0.6099.304 or newerA 5-10 Mbps internet connection, and necessary peripherals. Meeting these specifications ensures optimal system performance, enhanced security, and compatibility with modern software, providing users with an efficient and secure web experience. Additionally, the system requires Windows 11.

3.3 Technical Terms

The following are the technical terms use within the context of the propose WhereToFind, each playing a crucial role in understanding its functionality and operation:

Geolocation - is the ability to track a device’s whereabouts using GPS, cell phone towers, WiFi access points or a combination of these.[20]

Locator- a feature on a website that shows you where a particular store, bank, etc. is on a map: Simply click on the store locator button and follow the directions[21]. A feature that uses geo-location technology to help users find nearby hardware stores on an interactive map with real-time navigation.

Price List- a statement or list of the prevailing prices of the merchandise, stocks, specie, bills of exchange, or other matter dealt in issued statedly[22].It is use as real-time catalog of product prices from registered stores, allowing users to compare costs before purchasing.

Search engine - is a coordinated set of programs that searches for and identifies items in a database that match specified criteria.[23] It is use in the project to filter products by price and location, with results displayed in a structured interface to simplify comparison across stores.

Store Profiling - store profiling is an essential strategy in retail marketing that involves collecting and organising comprehensive information about each store in a retailer's estate[24].A feature in this project enabling store owners to create and manage their business profiles, including product listings and pricing.

System- The meaning of sytem is a regularly interacting or interdependent group of items forming a unified whole[25].An integrated web-based platform designed to provide hardware store location, price comparison, and store management functionalities.

Usability- the degree to which something is able or fit to be used[26]. The system's ease of use, usefulness, and user satisfaction, measured through the USE questionnaire.

Web-based- an external application that is accessed via a web browser over the Internet[27].A software solution accessible through browsers without installation, developed using web technologies like OutSystems.

4 Design and Methodology

The main objective of the project will be to develop Wheretofind: Hardware Store Locator and Price List System, a web-based platform that will assist users in locating hardware stores and comparing product prices in real time. The system will be designed to include essential features such as hardware store management profiling, price and product search functionality, geolocation mapping, and integration with OpenStreetMap for accurate and dynamic location-based services. To fully understand how the system will be constructed and implemented, a thorough discussion of its design and methodology will be essential.

This chapter will provide the foundation for the methodologies that will be applied during the planning, analysis, and development phases of the project. It will cover the system design diagrams, requirements analysis, development tools, selected model methodology, testing strategies, defined roles and responsibilities of the proponents, and budget management. These elements will collectively serve as the backbone for a structured and successful implementation of the system.

4.1 Concept

This section will include diagram that will extend the understanding of how Wheretofind will work. The diagrams will include a system architecture diagram that will give a high-level overview of how different components of the system will interact, a data flow diagram, which will visually represent how data will flow across the system. It will also include a Use-Case Diagram, which will show the various actions users will be able to perform and how they will interact with the system. An activity Diagram will be used to show the flow of activities or processes inside the system. An Entity-Relationship Diagram will also show the relationship between different entities in the database of the system.

4.1.1 System Architecture Diagram

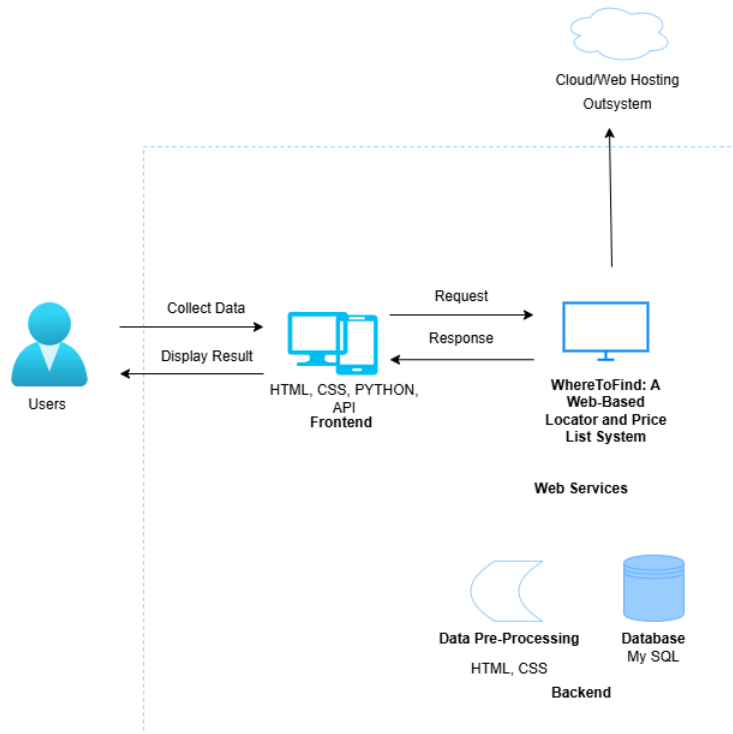


Figure 1: System Architecture Diagram System

System Architecture Diagram is a graphic representation that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components [22]. Figure 1 shows the general view of the system architecture diagram and outlines the structure of the proposed system.. The user interacts with the system through a frontend interface, built using HTML, CSS, and Python, serves as the user interface where customers interact with the

system. It handles HTTP requests (e.g., product searches) and displays responses dynamically. The Backend processes these requests, leveraging API integrations for data retrieval and business logic execution. Key backend functions include Data Pre-Processing to refine inputs and Web Services to facilitate communication between components. For data storage, the system employs a MySQL Database, ensuring efficient and secure management of product listings, user data, and transactional records. The backend also integrates with AWS Cloud/Web Hosting for scalable deployment and reliable performance. This integration improves the capabilities of the system towards the realization of conversational intent and It allows for much more intuitive user interactions.

