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SYSTEM REQUIREMENTS SPECIFICATION (SRS)

Project Title: **GIHON AI-Enhanced E-Commerce Platform**

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Prepared For: GIHON Executive Team

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1. Introduction

This Software Requirements Specification (SRS) document fully and clearly specifies the functional and non-functional requirements for the GIHON AI-Enhanced E-Commerce Platform. It serves as the authoritative reference for all stakeholders involved in the project and establishes a common understanding between the business and technical teams.

The objectives of this SRS document are to:

- ➔ Act as the formal agreement of record between project stakeholders (business owners, marketing, and leadership) and the development team (software developers, AI/ML engineers, and designers).
- ➔ Provide a foundation for system architecture, technical design, development, quality assurance (QA), testing, and implementation activities.
- ➔ Define verifiable and measurable acceptance criteria to ensure satisfaction of all system requirements.
- ➔ Serve as a long-term reference for system maintenance, enhancement, and onboarding of new team members.

1.1 Purpose

The purpose of this Software Requirements Specification (SRS) document is to outline the functional and non-functional requirements of the GIHON AI-Enhanced E-Commerce Platform.

The system provides three primary user interfaces:

1. Customers
2. Sellers
3. Administrators

This document is intended for developers, testers, system architects, project managers, and business stakeholders as a reference throughout the system lifecycle.

The primary goals of this SRS document are:

1.1.1 Authoritative Agreement

To formally establish a shared understanding between project stakeholders and the development team regarding system expectations, constraints, and required functionality.

1.1.2 Project Foundation

To act as the foundation for downstream activities including system design, development, testing, deployment, and maintenance by clearly defining user and business needs.

1.1.3 Verification Benchmark

To define measurable criteria that will be used to verify and validate the system prior to acceptance.

1.1.4 Long-Term Reference

To serve as a controlled reference document throughout the system's lifecycle, supporting future enhancements and team onboarding.

1.2 Product Scope

The GIHON AI-Enhanced E-Commerce Platform is a web-based marketplace designed to deliver an intelligent, personalized, and efficient online shopping experience.

The platform allows customers to:

- ➢ Browse and search products
- ➢ Manage user accounts
- ➢ Place orders and track deliveries
- ➢ Perform secure online transactions

Artificial intelligence and machine learning techniques are utilized to:

- ➢ Provide personalized product recommendations
- ➢ Enable natural-language product search
- ➢ Support customer interactions through a virtual shopping assistant

The system includes an administrative backend that enables authorized administrators to:

- ➢ Manage product catalogs and inventory
- ➢ Monitor customer and order data
- ➢ Adjust AI-related configurations
- ➢ View system performance analytics

The platform integrates with external services such as:

- ➢ Payment gateways
- ➢ Shipping providers
- ➢ Analytics and reporting tools

Out of Scope

The following features are explicitly excluded from this project:

- ➢ Native mobile applications
- ➢ Direct hardware control
- ➢ Migration of legacy data from existing systems

1.3 **Document Conventions**

The following conventions are used throughout this document:

- ➢ “Shall” indicates a mandatory requirement.
- ➢ “Should” indicates a recommended or desirable feature.
- ➢ “May” indicates an optional feature.
- ➢ Section headings follow IEEE SRS standards.
- ➢ AI-related terminology is used according to standard machine learning and software engineering practices.
- ➢ All referenced diagrams are expected to conform to standard UML notation.

1.3 Intended Audience and Reading Suggestions

Intended Audience: This document is intended for:

- ➢ Software Developers – to understand required system functionality.
- ➢ System Architects – to design the system architecture.
- ➢ Project Managers – for planning schedules and resources.
- ➢ Quality Assurance Engineers – for test planning and validation.
- ➢ Business Stakeholders – to confirm alignment with business goals.

Reading Suggestions

- ➢ Readers seeking an overview of system goals should review Section 1 (Introduction).
- ➢ Developers and architects should focus on Section 2 (Overall Description) and Section 3 (System Requirements).
- ➢ Testers should concentrate on functional and non-functional requirements.
- ➢ Stakeholders may review use cases and acceptance criteria for validation.

1.4 Definitions,Acronyms,&Abbreviations

term	Definition
Administrator	A privileged user responsible for managing users, products, orders, system settings, and analytics.
AI (Artificial Intelligence)	The ability of the system to perform tasks such as recommendations, search ranking, and customer assistance using algorithms that simulate human intelligence.
AI Operator / System Manager	A technical user responsible for monitoring, tuning, and maintaining AI/ML models and system performance.
Authentication	The process of verifying the identity of a user attempting to access the system.
Authorization	The process of determining what actions an authenticated user is permitted to perform.
Catalog	A structured collection of product information including name, description, price, images, and category.
Checkout	The process by which a customer completes a purchase, including payment and order confirmation.
Client	A user device (browser or mobile device) that accesses the system through the internet.
Cloud Infrastructure	Virtualized computing resources provided by cloud service providers such as AWS.
Curator (Seller)	A user responsible for creating, updating, and maintaining product listings and inventory data.
Customer	An end user who browses products, receives recommendations, and makes purchases.

E-Commerce	Electronic commerce; buying and selling goods and services over the internet.
Machine Learning (ML)	A subset of AI that enables systems to learn from data and improve performance over time without explicit programming.
Natural Language Processing (NLP)	AI techniques that allow the system to understand and process human language queries.
Payment Gateway	A third-party service that securely processes online payments.
Recommendation Engine	An AI-based component that suggests products based on user behavior and preferences.
Role-Based Access Control (RBAC)	A security mechanism that restricts system access based on user roles.
Stakeholder	Any individual or group with an interest in the system, including users, developers, and business owners.
System Requirement	A detailed description of a capability or constraint that the system must satisfy.
User Requirement	A high-level statement of what a user expects from the system.
Virtual Shopping Assistant	An AI-powered interface that assists customers during browsing and purchasing.

Acronym	Meaning
AI	Artificial Intelligence
API	Application Programming Interface
AWS	Amazon Web Services
CCPA	California Consumer Privacy Act
CRUD	Create, Read, Update, Delete
DBMS	Database Management System
GDPR	General Data Protection Regulation
GUI	Graphical User Interface
HTTPS	Hypertext Transfer Protocol Secure
JSON	JavaScript Object Notation
MFA	Multi-Factor Authentication
ML	Machine Learning
MVP	Minimum Viable Product
NFR	Non-Functional Requirement
NLP	Natural Language Processing
OS	Operating System
PCI DSS	Payment Card Industry Data Security Standard
RBAC	Role-Based Access Control
REST	Representational State Transfer
SRS	Software/System Requirements Specification
TLS	Transport Layer Security
UML	Unified Modeling Language

1.5 **Overview of the Document**

This SRS document defines the functional and non-functional requirements of the GIHON AI-enhanced E-commerce Platform. The document acts as an agreement between stakeholders and the development team by defining what the system shall do, and the constraints under which it shall operate.
This SRS includes:
A description of the system purpose, scope, and intended users
Overview of the environment and operating conditions of the system
A complete set of user-level and system-level functional requirements
Non-functional requirements: constraints on performance, security, reliability, and usability
Interface requirements, including: user, hardware, software, and communication interfaces.
Analysis models used to derive and validate the system requirements
The document is organized as follows:
Section 1 – Introduction
Provides the purpose, intended audience, definitions, and overview of the system.

Section 2 – General Description
Presents system context, product perspective, major system functions, user classes, operating environment, design constraints, assumptions, and dependencies.
Section 3 – Specific Requirements
Details in the functional and non-functional requirements of the system, including user requirements and system requirements.
Section 4 – External Interface Requirements Interaction between the system with outside entities, including users, hardware, software components, and communication networks.
Section 5 – Analysis Models Documents the analysis artefacts such as the use case model, sequence diagrams, and activity diagrams applied to support the requirements. Appendices Include supportive information like requirement elicitation artifacts and statements of traceability.

2. Overall Description

In this section, a high-level representation of the GIHON AI-Enhanced E-Commerce Platform will be described. The overall context, major characteristics, user types, operating environment, constraints, assumptions, and dependence will be discussed. The goal of this section is to give a basic overview of the system without focusing on the specific functionality, which will be covered in subsequent sections.
Information in this section can be used to aid stakeholders in understanding the nature of the system, who will use the system, and how the system will function at a conceptual level.

2.1 Product Perspective

The GIHON AI Platform is an innovative, stand-alone, web-based e-commerce platform incorporating AI technologies for the purposes of improving user experience, decision-making, and operational efficiency. This platform is not intended for replacement within an existing system, but for the deployment of an AI-enhanced platform capable of functioning as an interactive, central marketplace.
The system allows the integration of customers, administrators, and smart services in one environment and provides users with access to the system using web browsers while processing and logic take place on the server side.
GIHON AI, from a technical point of view, is designed with a server-client structure that consists of modules to provide scalability and extensibility.
The principal elements of the major system are:
Presentation Layer (Frontend):
Offers user interfaces for browsing and exploring products, searching, handling shopping carts, placing orders, and interacting with Artificial Intelligence-enabled functionalities like recommendations and virtual assistants.
Application Layer (Backend):

Deals with business logic, user authentication, authorization, order processing, and admin functionalities.
AI/ML Services Layer: Enables intelligent capabilities like personalization of recommended products, natural language search, customer behavior analysis, and virtual shopping assistants. Database Layer: It stores data such as the profiles of the individuals using it, the products, orders, transactions, system logs, and others.

2.2 Product Functions

The GIHON platform must include an all-around online e-commerce system catering to two main categories of users: Customers and Administrators. The core functionalities are fully integrated to facilitate the entire online purchase process and store management life cycle. The following points are high-level descriptions, with detailed descriptions covered in Section 3.
F1. User Identity & Access Management: The solution shall ensure a secure role-based access management system for all users.

- Registration for users and creating accounts.
- Secure authentication and password management.
- Managing User Profiles.
- Separate access controls for customers and administrators.

