Web-Based Computer Hardware Purchasing and Troubleshooting Assistant Management System

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February 2022

This dissertation is submitted in partial fulfillment of the requirement of the Degree of Bachelor of Information Technology of the University of Colombo School of Computing.

Abstract

The computer sales and servicing industry sells and services a wide range of computers, including desktops, laptops, notebooks, palmtops, and software, as well as peripherals such as printers, scanners, and keyboards. These products are typically purchased from domestic and foreign producers and distributors before being distributed to end-users such as households and companies.

Under the present system of U-Star Digital, customers used to come into the store and communicate their demands to the technician who built their computer. Customers arrived at the store, gave over the defective item or computer to the technicians, and then waited in their restroom until the task was finished. They presently use a phone-based and WhatsApp-based order system to take online orders. There are no other options than bank transfers, and the customer must confirm the order with formal transaction documents. Due to a lack of adequate delivery information, customers are not given accurate delivery information.

The main purpose of the research is to create and develop an online system for managing computer hardware and services that will help the company and its employees become more popular with their customers and market their business via the internet.

For modeling, the system uses a client-server architecture and a non-object-oriented iterative software development process called Rational Unified Process. The system is designed using the Unified Modeling Language. For front-end development, PHP is utilized as the server-side programming language, along with HTML, JavaScript, and CSS. As an integrated development environment, the Apache NetBeans IDE is employed. The Apache web server is utilized and MySQL is used to manage the database. It may be used with a web browser on any GUI-based OS platform as this is a web-based system. This system has offered to meet the needs of the client. It will be quite beneficial in archiving their commercial objectives.

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Chapter 1 – Introduction

1.1 Introduction

Many types of computers, including desktops, laptops, notebooks, palmtops, and software, as well as peripherals like printers, scanners, and keyboards, are sold and serviced in the computer sales and servicing industry. Before being supplied to end-users, such as households and businesses, these products are frequently purchased from domestic and international producers and distributors.

U-Star Digital is a renowned information and communication technology (ICT) company that has been in existence since 2010. They provide an unrivaled program and experience in ICT equipment repair, servicing, maintenance, and cleaning. They are depending on its technically advanced next-generation infrastructure to deliver best in class customer-aware and lifestyle-enhancing products and services that anticipate customers' needs.

1.2 Motivation of the Project

Customers used to come into the store and convey their needs to the technician who built their computer under the old system. Customers arrived at the shop, handed over the defective item or computer to the hardware professionals, and then waited in their restroom until the job was completed. To take online orders, they currently utilize a phone-based and WhatsApp-based order system. There are no other options than bank transfers, and the customer must send legal transaction paperwork to confirm the order. Customers are not given accurate delivery information due to a lack of appropriate delivery information.

Customers are on the go, busy, and mobile. They want frictionless and seamless services. By gaining a solid understanding of the needs of customers they are provided with a convenient product browsing experience, a simple payment system, and a delivery tracking system that allows customers to track their order as it arrives at their home. In addition, after the discussion with shop technicians, it was discovered that the average person has just around 25% of the average understanding of how to purchase items to build a computer. Others require technical support to purchase products. To use a virtual assistant to aid the rest of the team who are unfamiliar with computer hardware was

decided. Besides, the consumer has less time to troubleshoot computer hardware. Our solution was to create an efficient repair management module with an appointment booking module as a computer hardware service provider to prevent consumers from wasting time at their repair location. It is more important to deal with the warranties of the items. Adding a warranty checking feature that allows consumers to check the warranty status of individual parts purchased from the shop is also concerned.

An outstanding solution for U-Star Digital to continue their greatness in the computer sales and maintenance sector in this digital age can be added. By the same token, while pursuing a Bachelor's degree in Information Technology, this effort would substantially assist me in improving my project management, system analysis, design, and development abilities.

1.3 Objectives of the Project

The study's overall goal is to build and develop an online system for managing computer hardware and services that will assist the company and its employees in becoming more popular with their consumers and marketing their business through the internet.

The study's particular objectives are as follows:

- Include a virtual computer hardware assistant to let customers design a custom computer even if they don't know anything about computer hardware.
- Using an automated question-based module to implement Online Troubleshooting, and suggest the appropriate solution for resolving the problem.
- Including an appointment management module for taking care of appointments from clients who are having issues with their current stuff.
- Providing a feature-rich product browsing method, as well as a simple payment and shipping mechanism, to fulfill the customer's order.
- Implementing a warranty checker to whether the items bought by the customer are still covered under warranty.
- Inventory management, which makes it easy to manipulate items for the store and receive automated alerts when stock levels are low.
- Generate a variety of reports and graphics, including sales and stock data, to assist management in making decisions.

1.4 Scope of the Project

Web-Based Computer Hardware Purchasing and Troubleshooting Assistant management system has a broad reach that includes the following points of view.

1.4.1 Computer Hardware Assistant Module

This module assists customers who are unfamiliar with computer hardware. It takes all the details of individual items and matches them with the next most appropriate piece, and completes the assembly of an entire computer. After completing, customers have an option to check out the selected parts and make a payment to complete the assistant process.

1.4.2 Troubleshooting Assistant Module

With the help of this virtual assistant, consumers may troubleshoot their hardware failures without having to visit a computer repair shop, and they can order the right parts that the fault has accurately recognized. Customers can schedule an appointment with one of the computer hardware technicians if the problem is not resolved.