4.1.2 Data Flow Diagram

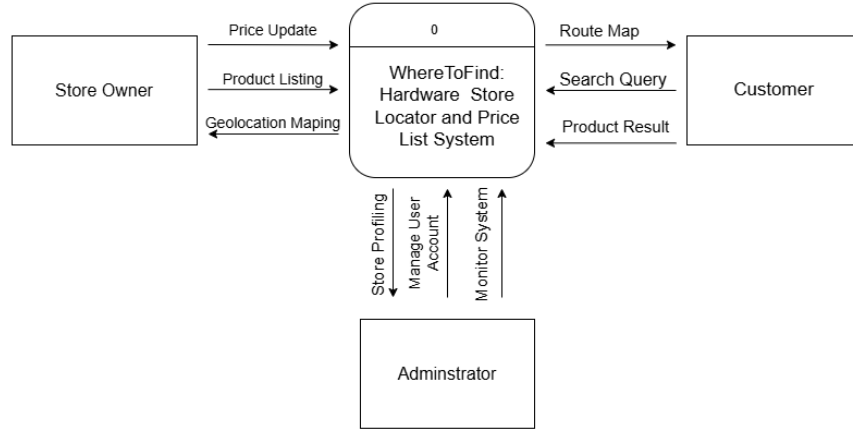


Figure 2: Data Flow Diagram Level 0

The provided diagram illustrates a Level 0 (Context Flow Diagram) for WhereToFind. The system is designed to serve three primary actors: Store Owners, Customers, and Administrators. Store Owners can manage stores and products, including updating product prices. Customers can search for stores and products, view product details, and navigate route directions. Administrators have access to additional functionalities such as viewing store profiling, monitoring the system, and managing user accounts.

Figure 3: Data Flow Diagram Level 1

In figure 3 Data Flow Diagram Level 1 of a system that deals with customer and store owner interactions as well as with the administration aspects of the system. The Store Owner module focuses on managing stores and products. Key functionalities include updating product prices and maintaining product details. The system allows

store owners to oversee their inventory and pricing efficiently, ensuring accurate and up-to-date information for customers. Customers interact with the system to search for stores and products, view detailed product information, and navigate route directions to locate stores. This module ensures a seamless experience for customers seeking hardware products and store locations. The Administrator module handles system management tasks. This includes viewing store profiles, monitoring the overall system performance, and managing user accounts. The administrator ensures the system operates smoothly, addressing any administrative needs that arise.

4.1.3 UML Use-Case Diagram

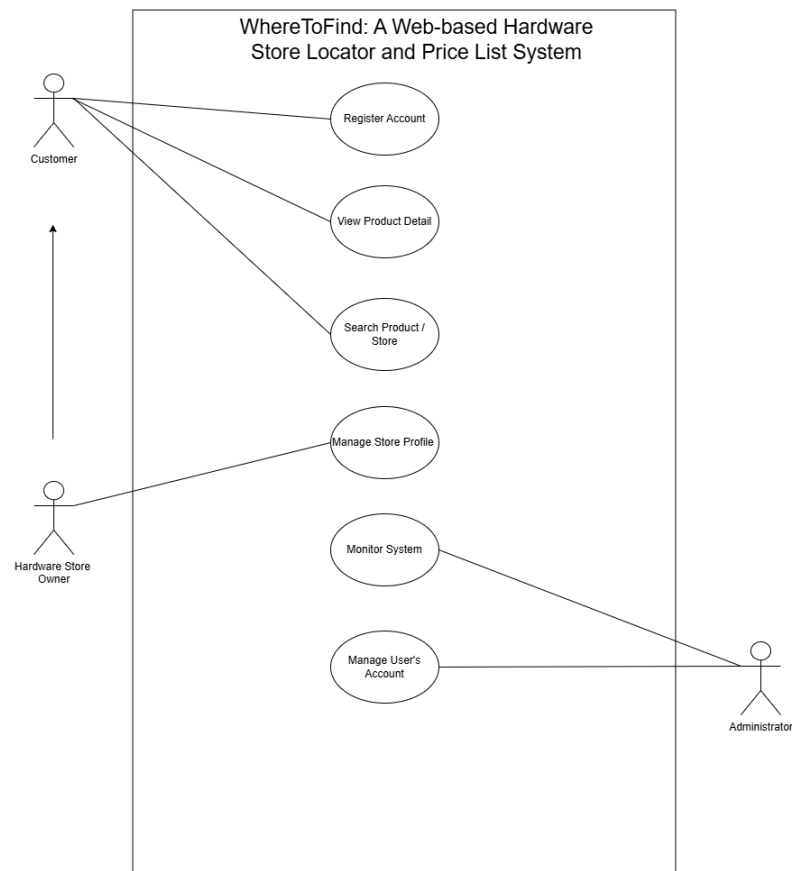


Figure 3: Data Flow Diagram Level 0

The main actors of WhereToFind include the Customers, the hardware store owner, and the administrator. Customers will interact with the WhereToFind by registering account and log-in, viewing product details, and searching product/store. Also, the the hardware store owner will manage their store profile. Meanwhile

administrators can manage user's account and monitor the system.