F2. Product Discovery & Browsing: Customers should be able to browse and explore products.

- Browsing products from classified listings.
- Searching and filtering product catalogs.
- Looking at detailed product pages, including photos, descriptions, and reviews.

F3. AI-Based Shopping Assistance System: The system should incorporate artificial intelligence in order to improve customer satisfaction.

- In conclusion, customer satisfaction has continued AI-based personalization to enhance customer engagement and satisfaction.
- Personalized product recommendations.
- Natural language processing and intent-based search queries.
- Offering support in real time through virtual shopping assistants.

F4: Order Processing & Fulfillment (Customer): The system shall support managing the customer's purchasing process from selection to completion.

- Cart management: Managing products within a shopping cart.
- Handling orders using a secure checkout and payment process.
- Offering order confirmations, histories, and tracking.

F5. Catalog & Inventory Management (Admin): The application shall include administrative functionality to control the product line.

- Creating, updating, and deleting product records.
- Tracking and controlling inventory levels.
- Organizing product categories and prices.

F6. Customer & Order Administration (Admin): The system shall offer administrators functionalities for customer and order management.

- Customer accounts viewing and management.
- Processing, Updating, and Fulfilling Orders.

F7. Analytics, Reporting & Insights: The system will provide insights into business intelligence based on the data

- Creating sales, revenue, and performance reports.
- Analyzing user behavior and engagement metrics.
- Offering demand and inventory forecasting using AI algorithms.

2.3 User Classes and Characteristics

The GIHON platform has been developed for three levels of users who belong to different classes according to their objectives, rights of access, as well as their technical capabilities. It is imperative to understand the classes of the users in order to set the necessary requirements.

2.3.1 Primary User

These are the classes users who represent the needs served by the central feature of the system.

a) Customer (End-User/Buyer):

- Description: An entity that uses, explores, views, selects, and buys products via the platform's user interface.
- Frequency of Use: Occasional to frequent, where browsing and transactions are the key activities.
- Technical Skills: Has basic digital literacy skills. Needs an interface that is not only consumer-friendly but also doesn't require any formal training or knowledge.
- Privilege Level: Low. Their access is limited to personal data, profile, shopping cart, and order history.

- Primary Objective: To search for products effectively, make an educated buying decision, and proceed with safe shopping.

b) Administrator (Business Operator/Store Manager):

- Description: Designated individual employee or owner who is charged with operating the digital storefront as well as managing it commercially using an administrative interface.
- Frequency of Use: Highly Frequent. Usage is integral to ongoing activities.
- Technical Skill Level: Moderate. Familiarity with business applications and web applications. Comprehension of fundamental e-commerce notions (inventories, orders, and customers) does not require high technical levels.
- Privilege Level: High. Users have complete access to all the operations of the business, such as catalog management, ordering, managing customers, and analytics.
- Primary Aims: The management of product listings and inventory, handling customer orders, evaluating business performance, and building customer bases.

2.3.2 Secondary User

The design of this user type engages with the expert subsystems and is less frequent but also very important.

c) System Manager / AI Operator (Technical Steward):

- Description: A technically competent user whose role entails the oversight, health, and optimization of the models and system performances in relation to AI/ML platforms.
- Frequency of Use: Periodic. Used for monitoring, maintenance, tuning, and analysis.
- Technical Skills: Advanced. Experienced in data science, system administration, and/or machine learning operations (MLOps). Familiarity with troubleshooting techniques, monitoring, and setup menus.
- Privilege Level: High. Has system administrative access to system health views, Artificial Intelligence views related to machine learning model performance, views of the configuration interfaces, and views of the audit logs. Primary Goals: To ensure system reliability, analyze and develop the AI recommendation models, carry out root cause analysis of problems, and offer insights to improve the system.

2.4 General Constraints

The GIHON AI-Enabled E-commerce platform will be constrained by the following environmental and developmental factors. These factors will determine the realm of operation of the given system.

2.4.1 Operating Environment

The software should function in a cloud-native environment that is aimed at high availability and elastic scaling.

- Hardware Platform:
  The hardware platform that the system will run on will be the cloud infrastructure that uses AWS with virtualized x86_64 or ARM64 instances.
- Operating System & Virtualization: The application will run using Docker containers orchestrated through a Kubernetes layer with Linux-based container images.
- Database Environment: The DBMS needs to support a high concurrency environment, involving at least the ability to maintain 1,000 read/write operations per second during peak load times.
- Software Coexistence: The software needs to peacefully coexist with the following third-party services:
  Payment Gateways Telle Birr, Chapa, Stripe and PayPal (PCI DSS Level 1 Compliant) and AI Integration.
- Cloud Storage: AWS S3 for static content & product images.
- Security Protocols: Any external communication is required to coexist with web infrastructure through the use of HTTPS/TLS 1.3 or later versions.

2.4.2 Regulatory and Policy Constraints

The legal and corporate policies which constrain the development team are as follows:

- Data Privacy: Rigorous conformity to GDPR guidelines for the EU and CCPA for the state of California is a prerequisite here. This leaves the developers with less flexibility on storage of data and will require capabilities about data minimization, consent, and the Right to be Forgotten.
- AI Ethics & Transparency: Biased algorithms must be independently checked every six months. The algorithm must keep "Explainable AI" logs, which list key recommendation factors that users can see.

- Financial Compliance: The developers will not be able to store credit-card verification value/PIN information on their own servers; all that information needs to stay in the PCI compliant third-party payment gateways.

2.4.3 Technical and Performance Limit

The following quantitative constraints narrow the design possibilities concerning AI models and architectural throughput:

- Time Requirements: Results of AI Search: < 500ms (90th percentile).
- Recommendation engine: < 300ms (95th percentile).
- Reliability: The service requires an uptime of at least 99.9%.
- AI Accuracy: The suggestion algorithm should at least score 85% accuracy and 80% recall in order to avoid the application of inaccurate experimental models.

2.4.4 Design Conventions & Programming Standards

For maintaining the system by the customer's internal staff, the following standards are mandatory:

- Programming Standards: JavaScript code needs ESLint validation. Documentation of interfaces (APIs) should be in OpenAPI
- “Access Control: The design needs to implement Role-Based Access Control with Multi-Factor Authentication for administration roles.”
- Language Support: The system has to support bilingual natural language processing capabilities in English and Amharic. 2.4.5 Resource and Implementation Constraints Phased Delivery:

Phase 1 (MVP):

Completion within 6 months (Core e-commerce and basic AI).

Phase 2: Completion within 12 months (Advanced AI, Mobile, and Analytics).

- Maintainability: "The design of the system should facilitate a new developer achieving 'quality output' within 4 hours of training."

2.5 Assumptions and Dependencies

This section describes the factors that are assumed to be true for the successful implementation of the GIHON platform and the external components upon which the software relies.

2.5.1 Assumptions

For the following factors, it is assumed that these would be in place. If any of these assumptions turn out to be incorrect or begin to change, it may make quite a difference in terms of project scope, timeline, and technical feasibility.

AS-1: Proficiency in Technology: The technology stack chosen for development, namely React.js (Frontend), Node.js (Backend), and Python, is assumed to have expertise among the development team.

AS-2: Financial Resources: The budget for the project is considered to be enough for continuous financing of AWS for cloud hosting at an enterprise level and also the subscription of premium APIs for AI, which is necessary for model interference.

AS-3: Technological Stability: The system assumes that, after development has begun, no fundamental variation in significant technology stack or architectural patterns will be requested or imposed.

AS-4: User Infrastructure: It is expected that the end-users - Customers and Sellers - have a stable internet connection with at least sufficient bandwidth to handle high-resolution product imagery and real-time AI interactions.

AS-5: Data Integrity by Sellers: It is going to be assumed that the administrative staff will provide, update, and maintain high-quality, accurate, and standardized product metadata, which will be important in terms of the AI recommendation engine's effectiveness.

AS-6: Availability of Training Data: The system assumes that there will be enough volumes of anonymized user interaction data that could be used for the continuous "learning" and refinement of the AI models.

2.5.2 Dependencies

This is the list of some external software components, services, and reusable modules that GIHON platform functionality depends on:

> **DE-1:** Payment Gateway Providers: The system relies on Telle Birr, Chappa, Stripe and PayPal to be up and for their API to be stable. Any outage in these services will take away all capability to process transactions.

DE-2: Cloud Infrastructure : The platform depends on AWS (Amazon Web Services) for hosting scalable resources, storage (S3), and container orchestration (EKS).
DE-3: AI/ML Frameworks: The recommendations and search engines rely on the continuing availability and support of open source libraries at least PyTorch or TensorFlow.
DE-4: Reusable Internal Modules: The project will reuse the User Authentication & Authorization Module-OAuth2/OpenID Connect-authored in a previously implemented internal e-commerce project.
DE-5: Analytics and Monitoring: The system relies on licensed commercial dashboards, either Mixpanel or Amplitude, for monitoring user behavior and platform health.
DE-6: Communication Services: The platform relies on third-party SMTP providers for sending emails and SMS gateway providers for sending order confirmations, MFA codes, and shipping notifications.
External Data Flow: AI-driven features are only effective if they have continuous, lawful access to high-quality interaction data generated by users. Reduced engagement or data availability could result in degrading AI accuracy.

3. Specific Requirements

This section details the User and System Requirements of the **GIHON AI-Enabled E-Commerce** Platform.
The requirements are divided into user requirements and system requirements, and then into functional requirements and non-functional requirements. Requirements are uniquely identifiable, prioritized, traceable, and verifiable.