1.4.3 Appointment Booking Module

This module aids in the scheduling of appointments for clients who wish to troubleshoot with in-house computer hardware professionals.

1.4.4 Shopping Cart Module

This module allows users to find the entire store for items and create customer orders using a shopping cart.

1.4.5 Payment Module

This module provides up-to-date information on all payments made by customers, as well as advanced payment filtering options and having bank transfers, and cash on delivery options.

1.4.6 Inventory Management Module

Has the ability to handle the complete inventory. Individual items and corresponding categories, brands, and models can be added, deleted, and updated.

1.4.8 Warranty Management Module

This module aids in the generation of warranty alerts. It shows the status of the warranties of the goods and how much time is left on each item's warranty.

1.4.9 Delivery Management Module

This module contains all of the customer-created delivery records in the system. It displays the order tracking number as well as information about the courier company.

1.4.11 Invoice Generating Module

In the system, this module generates a variety of invoices. It's compatible with the payment, computer hardware assistant, and troubleshooting modules.

1.4.12 Backup and System Log Module

This Module enables the backup of system data and extracts the system log such that the system may be audited for any additional issues.

1.4.13 User Management Module

This module helps to manage all of the users of the system. It aids in the selection of the right individual for the right position.

1.4.14 Report Management Module

This module will make it possible to generate, preview, and print a variety of reports in order to continue with the success of the business.

1.5 Structure Of Dissertation

The introduction is the first of six chapters in the dissertation. The contents of each chapter are listed below in brief.

Chapter 1 – Introduction

The project's goals and scope are explained in this chapter. It also explains the present system's flaws and what motivates the creation of this system.

Chapter 2 – Analysis

This chapter covers requirement collection strategies for both functional and non-functional requirements for a new system, as well as analysis approaches for understanding the existing system.

Chapter 3 – Design

The system's design, including database and user interface design, is covered in this chapter. To make the system's structure easier to understand, this chapter also contains top-level and module-level use cases.

Chapter 4 – Implementation

This chapter covers implementation technologies, hardware and software requirements, and the structure of key code modules.

Chapter 5 – Evaluation

This chapter explains how the system was tested using test cases and what the outcomes were. It describes the test cases and situations that were employed.

Chapter 6 – Conclusion

This chapter summarizes the lessons learned and suggests ways to enhance the system in the future.

Finally, a Glossary of Terms and General Index are included.

Chapter 2 – Analysis

2.1 Chapter Introduction

The process of identifying the underlying problem and comprehending the problem domain from a jumble of facts and figures is known as analysis. The purpose of the analysis is to provide a complete, consistent, and unambiguous image of the system. Also, what should the system supply to meet all user requirements. Requirements Engineering is another name for this procedure. The system can be designed with the help of analysis.

2.2 Fact Finding Techniques

Fact-gathering procedures are information-gathering strategies used in system analysis to properly define and comprehend system requirements. The following strategies were primarily employed:

1. Interviews
2. Observation
3. Existing Documents Analyzing

2.2.1 Interviews

The initial technique utilized to collect and establish system requirements, as well as clarify and confirm those needs, was an interview. In order to effectively address and weigh the inputs of each interviewee, the interviewer must first comprehend the perspective of each interviewee.

The following is the interview schedule that was used.

Date	**Interviewee**	**Position**	**Interview Duration**
23/10/2021	Mr. Samudu Kannangara	Owner	40 minutes
23/10/2021	Mr. Upali Kannangara	Stock Keeper	30 minutes
23/10/2021	Mr. Thamara Kannangara	Technician	40 minutes
25/10/2021	Mr. Susith Sewikrama	Delivery Manager	20 minutes
25/10/2021	Mr. Chamara Perera	Technician	30 minutes
27/10/2021	Miss. Kalpani Dinusha	Customer	20 minutes

Table 2.1 – Stakeholders Interview Schedule

2.2.2 Observation

Observation is a fact-finding technique in which system analysts observe how individuals perform tasks and activities during site visits. This is an excellent approach to learn what end users go through in their day-to-day processes, and it gives you a lot of insight into the business process.

2.2.3 Existing Documents Analyzing

Analyzing existing papers is a key strategy for acquiring requirements. When building a user-friendly system, evaluating the papers and reports of an existing system can help. Solid information and facts are usually collected by studying existing papers, which helps to corroborate and validate the requirements gathered through other methods.

2.3 Existing System

From the beginning, U-Star Digital has used a semi-paper-based manual approach. During the system analysis phase, it was discovered that the current system can only perform a limited number of functions.

Customers used to come into the store and convey their needs to the technician who built their computer under the old system. Customers arrived at the shop, handed over the defective item or computer to the hardware professionals, and then waited in their restroom until the job was completed. To take online orders, they currently utilize a phone-based and WhatsApp-based order system. There are no other options than bank transfers, and the customer must send legal transaction paperwork to confirm the order. Customers are not given accurate delivery information due to a lack of appropriate delivery information.

2.4 Existing System Use Case Diagrams

There were numerous downsides to the paper-based technique.

- It was discovered that data was repeating.
- Data that is unidentifiable owing to illegible handwriting.
- Data was lost because of misplacing the recording materials.
- It takes a long time.
- Manual computations are required.
- Data security is lacking.

- More manpower is required.

The following are the existing system's High-Level Use Case Diagrams for the modules listed.