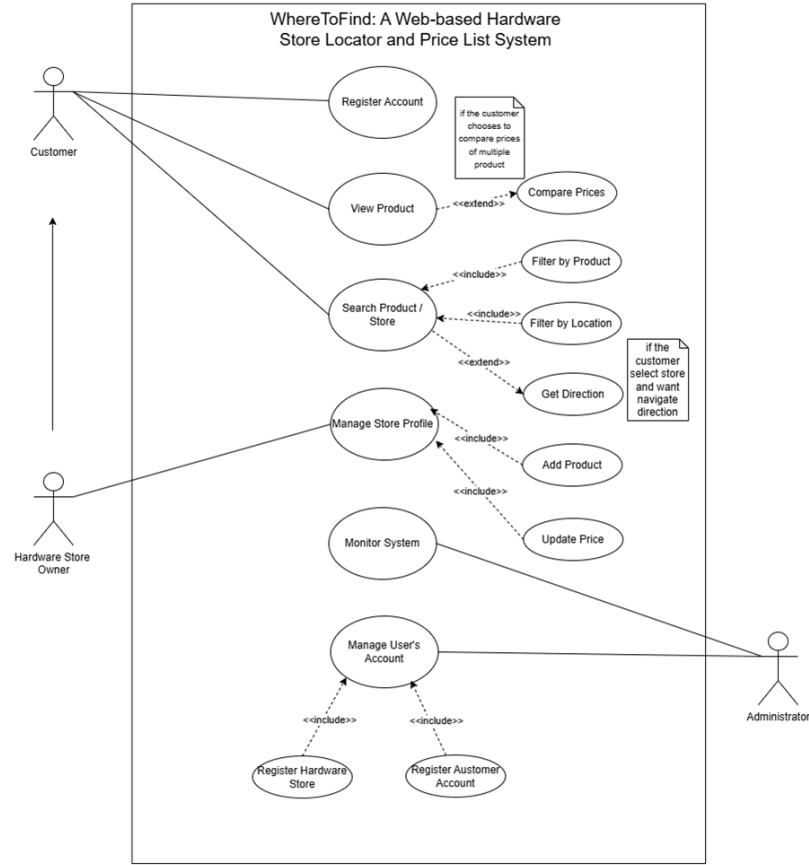


Figure 4: Extracted Functions

Figure 6 will present the use-case diagram for WhereToFind: A Web-based Hardware Store Locator and Price List System. It will outline the interactions among three main user types: Customers, Hardware Store Owners, and Administrators. Customers will be able to register, log in, search for stores or products, view product details, compare prices, and get directions, with the option to filter results by product or location. Hardware Store Owners will have the ability to manage their store profiles, update product information, register their stores, and assist customers as needed. Meanwhile, Administrators will oversee the entire system, managing user accounts and monitoring performance to ensure smooth operation.

4.1.4 UML Activity Diagram

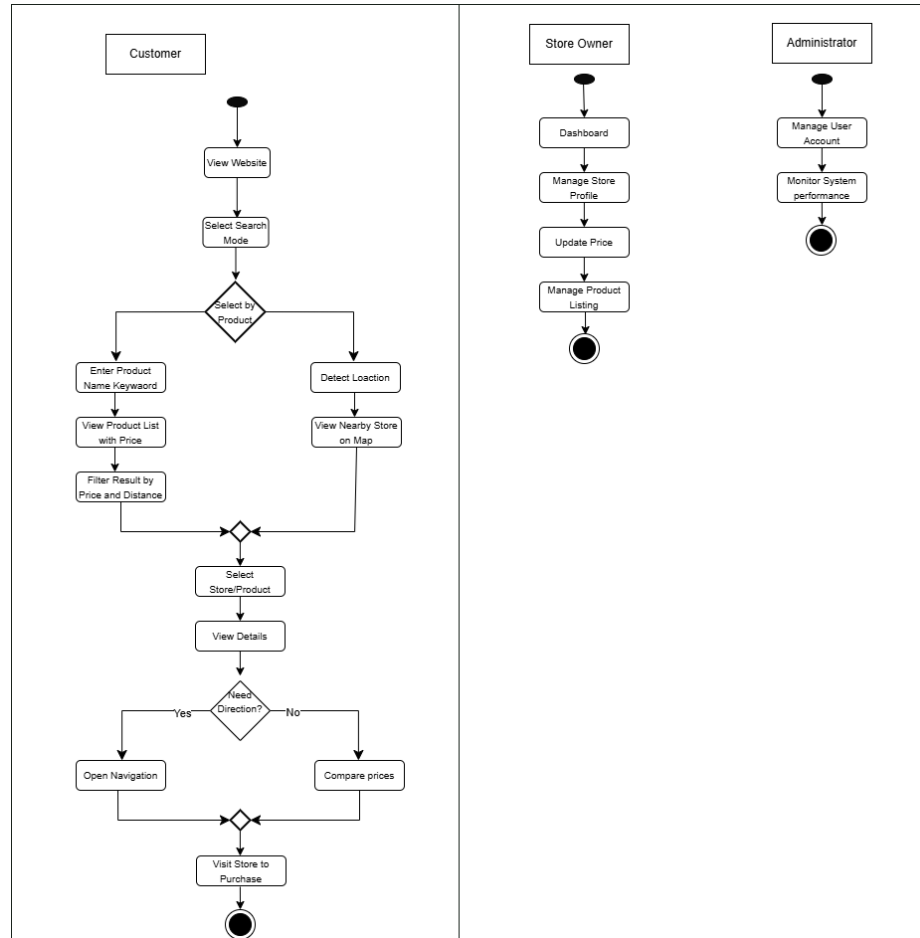


Figure 5: Data Flow Diagram Level 0

The activity diagram illustrates the sequential flow of actions and decisions involved in the WhereToFind a web-based hardware store locator and price list system, outlines the key interactions between customers, store owners, and administrators. For customers, the process begins with viewing the website and selecting a search mode, either by product or location. They enter a product name or keyword, view a list of products with prices, and apply filters like price range or distance. After selecting a store or product, they can view details, compare prices, and decide whether to get directions or visit the store to make a purchase.