3.1 User Requirements

User Requirements are high-level and non-technical statements used to articulate what a system has to perform from the end-user perspective as a description of why it is useful to the user. It emphasizes goals and needs and are never technically worded. It describes what different classes of users expect the system to do from their perspective. The primary user classes include:

1. Customers
2. Sellers

3. Administrators

3.1.1 Functional User Requirements

Group A. User Account and Access Management Requirements

Field	Description
Requirement ID	REQ-1
Requirement	User Registration
Description	The system shall allow users to create an account using email and password credentials.
Source	Customer
Priority	High
Related Requirements	REQ-2, REQ-3

Field	Description
Requirement ID	REQ-2
Requirement	User Login
Description	The system shall allow registered users to log in securely using valid credentials.
Source	Customer
Priority	High
Related Requirements	REQ-1

Field	Description
Requirement ID	REQ-3
Requirement	Role-Based Access
Description	The system shall provide different access privileges for customers, curators, and administrators.
Source	Administrator
Priority	High
Related Requirements	REQ-1

Group B. Product Browsing and Search Requirements

Field	Description
Requirement ID	REQ-4
Requirement	Product Browsing
Description	The system shall allow users to browse products by category and subcategory.
Source	Customer
Priority	High
Related Requirements	REQ-5

Field	Description
Requirement ID	REQ-5
Requirement	Product Search
Description	The system shall allow users to search for products using keywords and natural language queries.
Source	Customer
Priority	High
Related Requirements	REQ-4

Group C. Shopping and Checkout Requirements

Field	Description
Requirement ID	REQ-6
Requirement	Shopping Cart
Description	The system shall allow users to add, update, and remove products from a shopping cart.
Source	Customer
Priority	High
Related Requirements	REQ-7

Field	Description
Requirement ID	REQ-7
Requirement	Checkout
Description	The system shall allow users to complete purchases using third-party payment gateways.
Source	Customer
Priority	High
Related Requirements	REQ-6

Group D. Administration and Content Management Requirements

Field	Description
Requirement ID	REQ-8
Requirement	Product Management
Description	The system shall allow curators to add, update, and remove product listings.
Source	Curator
Priority	Medium
Related Requirements	REQ-4

Field	Description
Requirement ID	REQ-9
Requirement	User Management
Description	The system shall allow administrators to manage users and assign roles.
Source	Administrator
Priority	High
Related Requirements	REQ-3

Group E. Order Management Requirements

Field	Description
Requirement ID	REQ-10
Requirement	Order Confirmation
Description	The system shall generate order confirmation after a successful purchase.
Source	Customer
Priority	High
Related Requirements	REQ-7

Field	Description
Requirement ID	REQ-11
Requirement	Order History
Description	The system shall allow users to view their past orders and order statuses.
Source	Customer
Priority	Medium
Related Requirements	REQ-10

Group F.Notification and Communication Requirements

Field	Description
Requirement ID	REQ-12
Requirement	Order Notifications
Description	The system shall notify users via email or SMS about order confirmations and status updates.
Source	Customer
Priority	Medium
Related Requirements	REQ-10

Field	Description
Requirement ID	REQ-13
Requirement	Account Notifications
Description	The system shall notify users about account-related activities such as password changes or login alerts.
Source	Customer
Priority	Medium
Related Requirements	REQ-2

Group G. AI-Based Recommendation Requirements

Field	Description
Requirement ID	REQ-14
Requirement	Personalized Recommendations
Description	The system shall provide personalized product recommendations based on user behavior.
Source	Customer
Priority	High
Related Requirements	REQ-4, REQ-5

Field	Description
Requirement ID	REQ-15
Requirement	Recommendation Explanation
Description	The system shall allow users to view an explanation of why a product was recommended.
Source	Customer
Priority	Low
Related Requirements	REQ-14

H. Analytics and Reporting Requirements

Field	Description
Requirement ID	REQ-16
Requirement	Sales Analytics
Description	The system shall provide administrators with dashboards showing sales and usage statistics.
Source	Administrator
Priority	Medium
Related Requirements	REQ-10

Field	Description
Requirement ID	REQ-17
Requirement	Product Performance Reports
Description	The system shall allow curators to view reports on product popularity and performance.
Source	Curator
Priority	Low
Related Requirements	REQ-8

3.1.2 Non-Functional User Requirements

A. Usability and Accessibility Requirements

Field	Description
Requirement ID	NFR-1
Requirement	Usability
Description	The system shall provide an intuitive and easy-to-use interface for all user types.
Source	All Users
Priority	High
Related Requirements	REQ-1 to REQ-9

B. Localization Requirements

Field	Description
Requirement ID	NFR-2
Requirement	Language Support
Description	The system shall support both English and Amharic languages.
Source	Customer
Priority	Medium
Related Requirements	REQ-4, REQ-5

C. Security Requirements

Field	Description
Requirement ID	NFR-3
Requirement	Security
Description	The system shall protect user data using secure authentication and encryption mechanisms.
Source	Administrator
Priority	High
Related Requirements	REQ-2, REQ-7

D. Performance Requirements

Field	Description
Requirement ID	NFR-4
Requirement	Response Time
Description	The system shall respond to user actions within acceptable time limits under normal load conditions.
Source	All Users
Priority	High
Related Requirements	REQ-4, REQ-5, REQ-14

E. Reliability and Availability Requirements

Field	Description
Requirement ID	NFR-5
Requirement	System Availability
Description	The system shall be available 99.9% of the time excluding scheduled maintenance
Source	Administrator
Priority	High
Related Requirements	REQ-7 & REQ-10

F.Scalability Requirements

Field	Description
Requirement ID	NFR-6
Requirement	Scalability
Description	The system shall scale to support increasing numbers of users and transactions without performance degradation.
Source	Administrator
Priority	Medium
Related Requirements	REQ-6, REQ-14

G. Maintainability Requirements

Field	Description
Requirement ID	NFR-7
Requirement	Maintainability
Description	The system shall be modular and well-documented to support easy maintenance and future enhancements.
Source	Development Team
Priority	Medium
Related Requirements	REQ-8, REQ-9

H. Compatibility Requirements

Field	Description
Requirement ID	NFR-8
Requirement	Browser Compatibility
Description	The system shall function correctly on all modern web browsers and mobile devices.
Source	Customer
Priority	Medium
Related Requirements	REQ-4, REQ-6

3.2 System Requirements

This section describes the system level functional requirements to fulfill the user requirements described in Section 3.1

Each system requirement defines soft capabilities, system behaviors, and mechanisms for error management that must be satisfied for a specific set of use cases. Every requirement is specific, complete, clear, verifiable, and necessary.

3.2.1 User Account and Access Management - System Requirements

3.2.1SR-1 User Registration Processing:

The system shall validate all registration input including:

1. Email format (RFC 5322 compliant)
2. Password strength (minimum 8 characters with mixed case)
3. Unique email address (no duplicates in system)

Error Handling:

1. If email exists: Display "Email already registered"
2. If password weak: Show password requirements
3. If fields missing: Highlight required fields

3.2.1 SR-2 Secure User Authentication

The system shall authenticate users by comparing entered credentials with stored values.

Security Rules:

1. Passwords shall be hashed using bcrypts
2. Maximum 5 failed login attempts
3. Account lock for 30 minutes after failures

Error Handling:

1. Invalid credentials: "Invalid email or password"
2. Account locked: "Account temporarily locked. Try again in 30 minutes"

3.2.1 SR-3 Role-Based Authorization

The system will implement Role-Based Access Control (RBAC) to limit system functionalities depending on the roles allocated to users (Customer, Seller, Administrator).

1. Customer: Access to personal account, shopping, orders
2. Seller: Access to product management, inventory
3. Administrator: Full system access, user management
4. AI Operator: AI model management, system monitoring

Security Rules:

1. All unauthorized access attempts shall be logged
2. Admin functions require MFA after initial login
3. Role changes require administrator approval

Error Handling:

Attempts at unauthorized access will be denied and recorded for auditing purposes.

3.2.2 Product Browsing and Search – System Requirements

3.2.2 SR-4 Product Catalog Retrieval

4.1 The system shall be capable of retrieving and displaying products based on categories and subcategories.

Error Handling:

If products of a certain category do not exist, then it shall display ‘no products available’.

3.2.2 SR-5 Search Engine Processing

5.1 The system should be capable of handling searches using keywords as well as natural language searches with artificial intelligence-based search logic.

Error Handling:

If no result is obtained, then “No matching products found.” must be displayed.

Invalid input queries will require user corrections.

3.2.3 Shopping Cart and Checkout – System Requirements

3.2.3.1 SR-6: Shopping Cart Management

It should enable the addition, modification, or deletion of items in the Shopping Cart. Also, the system should be able to maintain the data in the Shopping Cart.

Error Handling:

If it is out of stock, it should not be added to the cart and the system should notify the user.

3.2.3.2 SR-7 Checkout Processing

7.1 The system should be able to compute order totals with taxes and discounts and redirect users to a secure third-party payment gateway.

Error Handling:

If it fails, the system will display "Payment unsuccessful. Try again."

The checklist shall not allow the submission of a transaction if it is incomplete

3.2.4 Order Management – System Requirements

3.2.4.1 SR-8: Order Confirmation Generation

The system should provide order confirmation for successful payment transactions and save the order details.

Error Handling:

If confirmation fails, the system will retry and notify the administrator.

3.2.4.1 SR-9 Order History

The system will enable the customer to check past orders and their status.

Error Handling:

If there is no order history, the system will display "No orders found."

3.2.5 Notification and Communication - System Requirements

3.2.5 SR-10 Notification Dispatch

The system will send notices (email/SMS) about order confirmation, status, and account events.

Error Handling:

If failed delivery of a notice occurs, it should log this event and repeat.

3.2.6 AI-Based Recommendation - System Requirements

3.2.6 SR-11 Recommendation Generation

The system should be able to provide users with AI model-driven product recommendations based on user behavior data.

- Justification:

If there is not enough data available, the system will show generic advice.

3.2.6 SR-12 Recommendation Explanation

The system should be able to generate a user-readable explanation of why it has made a particular recommendation to purchase a product.

Error Handling:

In a situation where there is no data for explanation purposes, “Explanation not available” shall be displayed on the system.

3.2.7 Administration and Analytics - System Requirements

3.2.7 SR-13: Product Manipulation

The system must enable the creation, modification, and deletion of products by the administrators.