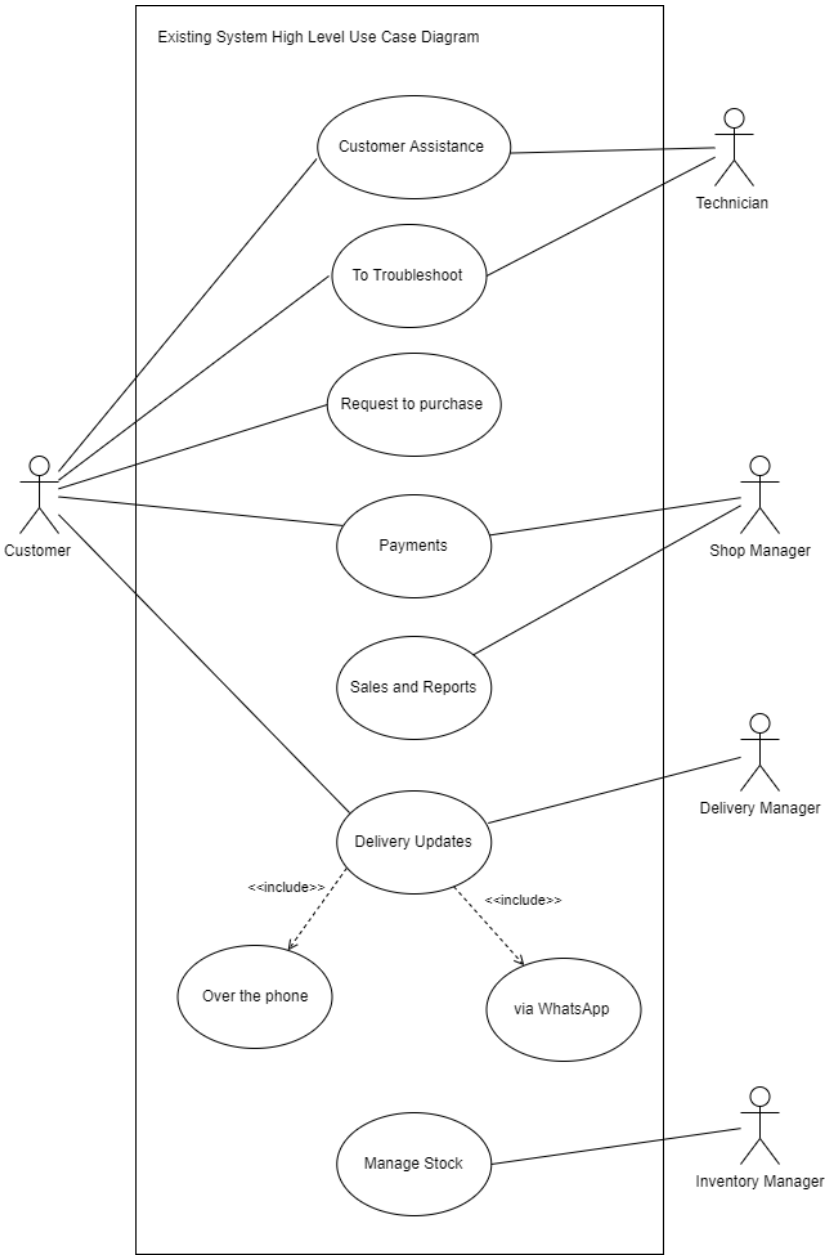

Figure 2.1 – Use Case Diagram for the Existing System.

2.5 Requirements Analysis

2.5.1 Functional Requirements

Calculations, data insertion, manipulation, and processing, as well as data presentation, are all defined by functional requirements. The system's required features are listed below.

- Computer Hardware Assistant
    - Customer selects the items begins with Processor.
    - Assist the customer with selected items matching item specifications.
    - Allow customer to make order end of the assisting process.
- Troubleshooting Assistant
    - Customers can enter the description of the defective item.
    - Detect the keywords of the entered text and suggest the solutions.
    - Customers can’t find the solutions they can make an appointment.
- Appointment Booking
    - Customers can select the date and time.
    - Customers need to fill brief of the appointment.
    - Check the item warranty to take free service.
    - The technician can pick up an appointment.
    - Generate job cards for the appointments.
    - The technician can update the status of the job card.
    - Notify the Technicians in a new order.
- Shopping Cart
    - Customer search and select items to add to the cart.
    - Customers can make the order in the selected items in the cart.
    - Calculates selected items' totals and discounts.
    - Orders are recorded in the Customer Dashboard Orders section and Shop Managers Orders section.
    - Able to update order status.
    - Notify the shop manager of a new order.
- Payment
    - Customers can select the payment method.
    - Carry the order totals to the payment method.

    - Proceed to checkout with total payment.
- Inventory Management
    - Insert, update and delete the Items, Brands, Models, and Item Specifications.
    - Notify with low stock and out-of-stock Items.
    - Able to create a low stock threshold.
    - Able to create discounts with a selected number of date periods.
    - Use the first in first out (FIFO) mechanism to manage inventory.
- Warranty Management
    - Notify the customer about the item's remaining warranty period.
    - Able to set the warranty durations of the items.
    - Able to create warranty types.
- Delivery Management
    - Able to create courier companies.
    - Customers can notify with courier company details and order tracking numbers when order dispatch in the warehouse.
    - Customers can view their order details by giving the courier company a tracking URL using the tracking number.
    - Customers were able to update the courier process when receiving the item.
- Invoice Generation
    - Calculate order totals and courier payment and generate an invoice for the customer.
    - Invoice can filter with the selected date range.
    - Invoices can export and have the ability to print.
- Backup and System Log
    - Enables the backup of system data and extracts the system log.
    - Track all the system behavior.
    - Ability to export the log.
- User Management
    - Able to manage all of the users of the system.
    - Aids to create user roles and permission.
- Report Management

- This module will make it possible to generate, preview, and print a variety of reports.
- Able to export and filter the reports within the selected time frame.