Store owners have access to a dashboard where they can manage their store profile, update product prices, and maintain their product listings. Administrators oversee user accounts, monitor system performance, and view nearby stores on a map to ensure the system runs smoothly. The diagram effectively captures the workflow of the system, highlighting the seamless navigation for customers and the management tools available for store owners and administrators. This structured approach ensures

efficient product searches, price comparisons, and store interactions, enhancing the overall user experience.

4.1.5 Entity-Relationship Diagram

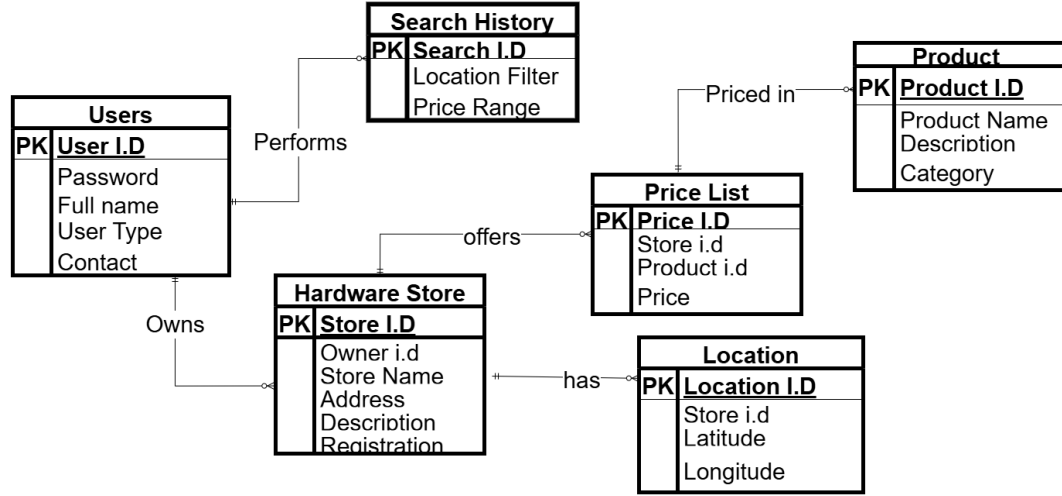


Figure 6: Entity-Relationship Diagram

This Entity Relationship Diagram (ERD) illustrates a system designed to manage hardware store data, involving users, products, prices, and locations. Users, who can be store owners or customers, perform searches that are tracked in the search history with filters like location and price range. Each hardware store is owned by a user and is associated with a specific location. Stores offer various products, and pricing details are maintained in the price list, which links products and stores. Products include attributes such as name, description, and category. Overall, the diagram provides a clear structure for how users interact with stores and products, ensuring organized and efficient data management.

4.2 Analysis and Design

In designing and planning the WhereToFind system, the development team will use several tools to map out how the system will work. One of the main tools they will use is Unified Modeling Language(UML), which will help them clearly represent how different parts of the system are expected to behave and interact. They will create use-case diagrams and sequence diagrams to show how users like customers, hardware store owners, and administrators will navigate and interact with the systems features.

To get the better picture of how the data will move in and out of the system, the team will also create a Context Flow Diagram(CFD). This diagram will show the flow of information between the system and external users, helping define its boundaries and making its easier to understand how everything will connect. Another important tool that will be used is the Entity-Relationship Diagram(ERD). This will help the team organize and structure the data such as price, product, and store details, and user accounts by showing the information. Using the ERD will make sure the database is designed properly and supports the features the system aims to provide.

4.2.1 Requirement Analysis

Requirements analysis is the process of determining user expectations for a new system[29]. The following will be the functional and nonfunctional requirements that the system will need to perform.

4.2.1.1 Non- Functional Requirements

Table 1: Functional Requirements

Task Requirements	Task Reference
The system should allow users to easily recognized if its features meet their needs and intended tasks.	Store Profiling
The system will satisfy users by providing and fulfilling user experience	Search Engine
The system should be easy to learn and operate with minimal effort from users.	Geo-Location Mapping

4.2.1.2 Non-functional Requirements

Nonfunctional Requirements is a function that's helps software operate efficiently[31]. Table 4.2.1.2 will present the system's non-functional requirements, including descriptions of each requirement and its corresponding task reference. These references will be adapted from the International Organization for Standardization's Software Quality Standards (ISO/IEC 25010).

Table 2: Functional Requirements

Task Requirements	Task Reference
The system will allow hardware store owners to create and update their store information, including store name, location, product catalog and price list	Usefulness
The system will enable to filter product name, price range and store location.	Satisfaction
The system will allow customers to search for product and view store locations.Enable distance calcution and route navigation.	Ease of use