Error Handling:

It will ensure that any invalid data concerning the product will not enable submission and will require correction

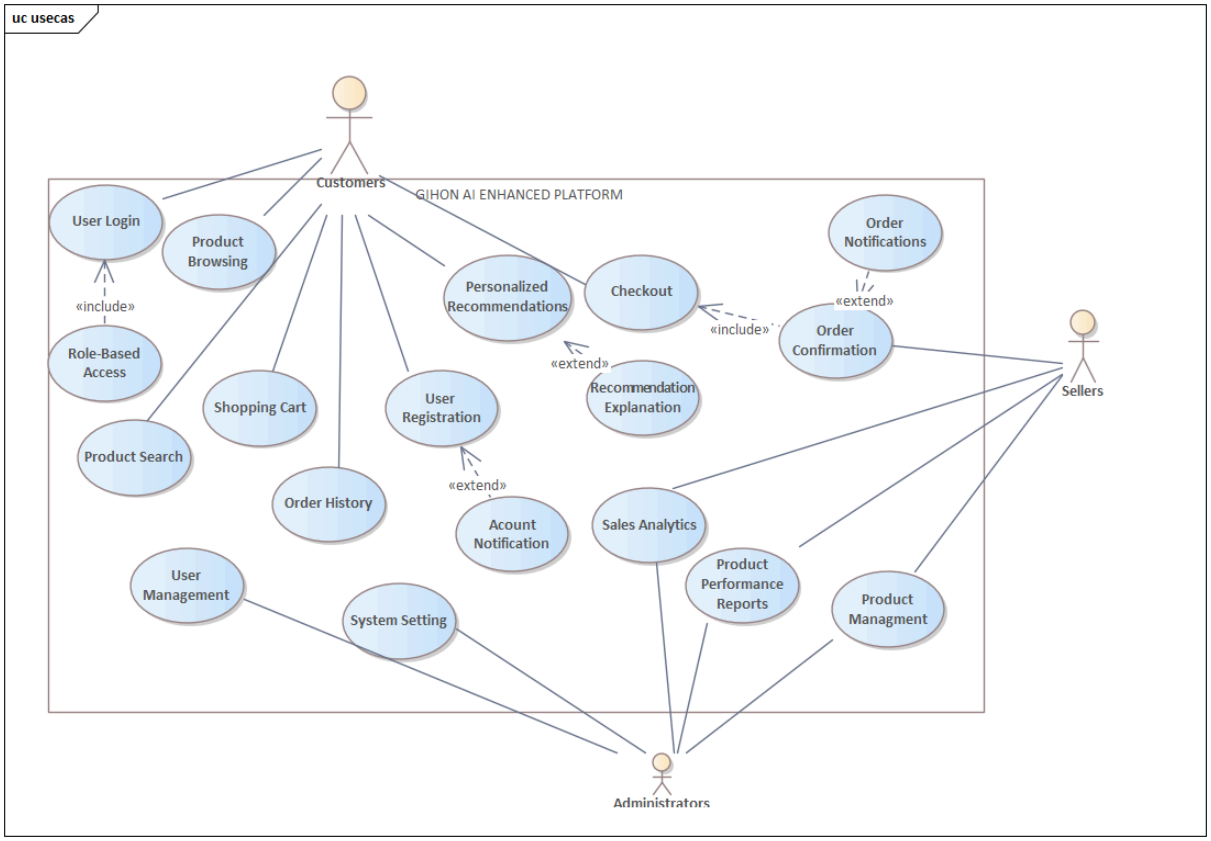
3.2.7 SR-14 User Management "The system should support administrators in managing user accounts and roles

Error Handling:System accounts with delete privileges will have delete attempts blocked.

3.2.7 SR-15 Analytics and Reporting

15.1 The system will be capable of producing dashboards and reports regarding sales, user activity, and product activity.

Error Handling: If the analytics data is not available, it shall show a warning message.



4. External Interface Requirements

- ## 4.1 **User Interfaces** introductions

- The purpose of this section of documentation is to define the logic of customer and administrative interfaces in the GIHON platform. It deals with screens, buttons, shortcuts, and error messages. The specifics of wireframes are given in another file, the UI Specification.

  4.1.1 Customer interface

- Purpose: Facilitates browsing of products, placing orders, and handling customer accounts.
- Main Screens and Components:

  Home Page: The home page features the product categories, the search facility, personalized product recommendations, and featured products.

  Product Page:Product images, descriptions, prices, reviews, and “Add to Cart” buttons are displayed here.

Shopping Cart & Checkout: Enhances displaying a list view of selected products, managing quantities, payment functionalities, and finalizing orders.

Header / Navbar: Appears on every page. It includes menu links, search functions, cart, profile, and logout.

Standard Buttons and Functions:Help, Back, and Logout links are present on every page.

Error messages are prominently displayed in red color with instructions for remedying.

Keyboard Shortcuts:Enter to search ESC to close pop-ups

Responsive layout optimized for desktop and mobile display.

Consistency in colors, fonts, and buttons on all screens.

The screen layout is designed to allow constant visibility of the header and the links.

4.1.2 Administrator Interface

- Purpose: Enables administrators to handle products, users, and transactions.
- Main Screens and Components:
- **Dashboard**: Provides data on user stats, sales, and activities on the platform.
- Product Management: The forms to manage product addition, modification, or deletion.
- Standard Buttons & Functions:Navigation and action buttons appear the same on all admin pages.
- Error messages are provided clearly with directions on rectification.
- Login authentication and Multi-factor authentication
- Screens for managing users
- Role & permission management UIs
- System Monitoring and Audit Log Views
- Analytics Dashboards

4.1.3 Input and Interaction interface

- All input fields should be accompanied by labels and placeholder text.
- The mandatory fields must be highlighted clearly.
- Input validation should be done in real time if possible.

- Keyboard navigation needs to be enabled for all interactive elements.
- Common keyboard shortcuts may be supported (for example, Enter on form submission).

4.1.4 Error Message and Feedback Standards

- "Error messages must be:"Clear,Brief,User friendly
- Errors will appear near the fields affected by them.
- Technical words should be avoided in system messages.
- Success messages should indicate completed actions (for example, “Order placed successfully”).

4.1.5 Seller Interface Components

“The curator interface shall include:”

- Secure login dashboard
- Product management screen (add product, edit product, delete product)
- Product Performance & Analytics Views
- Indicators of inventory status

4.1.6 Localization and Language Support interface

- "The user interface should support English and Amharic languages."
- Language choice could be accessible either from the login or header portion.
- Textual elements used in interfaces should be localizable.
- The interface needs to scale with screen sizes and resolutions.
- There should be touch controls for mobile devices.
- Text size and contrast should be accessible.

4.2 Hardware Interfaces

The GIHON AI-Enhanced E-Commerce Platform operates in a cloud-based, device-agnostic environment. This means that in the GIHON AI-Enhanced E-Commerce Platform,
there is no need for the software to directly control specialized hardware components; rather,
it communicates with common hardware components found in consumer and server systems,
using well-known operating system/network abstractions. This chapter explains hardware
environments and interactions between hardware and software components.

4.2.1 Client Devices

- The system will support access from the following client hardware devices:Desktop and Laptop Computers,Smartphones,Tablet devices
- These devices must be able to support:
- A display capable of displaying contemporary web-based content
- Input devices like keyboard/mouse/personal touchscreen or similar input devices
- Network Connectivity to Access the Platform
- The software shall not require any custom hardware peripherals.

4.2.2 Server and Hosting Hardware

The system should be able to run on cloud servers offered by cloud service providers.
The hosting hardware must have the following capabilities:
Compute resources (CPU, memory) - virtualization
Persistent and scalable storage devices
High Availability Networking Hardware
It should not be assumed that the software will depend on a specific server model because server management is the responsibility of the cloud.

4.2.3 Input Hardware Interfaces

The platform shall support standard input devices (keyboards, mice, touchscreens) through browser/OS APIs. All functionality must be keyboard accessible with ≤100ms response time. Touch targets shall be ≥44×44 pixels. No direct hardware access allowed.

4.2.4 Output Hardware

“The platform shall provide output through common display hardware, namely:”LCD, LED
Rendering images on screens (product listings, suggestions, verification messages): Rendering images on
Optional audio output (if available on the client device) for support with screen readers
B. All output shall be done via standard web technologies supported by current web browsers.
Communication between the client computers and server infrastructure will be done using normal networking components such as:
Wired or wireless network cards on client computers
Networking devices from cloud providers at the server-level

The system shall employ basic internet communication protocols using TCP/IP to transfer data between hardware nodes.

4.2.6 Peripheral and External Hardware Devices

The system shall not directly interface or control any external hardware peripherals such as:

- Barcode scanners
- Point-of-Sale Terminals
- Printers
- Any interaction with such devices, if necessary in future additions, is to be handled by external systems/middleware and is thereby out of scope of this SRS document.

4.3 Software Interfaces

The GIHON AI-Enabled E-Commerce Platform is an integration point for many software components both internal and external to the platform, so as to provide it with its functionalities. However, descriptions on how the system is logically linked with other software tools, such as operating systems, databases, other software, and AI tools, shall be found in the API documentation.

4.3.1 Operating System

- ➢ The system will run on common operating systems used in servers and clients.
- ➢ Client-side operating systems:
- ➢ Windows, Linux, macOS
- ➢ Android & iOS (mobile browsers)
- ➢ Server-side operating systems:
- ➢ Operating Systems Based on Linux Supplied by Cloud Hosting Providers
- ➢ The system shall use services provided by the operating system for process handling, memory management, file handling, and communication.

4.3.2 Web Browser

The system will be compatible with current web browsers in order to support the user interface.

Browsers that the software supports

- ➢ Google Chrome
- ➢ mozilla firefox
- ➢ Microsoft Edge
- ➢ Safari

➢ The system should not require any proprietary browsers or plugins.