2.5.1 Non-Functional Requirements

Non-functional requirements had to be met in order for a system to be valuable and successful.

- Usability

  The system is directly connected to all of the shop's consumers. Users of the system can access necessary reports and appointments over the internet. Giving clients better service means making data easier to access and sending notifications about existing purchases.

- Maintainability

  It's simple to correct a bug, add new features, make changes to support new operating systems, and make the software easier to maintain for others. It also improves the contentment of members.

- Performance

  The system should be quick and finish the task in the shortest time possible. Data should be retrieved as soon as feasible, and the response time should be minimal.

- Security

  Considering client personal information such as email addresses, phone numbers, and physical addresses is saved in the system, security is a top priority for the system to protect users' sensitive data.

- Reliability and accuracy

  The system's major features include the generation of progress reports and workout programs. As a result, the system's accuracy and dependability are critical.

2.6 Similar Systems and Literature Reviews

It was required to examine the existing system before designing the web-based Computer Hardware Purchasing and Troubleshooting Assistant management system. Because the current system is semi-paper-based, a literature review and related system analysis were also decided. The systems listed below were evaluated in order to have a thorough understanding of the situation.

2.6.1 Microcenter

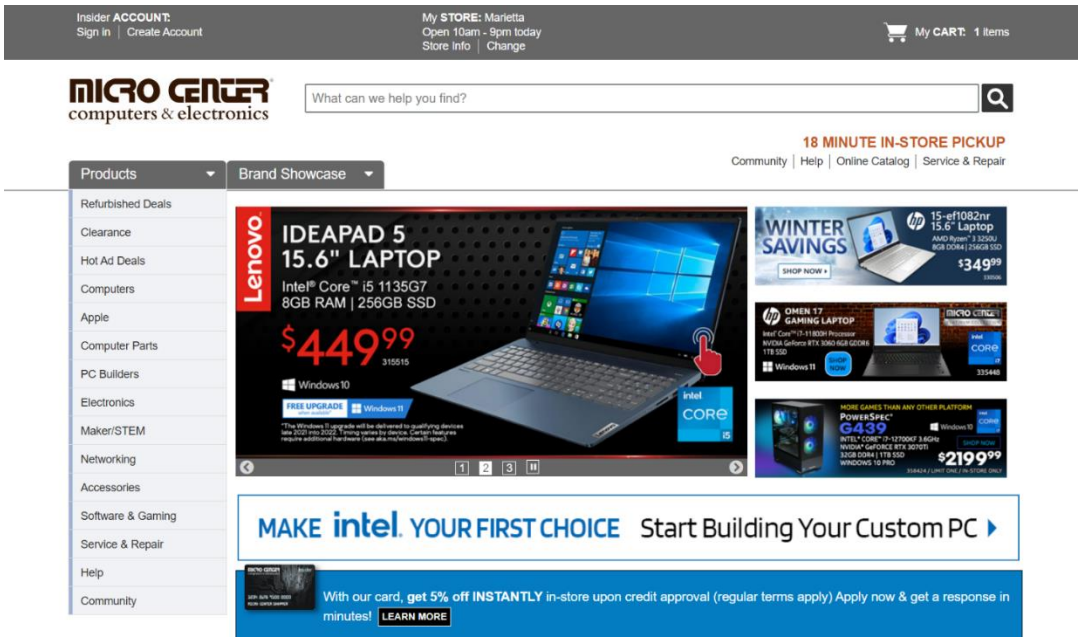

Figure 2.2 – Interface Design of Microcenter Similar System

Micro Center offers more computers, electronics, networking, and communication devices (more than 30,000 items in stock) than any other company. Micro Center is deeply passionate about providing information technology products and technology support services. We have offered in-store pickup of online orders since 2010.[1]