4.3 Development Model

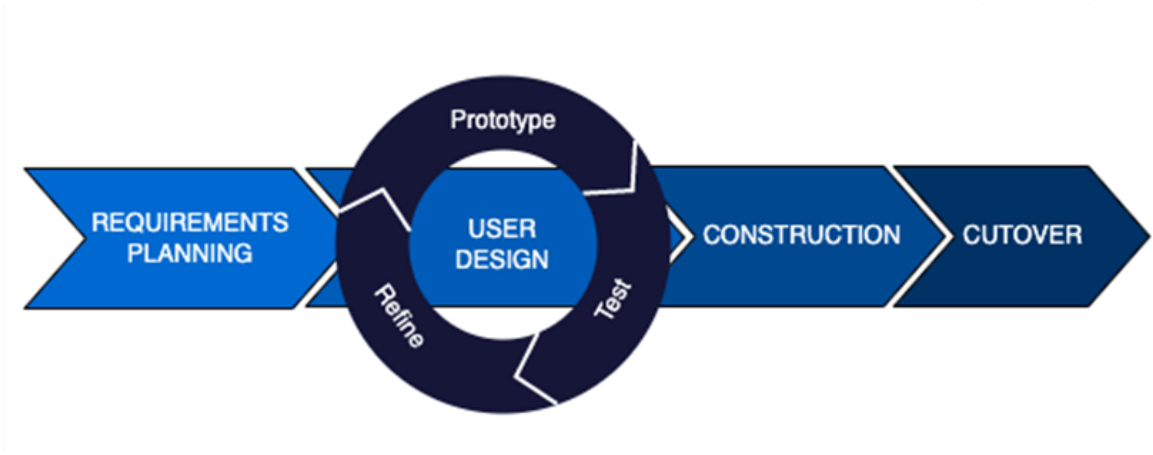


Figure 7: Rapid Application Model

Rapid Application Development (RAD) will be the development model used during the development of the WhereToFind. Rapid Application Development (RAD) methodology is a flexible way to create and deploy software applications quickly. The RAD method is effectively designed to adapt to changes and new inputs like features and functions, updates, etc. It is designed to be flexible to changes and to accept new inputs, like features and functions, at every step of the development process[32]. This makes it suitable for the development of WhereToFind as it allows rapid development and deployment of the software, accelerating the time it takes to bring WhereToFind to market.

Figure 9: Rapid Application Model

Define Requirements: In this phase, the researchers conducted stakeholder consultations to define the system’s core functionalities, including user registration,

store profiling, geo-location integration, and price search capabilities. Given the niche focus on hardware stores, RAD’s streamlined requirements gathering helped avoid excessive documentation while ensuring key features were prioritized. By analyzing existing systems such as Shopbots and Where2Buy, the researchers identified gaps in the market and refined the project scope to ensure “WhereToFind” would effectively meet user needs.

User Design: The researchers developed early prototypes to gather user feedback. They designed wireframes and mockups for the web interface, emphasizing intuitive navigation, mobile responsiveness, and efficient search filters. The integration of Google Maps API or OpenStreetMap was planned to provide accurate store location tracking. By involving users early in the design process, the researchers were able to refine the interface based on usability testing, ensuring the final product would be user-friendly for both customers and store owners.

Rapid Construction: Leveraging OutSystems, a low-code development platform, the researchers accelerated the implementation of key features such as user authentication, store dashboards, and real-time price listings. RAD’s modular approach allowed for the quick assembly of reusable components, including the geo-location mapping system and search engine. Since RAD prioritizes functional prototypes over perfection in early iterations, the team could deploy a working version swiftly and make iterative improvements based on real-world testing.

Rapid Cutover: In the final phase, the researchers deployed the system for pilot testing, collected user feedback, and made necessary refinements. RAD’s flexibility enabled them to address issues such as map accuracy and search performance before full-scale implementation. Training materials were prepared for store owners to manage their profiles, and the system’s usability was evaluated using the USE questionnaire measuring usefulness, satisfaction, and ease of use. The iterative nature of RAD ensured that the final product was both functional and aligned with stakeholder expectations, making it ready for real-world application.

4.4 Development Approach

Shown below is the approach that will be used as a step to implement the development model in the development of the system. The Bottom-Up Approach process begins at the most detailed and basic level and works upwards to form a comprehensive software solution[33]. This approach is suitable for the nature of Rapid Application Development (RAD) Model. The researchers would, first, identify the basic functionalities and features of the WhereToFind. These functionalities are then translated into basic components, which are incrementally developed, tested, and integrated. Through stakeholder feedback, the system may evolve to meet changing requirements. End-to-end testing ensures functionality, performance, and reliability, while continuous deployment allows stakeholders to provide feedback on new features.

The development cycle continues until the WhereToFind: is completely developed.

4.5 Development Tools

The researchers will be using the following software development platforms and applications to create the system:

Outsystem

OutSystems is a low-code development platform that enables organizations to build, deploy, and manage custom applications with minimal hand-coding. It provides a visual development environment where developers can create applications by assembling pre-built components using a drag-and-drop interface[33]. OutSystems is to be used as the primary development platform for the development of WhereToFind. It offers a visual development environment wherein researchers can design web application user interfaces.

FIGMA

It is a browser-based, collaborative user interface design tool that lets users work together to create vibrant and interactive prototypes [34]. This tool will be used by the developers to design the mockup and prototype of the system.

OpenStreetMap

OpenStreetMap (OSM) is an internationally recognized open-source mapping project that utilizes the power of a global community to create, update and share detailed and accurate maps of the world[35]. This tool will be used by the developers to locate nearby hardware store and navigate routes.

Aws

Amazon Web Services are cloud-based service platforms provided by Amazon that enable businesses and individuals to construct, deploy, and manage various applications and infrastructure in the cloud or web with variable services and tools provided[36]. AWS is a cloud computing platform that will be used by the researchers to host the WhereToFind to the world wide web.

MySQL

MySQL is an open-source relational database management system[37]. MySQL represents the relational database management system used to store and manage the structured data required for WhereToFind, including product and store information, routes, customers, and system configurations, providing storage and retrieval capabilities.