4.3.3 Database Interfaces

The system must interface with a relational database management system (RDBMS) for trans-actional data and a NoSQL or search-optimized database for analytical/ai data.
The information that can be stored and retrieved includes:
User Profiles & Authentication MetaData
Product catalogs and categories
The company offers
Orders, Payments, and Record of Transactions
Audit logs and system activity records
User interaction data for analytics/AI model training (anonymized)
Database access should take place through secure server-side data access layers.
Direct client access to databases is not allowed.

4.3.4 Payment Gateway

The system shall support integration with third-party payment processing.
Some examples of services offered are:

- ➢ Stripe
- ➢ PayPal
- ➢ Chapa
- ➢ TelleBirr

Data exchanged:
Outgoing:Order value, money denomination, transaction identifiers
Entering the System: Payment status confirmation, payment numbers
“The system will not be storing or processing sensitive payment authentication details; this process will be handled by the payment gateway.”
Incoming: Behavior data of users, search queries, product information
Inbound:

Ranked search results
Recommendations
Relevance scores/Rating

The exchange of data related to AI must adhere to privacy rules specified elsewhere in this SRS.

4.3.5 Authentication and Authorization Interfaces

"The system shall support an internal authentication and authorization module."

The system shall interface with an internal

Services Provided:

User identity verification

Role-based access control enforcement

Multi-factor authentication support

Data exchanged:

Authentication requests (credentials, tokens)

Roles/permissions decision

All data involved in the authentication procedure shall be transmitted through secure, encrypted channels.

4.3.6 External Communication and Notification Interfaces

The system should link with third-party notification systems to relay system notifications.

Examples are:

- ➢ E-mail delivery services
- ➢ Services like SMS or push notifications
- ➢ Data exchanged:
- ➢ Inbound/Outgoing: Order confirmation notices, alerts, password reset
- ➢ Incoming: Delivery status or error messages

4.3.7 Analytics and Monitoring Interfaces

The system will interface with analytics and monitoring tools for gathering usage metrics and system performance information.

Data exchanged

User interaction events (anonymized)

System Performance Metrics

Metric Description

Error and exception logs

These interfaces enable operational monitoring and improvement of the system continuously.

4.3.8 API Interfaces

The system shall make internal and external services available through documented application programming interfaces (APIs).

There will be RESTful APIs with standardized data formats.

All APIs must be documented with OpenAPI (Swagger) specifications.

The access to APIs must be secured by means of authentication/authorization wherever necessary.
The definition of each API is described within a different document called 'API Specification'.

4.3.9 Data Sharing

Data sharing between software components should be realised in secured service interfaces.
"The data being shared must be consistent, validated, and protected from unauthorized access There shall be no global shared memory regions among the components.

4.4 Communications Interfaces

The GIHON e-Commerce Platform using AI requires secure and standardized means of communications between devices, servers, third-party services, and third-party integrations. In this section, descriptions of means of communications will be explained.

4.4.1 Client-Server Communication

Protocol: HTTPS/ TCP IP
Function: Ensuring secure transfer of requests and responses from client sides (Browsers & Mobile Devices) to server sides
Message Format: Using JSON for Data Transfer (Example: APIs)
Security Requirements:
All communication is to be encrypted using TLS 1.3 and above
"Server certificates need to be verified by the client in order to avoid man-in-the-middle attacks"

Performance Requirements:

90% of search queries must respond within 500ms, when subjected to normal loads (up to 1000 concurrent users)
90% of the AI recommendation calls must respond in 300ms at a typical load

4.4.2 Inter-Service Communication (Microservices)

Protocol: RESTful APIs on HTTPS; gRPC support possible in case high-performance service communications are required
Message Type: JSON or Protocol Buffers (protobuf) Message
Purpose: Facilitating the communication of microservices for:
Product service → Inventory service
recommendation_engine
analytics_service

- Authentication/Authorization service → Admin and Seller modules
- Security Requirements: Mutual TLS (mTLS) for sensitive internal API calls
- Synchronization : Services will be able to handle asynchronous communication when needed with the help of a message queue (like AWS SQS).

4.4.3 External Service

- Payment Gateways (Stripe, PayPal chapa)
- Protocol: HTTPS REST API
- Serializer Format: JSON
- Security Features: Compliant with PCI DSS encryption and
- Purpose: Payment request submission, payment notification receipt, refund processing
- Notification Services (Email, SMS, Push Notifications):Format of a notification message in JSON format
- Security: Encryption of message delivery via TLS
- Use case: transmitting order confirmations, shipping notices, password reset instructions, and system notifications
- Analytics Services (Mixpanel, Amplitude
- Data format: payloads via JSON
- Purpose: Sending anonymized data about interactions from users for system monitoring and AI-model training purposes

4.4.4 Web Browser

The system will enable communication with client browsers through HTTPS connections
The browser requests should be supported for HTTP/2 when available for optimal performance
Cookies and local storage must be used correctly for session management with encryption of sensitive information

4.4.5 Synchronization Mechanisms

Microservices should communicate their data through:
Event-driven message queues (Asynchronous)
RESTful APIs for synchronous operations
Product inventory changes should be distributed in near real-time fashion to synchronize services properly

4.4.6 Communication Constraints

There shall be no proprietary or non-standard protocols mandated in the client domain
Communications in the network shall be able to handle times when the network is intermittently unavailable, with appropriate retry logic
Bandwidth requirements should support the following:
Average product page size ≤ 3MB
Handling concurrent requests for up to 10,000 users without a degradation in performance

4.4.7 Data Security

The data that will be transmitted will be in accordance with GDPR and CCPA privacy laws
“Personal data in transit will at all times be encrypted.”
Sensitive API keys/tokens should never be sent over the wire in plain text The logging of the transmission of data should not record sensitive information such as the credit card number or password

5. Analysis Models

5.1 System Use Case Model

Introduction

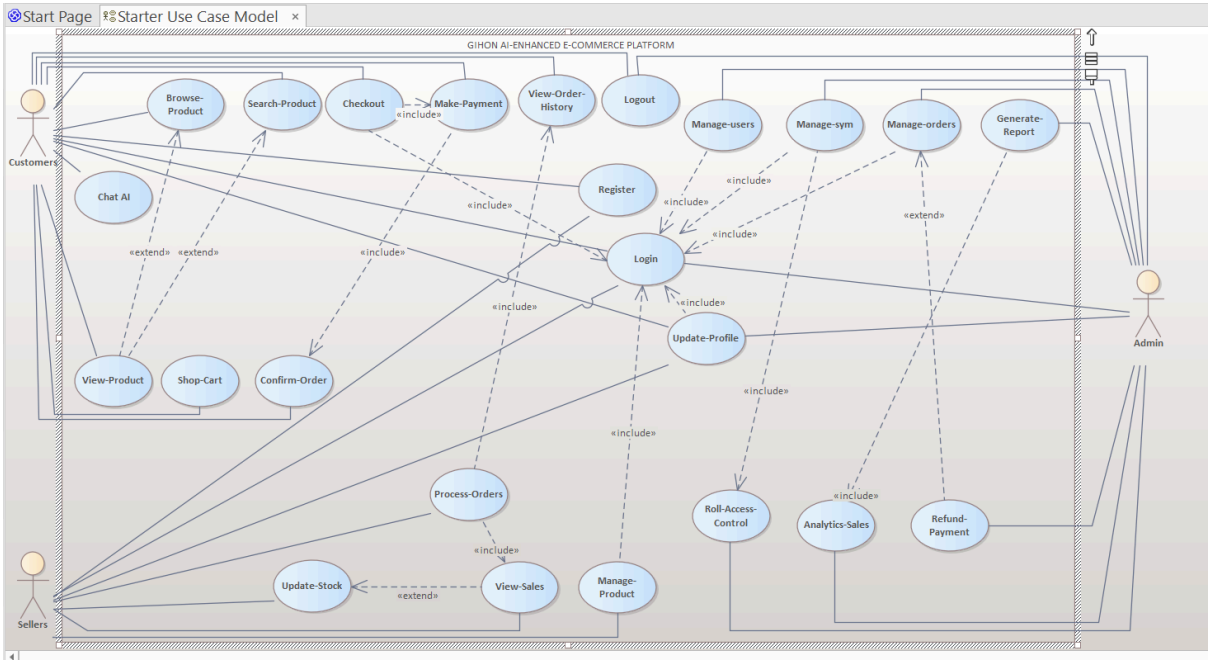
The System Use Case Model captures the interactions between users (actors) and the system, showing how the system fulfills user goals. It organizes requirements in a user-centric way and provides a basis for designing sequence and activity models.

Actors

Customer: Browses products, searches, adds to cart, completes purchases.
seller: Manages product listings and content.
Administrator: Manages users, roles, and system audit logs.

Actors	Shown in the diagram as stick figures with a name underneath. They represent elements that will be directly interacting with the system.
Use Cases	Oval shapes that have their names in the center. These represent direct functionality within the system that must be implemented.
Interactions	Lines that connect the actors with the different Use Cases. These show that there is some form of direct interaction between the actor and that specific functionality.
Includes	Dotted lines labeled "<<include>>" that connect two use cases and have an arrow pointing towards one. This means that the use case without the arrow calls on the functionality of the use case with the arrow.
Extends	Dotted lines labeled "<<extends>>" that connect two use cases and have an arrow pointing towards one. This means that the use case without the arrow takes all of the functionality of

	the use case with the arrow and adds extra functionality.
The System Boundary	The large rectangle that contains the Use Cases. Everything within the rectangle is what the system is responsible for implementing.
Use Case Template	Describes the basic functionality and features of each use case and the can be found in the pages following the use case diagram.
Type	A field in the use case template that states whether or not the use case is directly interacted with by an actor (Primary) or not (Secondary) as well as whether or not it is essential to having a functioning system.
Cross Ref	A field in the use case templates that states which one of the original requirements that particular use case satisfies.
Use-Cases	A field in the use case templates that state which other use cases must be executed prior to that particular use case.