2.6.2 Newegg

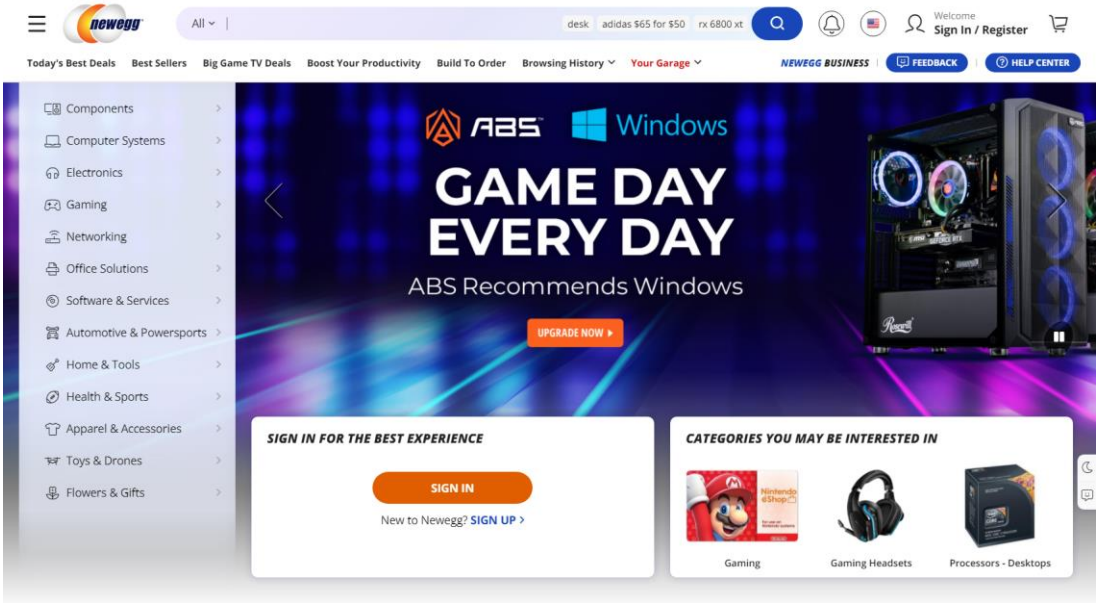

Figure 2.3 – Interface Design of NewEgg Similar System

"Today, millions of customers turn to Newegg to shop for the latest PC components, consumer electronics, smart home and gaming products. Newegg is consistently ranked as one of the best online shopping destinations, and the company regularly earns industry-leading customer service ratings." [2]

2.6.3 Comparison of the Proposed System to a Comparable System

The results of the comparison as below (table 2.2)

Functionality	**Proposed System**	**Microcenter**	**NewEgg**
Computer Hardware Assistant	Yes	Yes	No
Troubleshooting Assistant	Yes	No	No
Appointment Booking	Yes	Yes	No
Shopping Cart	Yes	Yes	Yes
Payment Management	Yes	Yes	Yes
Inventory Management	Yes	Yes	Yes
Warranty Management	Yes	No	Yes
Delivery Management	Yes	Yes	Yes
Mobile App	No	No	Yes

Table 2.2 – Comparison between Proposed System and Similar Systems

2.7 Model of the Proposed System's Process

The Software Development Process, also known as the Software Development Lifecycle, is the division of software development activity into phases in order to better design, project management, and product management.

Scrum, Extreme Programming (XP), RUP, and other process models exist for developing software systems.

2.7.1 Scrum

“The Scrum process organizes development into a sequence of sprints, each of which results in a potentially usable product with an added increment of function. The tasks for each sprint are set, in consultation with a stakeholder representative, during a sprint planning meeting and cannot be added to during the sprint. Each task is typically expressed as a user story. Each sprint is time boxed: the end date of the sprint does not change. Tasks that cannot be accomplished in time are returned by the team to the backlog for future consideration.” [3]

2.7.2 Extreme Programming (XP)

“Extreme Programming (XP) is an agile software development framework that aims to produce higher quality software, and higher quality of life for the development team. XP is the most specific of the agile frameworks regarding appropriate engineering practices for software development.”[4]

2.7.3 Rational Unified Process (RUP)

“Stands for "Rational Unified Process." RUP is a software development process from Rational, a division of IBM. It divides the development process into four distinct phases that each involve business modelling, analysis and design, implementation, testing, and deployment. The four phases are:

1. **Inception -** The idea for the project is stated. The development team determines if the project is worth pursuing and what resources will be needed.
2. **Elaboration -** The project's architecture and required resources are further evaluated. Developers consider possible applications of the software and costs associated with the development.
3. **Construction -** The project is developed and completed. The software is designed, written, and tested.

4. **Transition -** The software is released to the public. Final adjustments or updates are made based on feedback from end users.

The RUP development methodology provides a structured way for companies to envision create software programs. Since it provides a specific plan for each step of the development process, it helps prevent resources from being wasted and reduces unexpected development costs" [5]

Based on the considerations outlined in Table 2.3, the Rational Unified Process (RUP) was chosen as the best process model for the proposed system over other approaches.

RUP	Scrum	XP
A good option for a huge, long-term project.	There is no set termination date. At the end of the current iteration, the next iteration plan is determined.	Release regularly.
The planning process is driven by the end date and includes intermediate milestones.	Scrum employs a project backlog instead of scope.	A shorter time limit
Requirements are fixed	It's ideal for rapid upgrade tasks that don't have to be completed by a certain date.	Expecting adjustments in requirements.
The scope of the project is predetermined.	Documentation is severely limited.	There is a lack of general design.
Documentation is required.		There is little to no documentation.

Table 2.3 – Comparison between Different Process Models

Chapter 3 – Design

3.1 Chapter Introduction

The design chapter discusses the proposed system's overall structure. This chapter describes the design processes, tools, and techniques used in the design phase, as well as the database of the system, as well as appropriate Use Case Diagrams, Entity Relationship Diagrams, and other UML Diagrams.

3.2 Alternate Solution

Alternatives to the Web-Based Computer Hardware Purchasing and Troubleshooting Assistant management system include a mobile application, the use of a software collection, or the continued use of the current manual system.

3.2.1 Stand-alone System

The stand-alone software is software that is not bundled with another piece of software and does not require an internet connection to run (work offline). It is not very useful for the Web-Based Computer Hardware Purchasing and Troubleshooting Assistant management system because outdoor service management cannot be carried out without the use of the internet, it is more expensive, and installation and maintenance are more difficult than with a Web-Based System.