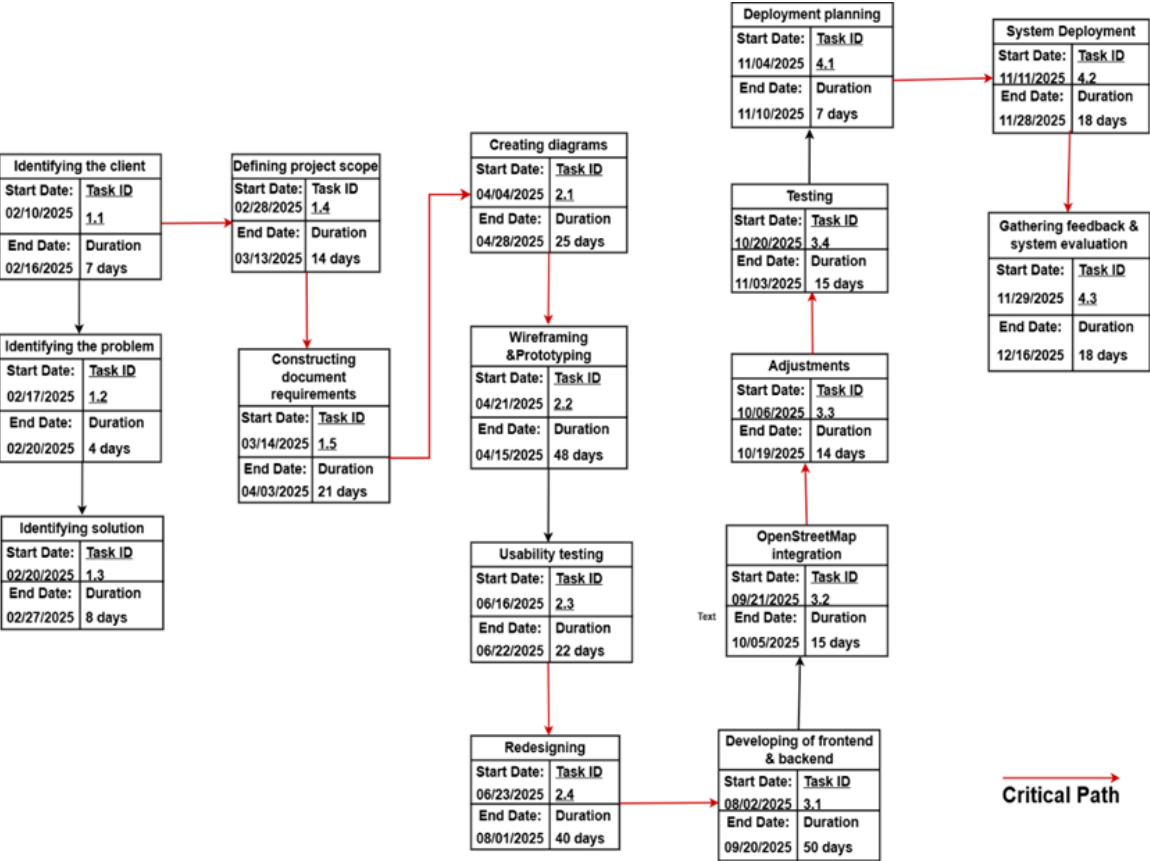
4.6 Schedule and Timeline

Work Breakdown Structure (WBS)			
TASK ID	MINIMUM REQUIREMENTS	DURATION	PREDECESSOR
1	Identifying the client	7 days	
2	Identifying the problem	4 days	1
3	Identifying solution	8 days	1, 2
4	Defining project scope	14 days	2, 3
5	Contructing document requirements	21 days	1, 4
6	Creating diagrams	25 days	5
7	Wireframing & Prototyping	48 days	6
8	Usability testing	7 days	7
9	Redesigning	40 days	8
10	Development of frontend & backend	50 days	9
11	OpenStreetMap integration	15days	10
12	Adjustment	14 days	9, 10
13	Testing	15 days	10, 11, 12
14	Deployment planning	7 days	13
15	System deployment	18 days	14
16	Gathering feedback & system evaluation	18 days	15

GHANTT CHART

TASK ID	TASK DESCRIPTION	Start Date	End Date	Duration	Q1			Q2			Q3			Q4		
					Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	PHASE 1: Requirements Planning															
1.1	Identifying the client	02/10/25	02/16/25	7d												
1.2	Identifying the problem	02/17/25	02/20/25	4d												
1.3	Identifying solution	02/20/25	02/27/25	8d												
1.4	Defining project scope	02/28/25	03/13/25	14d												
1.5	Constructing document requirements	03/14/25	04/03/25	21d												
2	User Design															
2.1	Creating diagrams	04/04/25	04/28/25	25d												
2.2	Wireframing &Prototyping	04/29/25	06/15/25	48d												
2.3	Usability testing	06/16/25	06/22/25	7d												
2.4	Redesigning	06/23/25	08/01/25	40d												
3	Construction															
3.1	Developing of frontend & backend	08/02/25	09/20/25	50d												
3.2	OpenStreetMap integration	09/21/25	10/05/25	15d												
3.3	Adjustments	10/06/25	10/19/25	14d												
3.4	Testing	10/20/25	11/03/25	15d												
4	Cutover															
4.1	Deployment planning	11/04/25	11/10/25	7d												
4.2	System Deployment	11/11/25	11/28/25	18d												
4.3	Gathering feedback & system evaluation	11/29/25	12/16/25	18d												

CRITICAL PATH



4.7 Responsibilities

Name	Position	Responsibilities
Kailah Kristine E. Sus	Technical writer	The role of the technical writer will be to ensure that technical information is communicated effectively to various stakeholders. They will translate complex technical concepts into clear and understandable language, making documentation accessible to the intended audience.
Manallo, Jemarie L.	Programmer	The programmer will play a critical role in the development and maintenance of the web-based system and will collaborate closely with other team members to ensure the project's success. The programmer will work closely with the system analyst, designers, and more.
Cebujano, Archie Gem C.	System analyst	The system analyst will be responsible for analyzing the requirements of the Wheretofind: A Web-based Hardware Store Locator and Price List System project and translating them into technical specifications.