5.2 Sequence Diagrams

Introduction

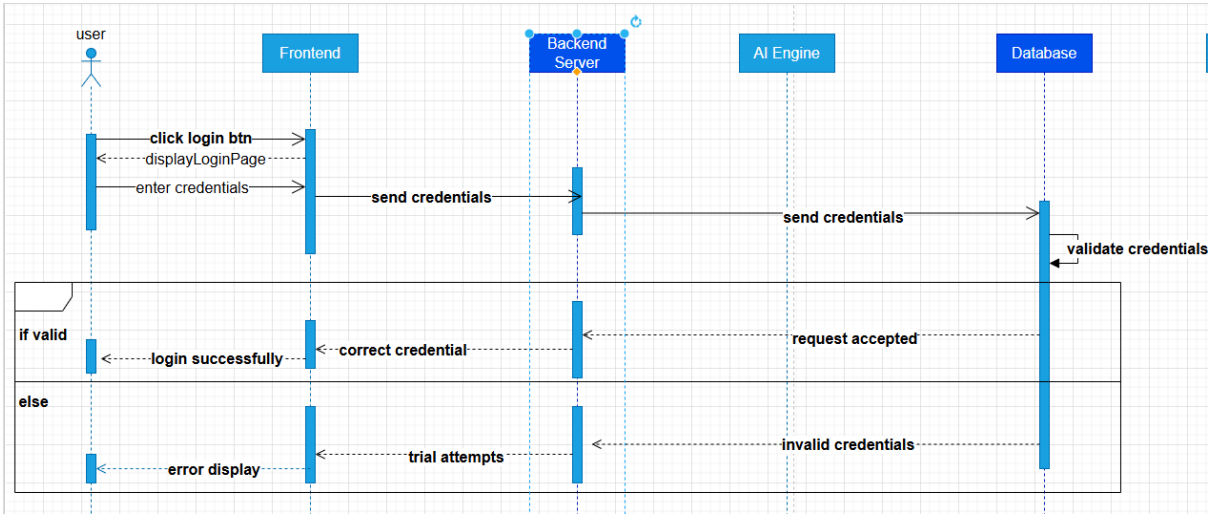
Sequence diagrams depict the **time-ordered interactions** between actors and system components. They illustrate the flow of events needed to fulfill a use case.

Example: Checkout Sequence

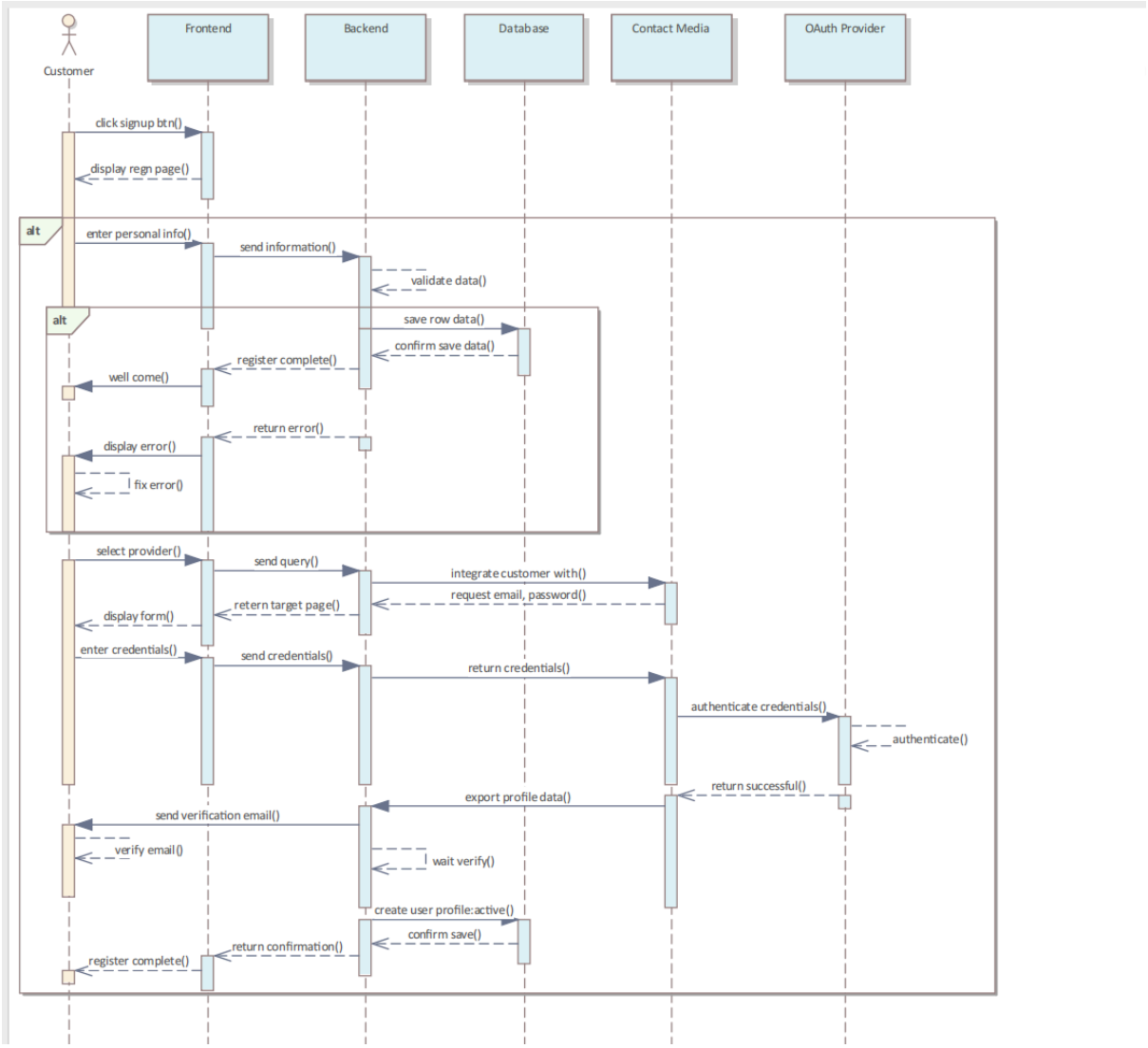
Actors: Customer, Web Interface, Cart Service, Payment Gateway, Notification Service
Flow:

1. Customer submits order from cart
2. Web interface validates order details
3. Cart service processes the order and communicates with payment gateway
4. Payment gateway returns transaction confirmation
5. Web interface updates order status
6. Notification service sends confirmation email or SMS to customer

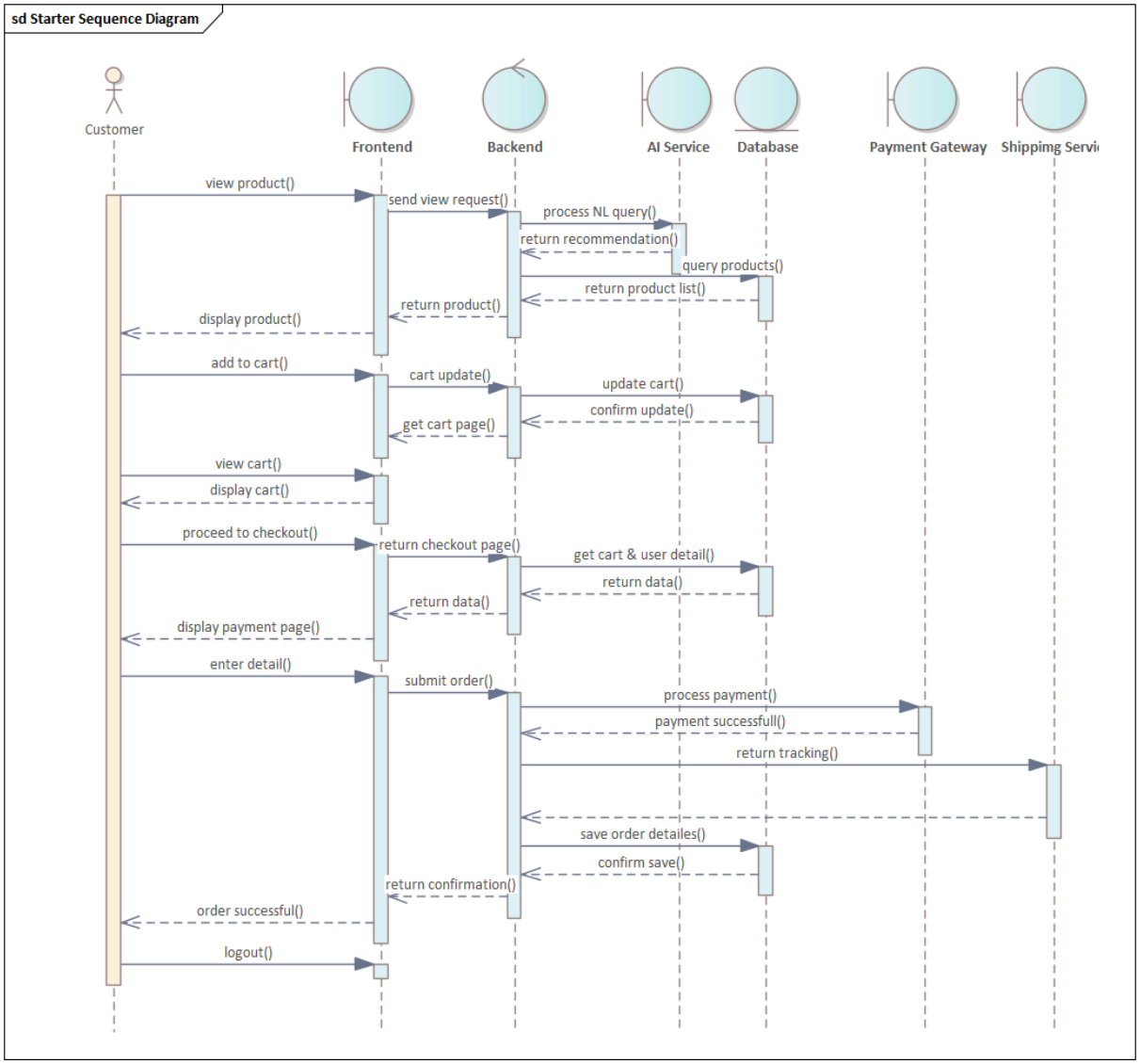
5.2.1 sequence diagram for the login process