3.2.2 Collection of Software

The applications in the following list may be helpful in managing the Computer Hardware Purchasing and Troubleshooting Assistant management system.

- Appointment booking is a tool that assists in the scheduling of customer appointments.
- Inventory can manage individual objects as well as their corresponding categories, brands, and models.
- The warranty module facilitates the creation of warranty warnings. It displays the status of the goods' warranties as well as the remaining time on each item's warranty.

3.2.3 Reason to Choose the Web-Based System

- The client's desire for a web-based system was unique.

- It's simple to keep track of the system's progress from any location.
- The system would be platform-independent.
- Because the database is centralized and everything is synchronized, maintenance is simple.
- Allow users to access the system at any time and from any location.
- It also allows for the usage of a wide range of devices to access the system.

3.3 The Architectural Design of the System

As a Procedural Programming Design Concept, the system will be developed utilizing the Non-Object Oriented technique.

In a procedural language, a program is a list of statements, each of which instructs the computer to perform a certain task. It concentrates on the technique (function) and algorithm that are required to complete the derived computation. When a program grows in size, it is divided into functions, each with a distinct purpose. One of the fundamentals of structured programming is the division of the program into functions and modules.

Procedural-oriented programming has several characteristics.

- The emphasis is on getting things done (Functions).
- The program is divided into many functions.
- Passing parameters across functions allows them to communicate with one another.
- Global variables are shared between functions.
- The procedure calls are based on the notion.
- When it comes to program design, it takes a top-down approach.

3.4 Use Case Diagram for the Proposed System

The following is a high-level Use Case Diagram for the Proposed System.

The system's actors:

Admin: Create users and manage user permissions in the system.

Shop Manager: Manage all the orders made by the customers.

Inventory Manager: Manage the inventory of the store.

Delivery Manager: Manage all deliveries and register new courier companies

Technician: Respond to the customer's appointments and follow the job card.

Customer: Make orders and make appointments.