4.8 Budget and cost Management

4.8.1 Proponents Budget And Cost Management

Table 3: Materials and Supplies

Item Name	Quantity	Unit Price	Amount
Bond paper(Short)	2 rim	P250.00	P500.00
Ballpen(Black)	3 pcs.	P12.00	P36.00
White Folder	1 dozen	P15.00	P180.00
Binder Clip	8 pcs.	P3.00	P24.00
Total			P740.00

The table will outlined all the expenses on materials and supplies of the researchers. The total amount of the expenses is PHP 740.00.

4.8.2 System's Operation Cost In Development

Table 4: Materials and Supplies

Services	Provider	Monthly Fee	Total amount/per year
Cloud Hosting	Outsystem	Free	Free
	Integration Hub		
Internet	Converge	P1,500.00	P18,000.00
Geolocation Integration	Openstreetmap	Free	
Total			P18,000.00

4.9 Verification And Validation

The Verification and validation in project development are essential to verify that the system accurately meets requirements. The following are discussed below.

4.9.1 Verification

The researchers ensure that the WhereToFind is appropriately planned and will be implemented according to the requirements and specifications. The system would undergo thorough planning, designing, system construction, reviewing and performing various kinds of testing until it's free from errors and is ready to be deployed.

4.9.2 Validation

The table provides a structured approach for validation using the Likert Scale methodology. The Likert Scale is a commonly used tool in surveys and assessments to measure the level of agreement or disagreement with a statement or set of statements [38]. In this case, the Likert Scale is divided into five categories based on the range calculated using the formula $(\text{high value} - \text{lowest value}) / 5$, where the high value is 5 and the lowest value is 1.

By using this table, evaluators can assign mean values to various software characteristics based on user feedback or assessments. This structured approach helps clearly define the levels of agreement or disagreement, providing a standardized method for evaluating and interpreting data related to software characteristics such as Usefulness, Satisfaction, and Ease of Use.

Mean	Description
4.21 - 5.0	Not Usable at All
3.21 - 4.20	Slightly Usable
2.41 - 3.20	Moderately Usable
1.81 - 2.40	Usable
1.0 - 1.80	Highly Usable

4.10 Testing

System	WhereToFind: A Web-based Hardware Store Locator And Price List System
Test Module	<p>Main Module: Store profiling ;</p> <p>Submodules: Search Registration, Profile Editing</p> <p>Main Modules: Product And Price Search</p> <p>Submodules:Search Engine, Filtering, Price Sorting</p> <p>Main Modules: Geolocation mapping;</p> <p>Submodules: Store Locator(OpenStreetMap),Location Access, Direction Finder</p> <p>Main Module: System Usability Evaluation;</p> <p>Submodules: USE Questionnaire.</p>
Access Requirements	<p>URL:</p> <p>Log In Credentials</p> <p>[Username]</p> <p>[Password]</p> <p>[User Type]</p>
Goal of the Test	<p>The primary goal of this testing process to verify that each modules functions according to the project's approved requirements and user expectations. Testing will ensure that the system will allow store owners to manage their profiles, users to search for product with up-to-date pricing, and stores to be accurately located via Geolocation. It will also evaluate the systems usability through response to the USE Questionnaire.</p>
Out of Scope	<p>The Review and Rating System feature, with considered for future implementation and will not be included in this testing cycle.</p>

Testing Steps

Login Verification

- ;Access the provided URL
- ;Input valid login credentials
- ;Verify correct dashboard access for each user role

Navigation Testing

- ;Navigate through the modules
- ;Verify correct routing of all buttons and menu links

Functionality Testing

- ; Register a store and test profile updates
- ;Search for products and compare prices
- ;Use category filters and sorting
- ;View store location and OpenStreetMap

Data input Validation

- ;Tester will input valid data and invalid data
- ;Verify presence of error prompts and required field indicators

Integration testing

- ;Check OpenStreetMap integration for live location and map rendering
- ;Validate that the search engine pulls accurate product data from the database

Usability Testing

- ; Evaluate if users can complete key tasks easily
- ;Analyze feedback from the USE Questionnaire

Security Testing

- ;The system will be checked for secure login and proper role-based access.
- ;Password will be verified to be stored securely

System	WhereToFind: A Web-based Hardware Locator and Price List Sytem Maintainability Testing ;Check if updates reflect properly without breaking other modules Compatibility Testing ;Test across browsers: Chrome, Edge ;Test across devices; mobile(Andriod, IOS),desktop,laptop ;Confirm full system functionality on varying screen sizes
Target devices	Smartphones, Laptops and desktops Software Required: Compatible Web Browsers(Chrome, Microsoft Edge)

References

- [1] Price.com.hk. [Online]. Available: <http://www.price.com.hk/>.
- [2] Consumer Council - Online Price Watch (CCOPW). [Online]. Available: <https://www3.consumer.org.hk/pricewatch/supermarket/>.
- [3] D. Clark, "Shopbots become agents for business change," *Computer*, vol. 33, no. 2, pp. 18–21, 2000.
- [4] B. Krulwich, "Bargain finder agent prototype," Anderson Consulting, 1995.
- [5] Shopping.com. [Online]. Available: <http://www.shopping.com/>.
- [6] Pricegrabber. [Online]. Available: <http://www.pricegrabber.com/>.
- [7] Yaoota. [Online]. Available: <https://yaoota.com/en-eg/>.
- [8] Price-cream.com. [Online]. Available: <http://price-cream.com/>.
- [9] G. Gültekin and O. Bayat, "Smart location-based mobile shopping android application," *Journal of Computer and Communications*, vol. 2, pp. 54–63, 2014.
- [10] idealo – Your Price Comparison. *www.ideal.co.uk*. [Online]. Available: <https://www.ideal.co.uk/>
- [11] Gültekin and O. Bayat, "Smart Location-Based Mobile Shopping Android Application," *Journal of Computer and Communications*, vol. 02, no. 08, pp. 54–63, 2021. doi: <https://doi.org/10.4236/jcc.2021.28006>.