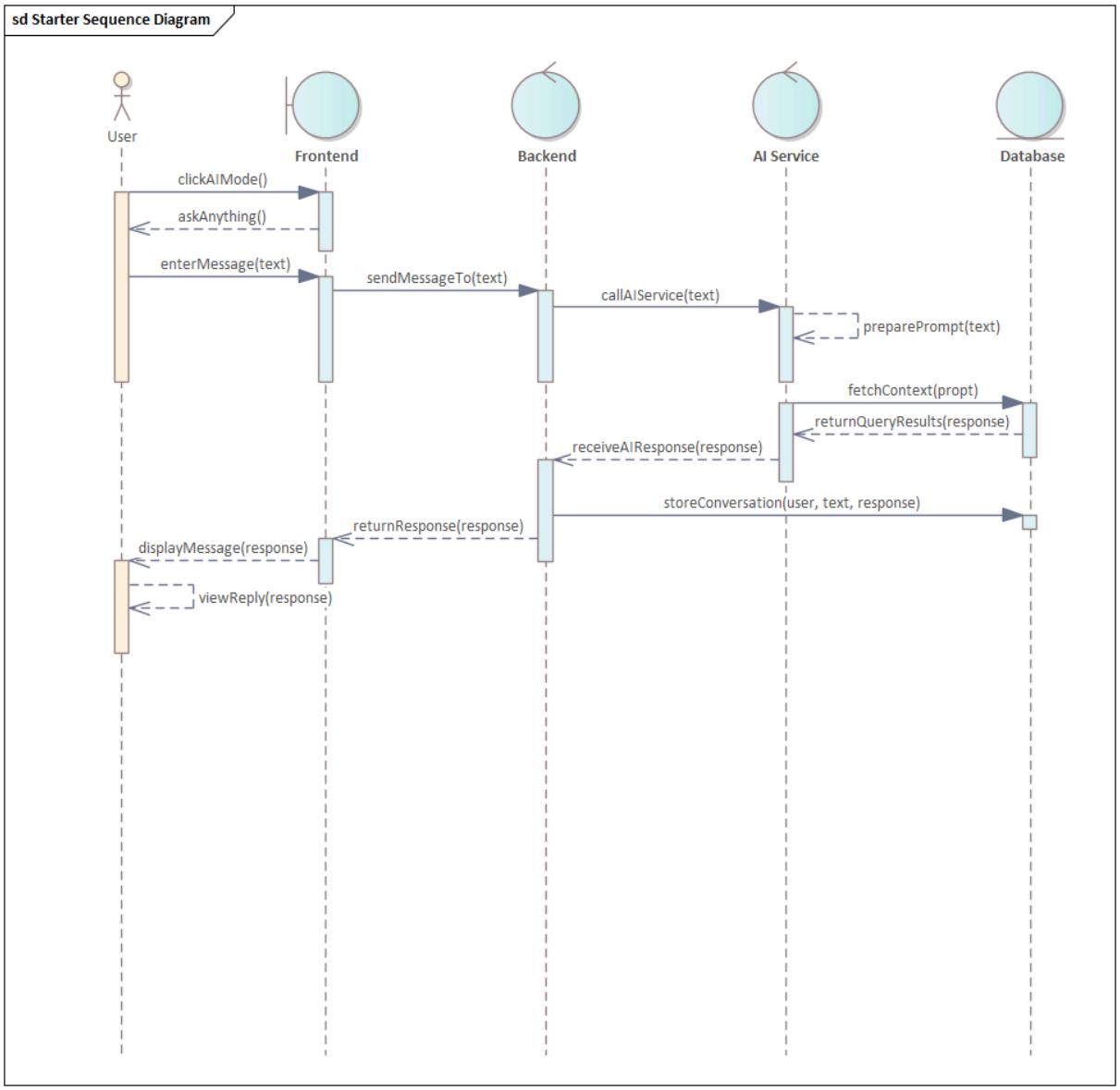
5.2.2 sequence diagram for the Registration process



5.2.3 sequence diagram for the ordering process



5.2.4 sequence diagram for the chatAI process



5.3 Activity Diagrams

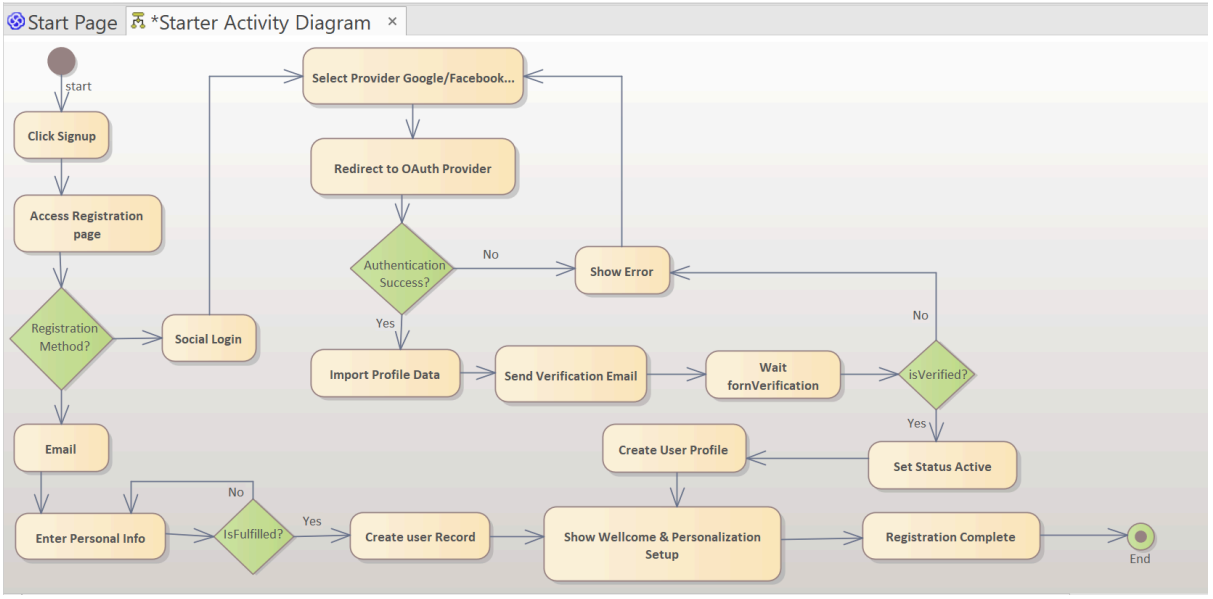
Introduction

Activity diagrams describe the **workflow of operations** or the **dynamic behavior** of the system. They are particularly useful to visualize conditional flows and parallel processes.

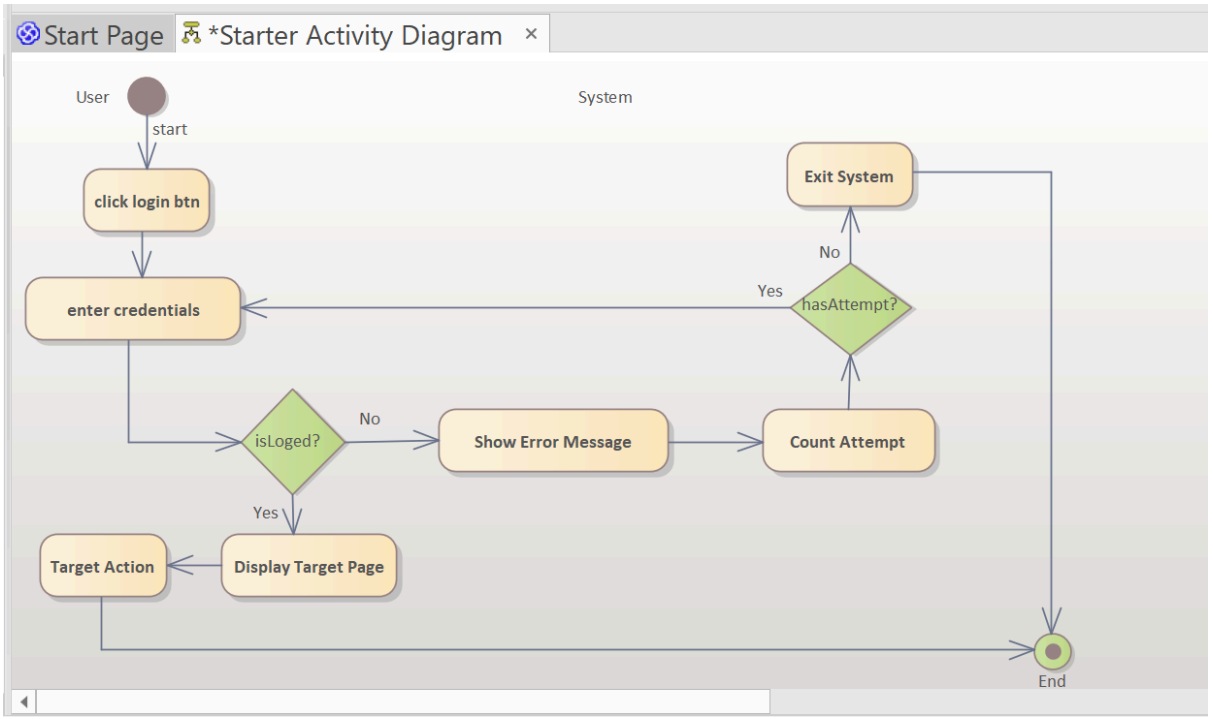
Example: Product Search and Recommendation Workflow