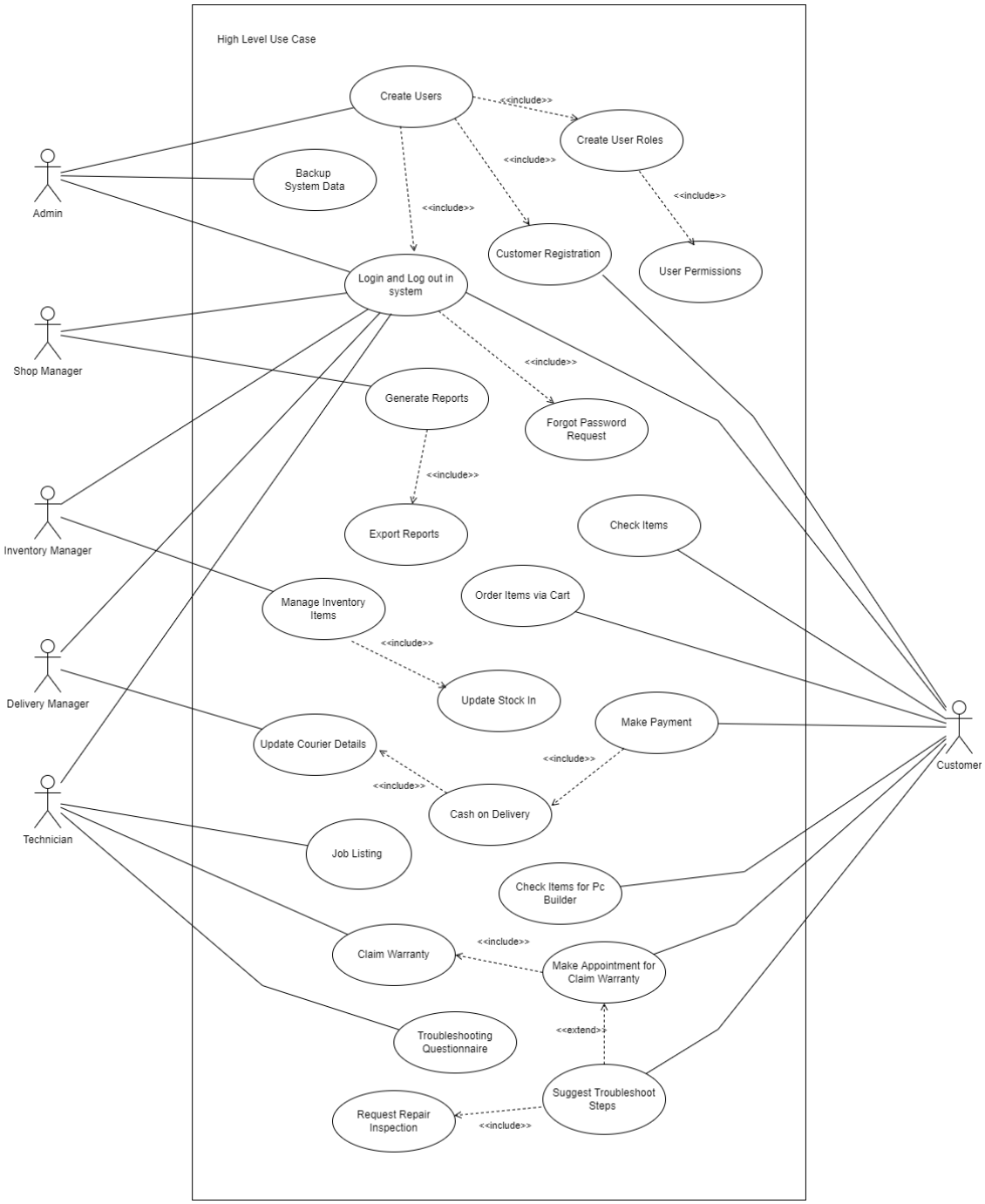

Figure 3. 1 - Use Case Diagram for the Proposed System

3.5 Use Case Narratives for the Proposed System

3.5.1 Use Case Narratives for Login Module

Use-case Number	UC-04	
Use-Case Name	Login	
Priority	High	
Actor	Admin, Shop Manager, Inventory Manager, Delivery Manager, Technician, Customer	
Description	This use case describes how Shop Staff and Customers are logins to the System.	
Precondition	All actors are properly registered to the system.	
Post-condition	If the use case was successful, the actor is now logged into the system. If not, the system state is unchanged.	
Basic course of Action	**User Action**	**System Response**
	1. The Actor is on the login page to log in to the system. 3. The Actor enters username and password, click on a Login Button.	2. The system promotes the Actor to enter the Username and Password. 4. The system verifies that all the filled have been filled out and valid. 5. The system successfully logged in the system. 6. Use case Exit
Alternate course of Action	4.1 If all fields are not filled out and not matched to the username and password the system notifies the actor a message “Invalid Username or Password” and then goes back or returns to step 3 of the basic course of Action to enter again.	

Table 3.1 - Use Case Narrative for Login Module

3.5.2 Use Case Narratives for Insert Inventory Item

Use-case Number	UC-08	
Use-Case Name	Insert Inventory Item	
Priority	High	
Actor	Inventory Manager	
Description	This use case describes how to manage items in inventory	
Precondition	None	
Post-condition	If the use case was successful, the actor can add the product to the system and set it to sell to the customers.	
Basic course of Action	**User Action**	**System Response**
	1. Actor clicks the "Add Item" in the Item Management section. 3. Actor fill the fields (Item Image, Item Name, Category, Brand, Model, SKU number, Insert variable specifications, reorder level, Unit price, and Sale price) 4. Actor click "Insert Item"	2. System prompts the form to insert details to the actor. 5. System validates the Item Name and SKU already in the system. 6. System display massage "New Item Insert"
Alternate course of Action	5.1. If an item is already inserted into the system display the popup message "This Item Already in the System".	

Table 3.2 - Use Case Narrative for Login Module

3.6 ER Diagram for the Proposed System

The high-level ER Diagram below depicts the relationships between the proposed system's constituents. (Figure 3.2)