- [12] A. Dawn Shaikh, R. Khan, K. Panokher, K. Ranjan, and V. Sonaje, “E-commerce Price Comparison Website using Web Scraping,” *International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences*, vol. 11, no. 3, Jun. 2023. doi: <https://doi.org/10.37082/ijirmps.v11.i3.230223>.
- [13] S. Chowdhury, “Application for Searching Product nearby location,” Dec. 20, 2020. [Online]. Available: https://www.researchgate.net/publication/329800835_Application_for_Searching_Product_nearby_location
- [14] Lapada, “E-locate: A Room for Rent Locator,” *ResearchGate.com*, Jun. 2020. [Online]. Available: https://www.researchgate.net/profile/Andy-Lapada/publication/372216063_Development_and_Evaluation_of_a_Management_Information_System_with_SMS_Notification_Technology_in_a_Philippine_Military_Camp/links/64a9733b8de7ed28ba85f576/Development-and-Evaluation-of-a-Management-Information-System-with-SMS-Notification-Technology-in-a-Philippine-Military-Camp.pdf
- [15] K. C. Chan, T. L. Cheung, S. H. Lai, K. C. Kwan, H. Yue, and W.-M. Pang, “Where2Buy: A Location-Based Shopping App with Products-wise Searching,” *2022 IEEE International Symposium on Multimedia (ISM)*, Dec. 2022. doi: <https://doi.org/10.1109/ism.2022.87>.
- [16] A. S. Guevarra and A. E. Ignacio, “Implementation of an Android Mobile Location-Based Service Application for General Auto Repair Shops,” *International Journal of Multidisciplinary: Applied Business and Education Research*, vol. 2, no. 1, pp. 49–62, Feb. 2021. doi: <https://doi.org/10.11594/ijmaber.02.01.07>.
- [17] Siemens TeamCenter. *Outsystems.com*, Apr. 2024. [Online]. Available: <https://www.outsystems.com/forge/component-overview/18351/siemens-teamcenter-011>
- [18] Bosch builds digital factory and eliminates shadow IT. *Outsystems.com*, 2024. [Online]. Available: <https://www.outsystems.com/case-studies/bosch-digital-factor>
- [19] MyAXA App — AXA Philippines. *Axa.com.ph*, 2020. [Online]. Available: <https://www.axa.com.ph/myaxa-app>
- [20] J. Frankenfield, “Geolocation Definition,” Investopedia, Jan. 25, 2021. Available <https://www.investopedia.com/terms/g/geolocation.asp>
- [21] Cambridge Dictionary, “locator,” @CambridgeWords, Apr. 02, 2025. Available: <https://dictionary.cambridge.org/us/dictionary/english/locator>
- [22] “Definition of PRICE LIST,” Merriam-webster.com, 2020. available: <https://www.merriam-webster.com/dictionary/price%20list>

- [23] B. Lutkevich, “What is a search engine? — Definition from TechTarget,” WhatIs.com, 2022. available: <https://www.techtarget.com/whatis/definition/search-engine>
- [24] I. Turner, “Mauveworx Blog: What Is Store Profiling?,” Mauveworx.com, Sep. 23, 2022. available : <https://www.mauveworx.com/blog/what-is-store-profiling>
- [25] Merriam-Webster, “Definition of SYSTEM,” Merriam-webster.com, 2019. available: <https://www.merriam-webster.com/dictionary/system>
- [26] Interaction Design Foundation, “What is Usability?,” The Interaction Design Foundation, Jun. 01, 2016. available: <https://www.interaction-design.org/literature/topics/usability>
- [27] “Web-based Definition,” Law Insider. available: <https://www.lawinsider.com/dictionary/web-based>
- [28] R. Awati, “What is Requirements Analysis?” *TechTarget Search Software Quality*, 2023. [Online]. Available: TechTarget.
- [29] Indeed Career Guide, “Common Functional and Non-Functional Requirements,” [Online]. Available: Indeed Career Guide.
- [30] Indeed Career Guide, “Common Functional and Non-Functional Requirements,” [Online]. Available: Indeed Career Guide.
- [31] Team Kissflow, “RAD Methodology — Rapid Application Development Phases,” *Kissflow.com*, Apr. 5, 2024. [Online]. Available: <https://kissflow.com/application-development/rad/rapid-application-development-methodology-essentials/>
- [32] Aarthimanikandan, “What is OutSystems?” *Medium*, 2023.
- [33] Noble Desktop, “What Is Figma,” [Online]. Available: <https://www.nobledesktop.com/learn/figma/what-is-figma>
- [34] Atlas.co, “OpenStreetMap,” 2025. [Online]. Available: <https://atlas.co/glossary/open-street-map/>
- [35] K. B. Paul and S. G. Alexander, “Amazon Web Services (AWS),” *TechTarget*, 2022.
- [36] Anonymous, “What is MySQL?,” *DigitalOcean*, 2020.