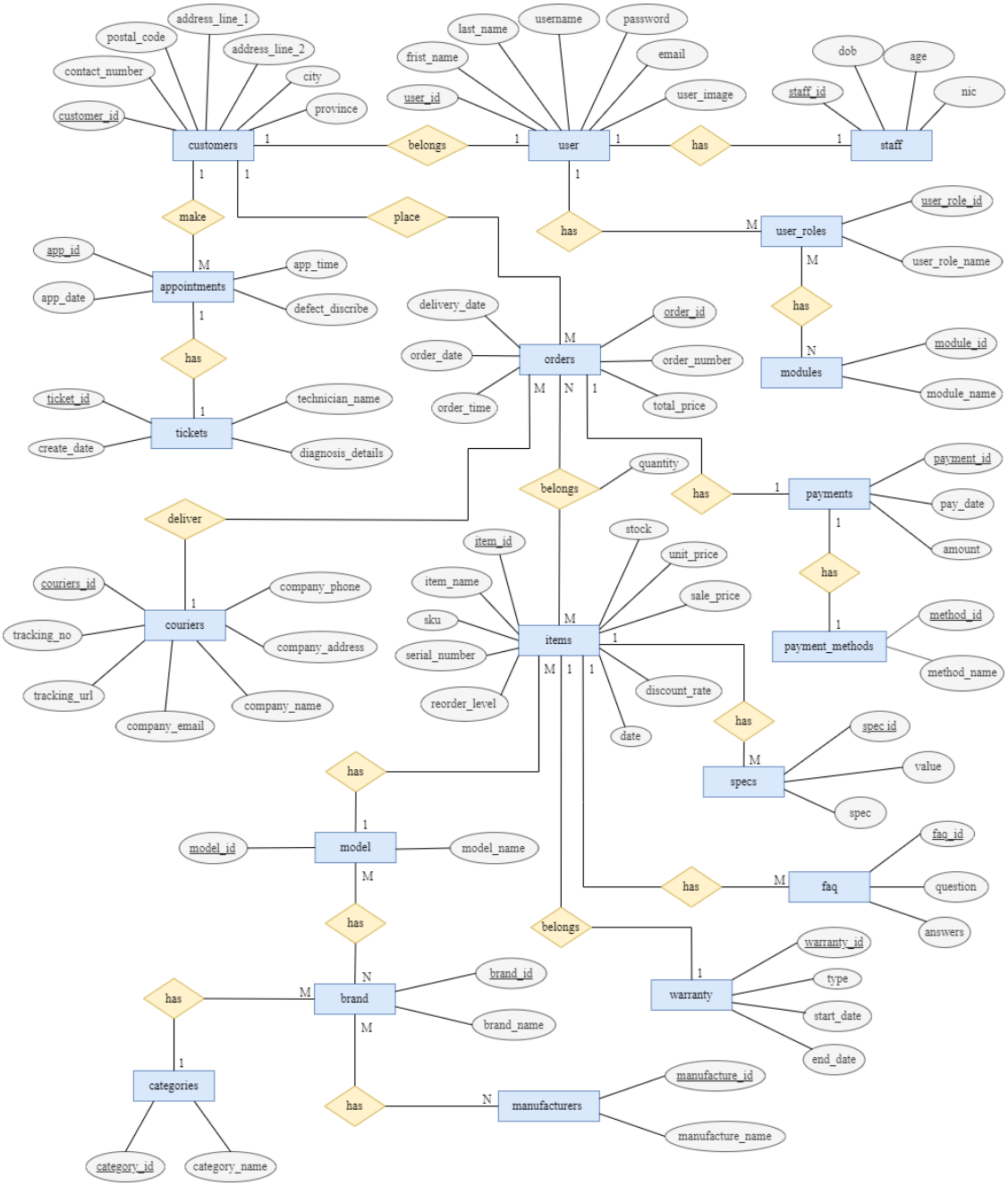

Figure 3. 2 – ER Diagram for Proposed System

3.7 Activity Diagrams for the Proposed System

3.7.1 Activity Diagram for Login

The activity diagram for creating workouts is shown in Figure 3.3.

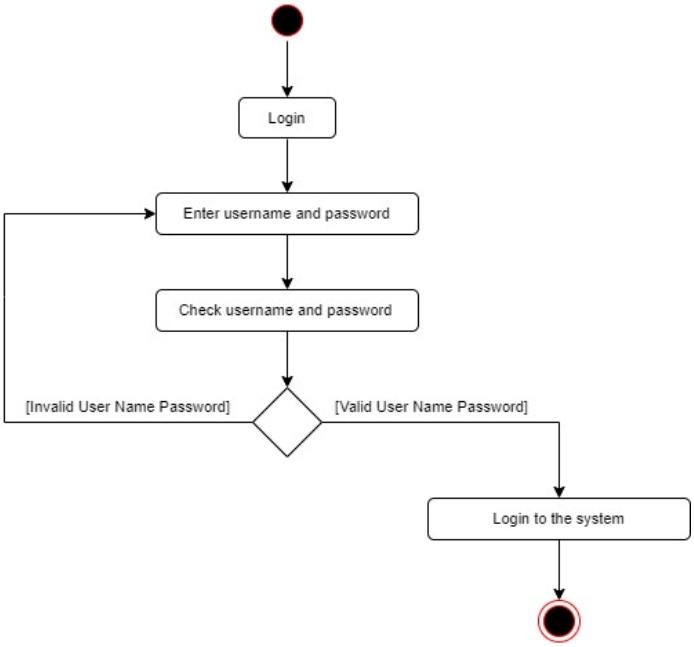

Figure 3. 3 – Activity Diagram for Login

3.7.2 Activity Diagram for Add Item

The activity diagram for add new item to inventory is shown in Figure 3.3.

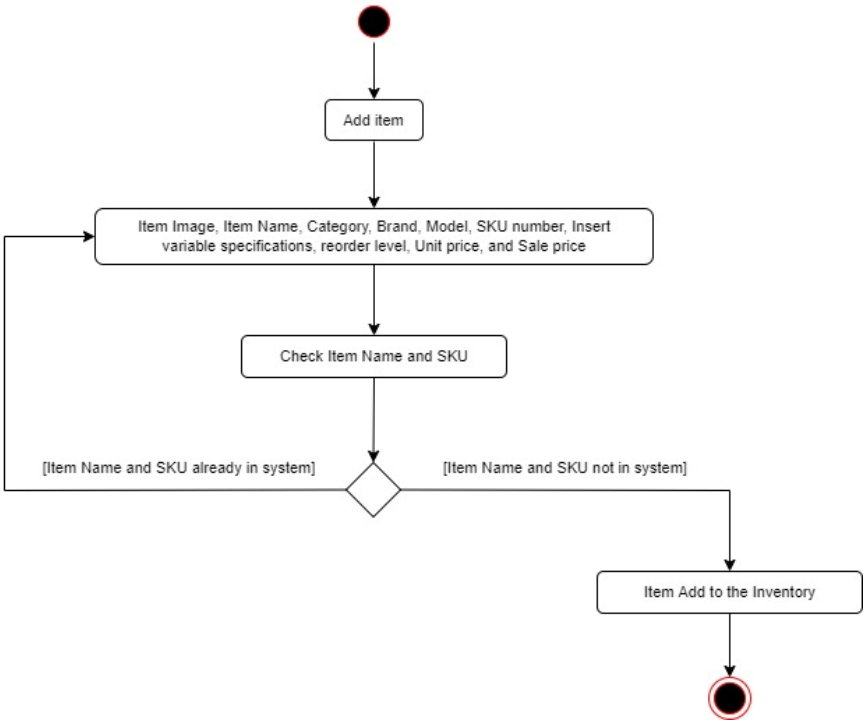

Figure 3. 3 – Activity Diagram for Add Item

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