1. Customer inputs search query
2. System validates query
3. AI search engine returns ranked results
4. Recommendation engine suggests related products
5. System displays results and recommendations to the customer
6. Customer can select product, add to cart, or refine search

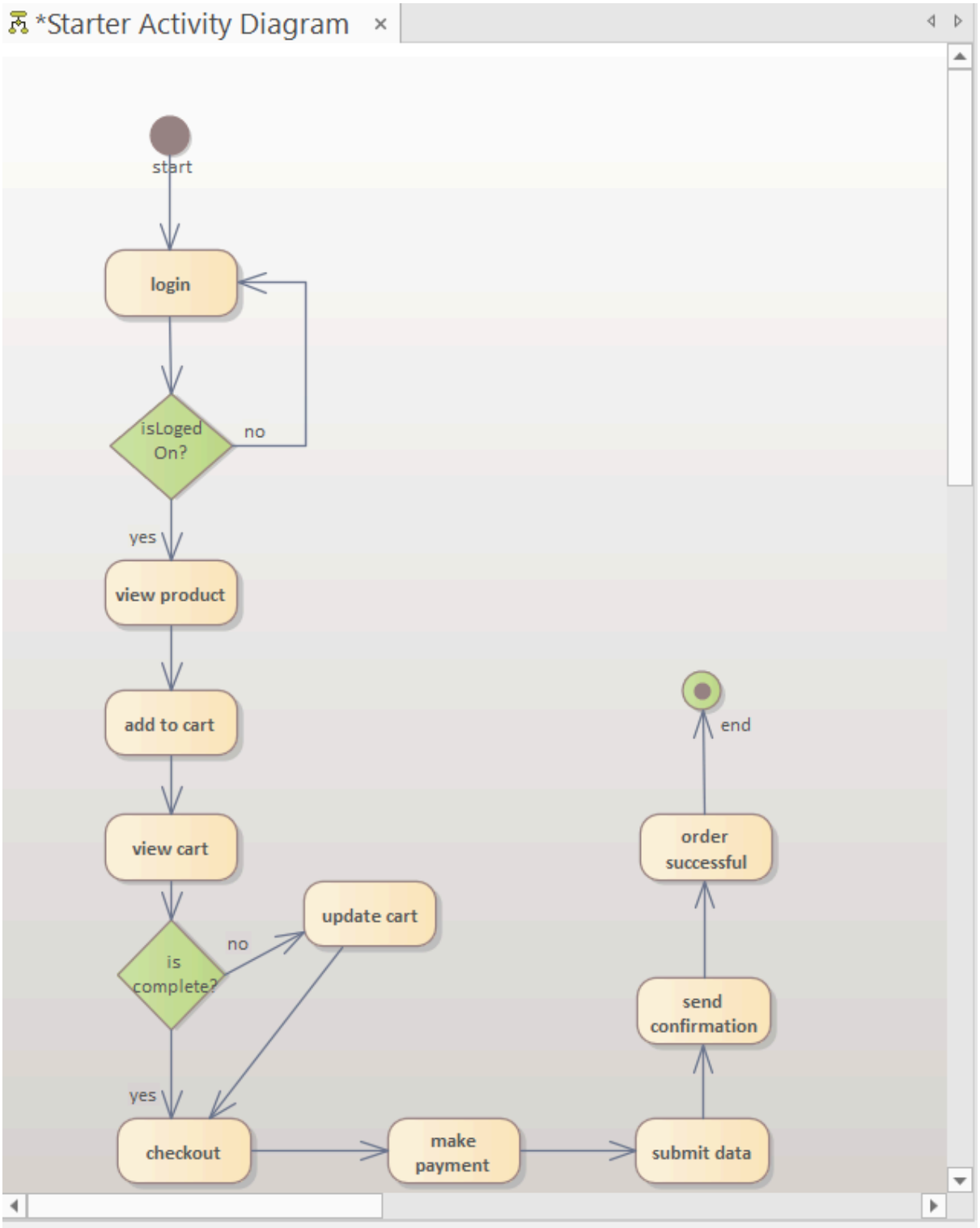
5.3.1 Activity Diagrams: Registration page diagram



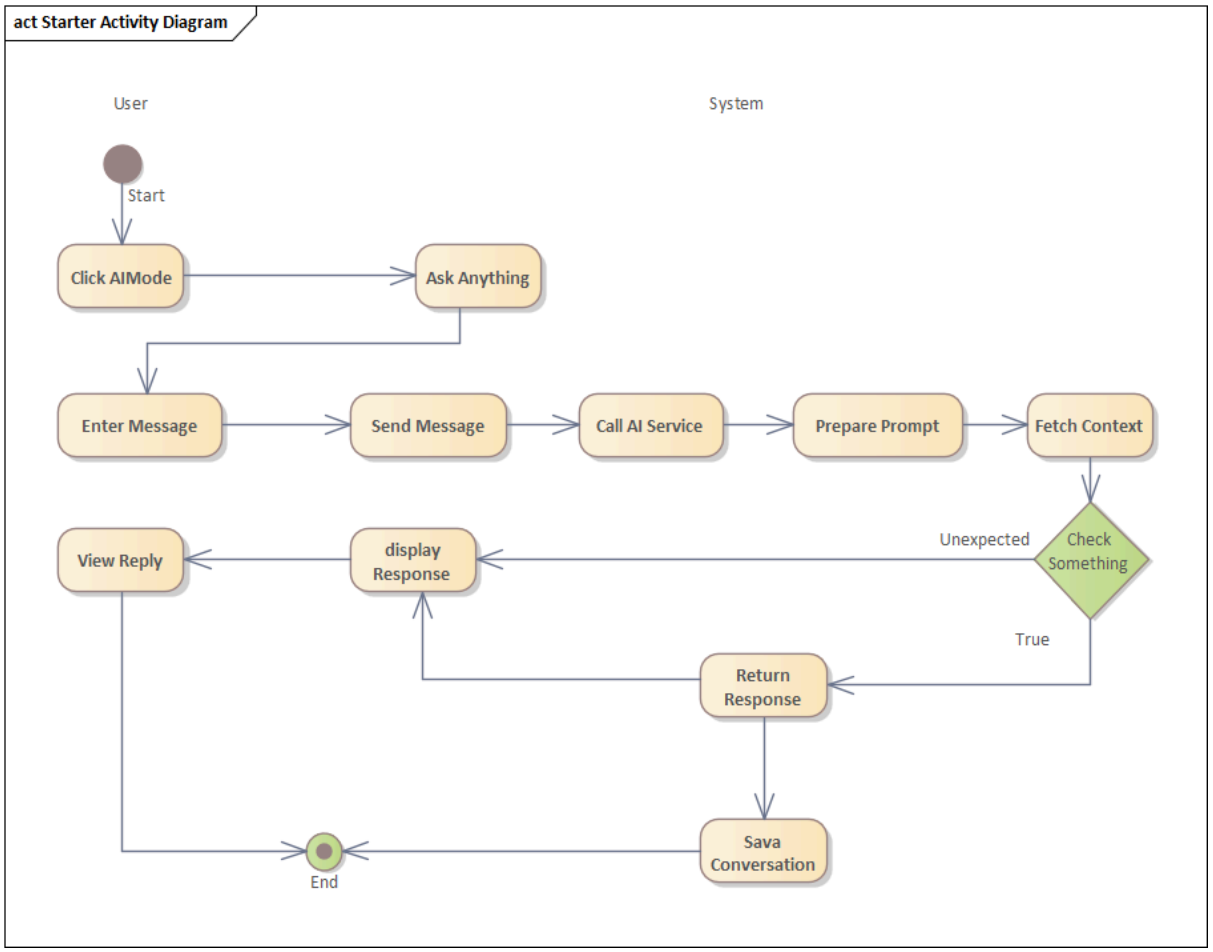
5.3.2 Activity Diagrams: login page diagram



5.3.3 Activity Diagrams: checkout page diagram



5.4.4 Activity diagram for the chatAI process



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Appendix

Appendix A: Requirements Traceability Matrix (RTM)

D.1 Functional Requirements Traceability Matrix

Req ID	Description	Source	Priority	Use Case	Module	Test Case	Status
REQ-1	User Registration	Customer Interview	High	UC-REGISTER	Auth Module	TC-001	Approved
REQ-2	User Login	Customer Interview	High	UC-LOGIN	Auth Module	TC-002	Approved
REQ-3	Role-Based Access Control	Administrator Interview	High	UC-ACCESS-CONTROL	Auth Module	TC-003	Approved
REQ-4	Product Browsing	Customer Survey	High	UC-BROWSE	Catalog Service	TC-004	Approved
REQ-5	Product Search	Customer Survey	High	UC-SEARCH	Search Service	TC-005	Approved
REQ-6	Shopping Cart Management	Customer Workshop	High	UC-ADD-TO-CART	Cart Service	TC-006	Approved
REQ-7	Checkout & Payment	Customer Workshop	High	UC-CHECKOUT	Payment Service	TC-007	Approved
REQ-8	Product Management	Seller Interview	Medium	UC-MANAGE-PRODUCT	Admin Service	TC-008	Approved
REQ-9	User Management	Administrator Interview	High	UC-MANAGE-USERS	Admin Service	TC-009	Approved
REQ-10	Order Confirmation	Customer Interview	High	UC-CHECKOUT	Order Service	TC-010	Approved

REQ-11	Order History	Customer Survey	Medium	UC-VIEW-ORDERS	Order Service	TC-011	Approved
REQ-12	Order Notifications	Customer Survey	Medium	UC-ORDER-UPDATE	Notification Service	TC-012	Approved
REQ-13	Account Notifications	Customer Interview	Medium	UC-PASSWORD-CHANGE	Notification Service	TC-013	Approved
REQ-14	Personalized Recommendations	Marketing Team	High	UC-RECOMMEND	AI/ML Service	TC-014	Approved
REQ-15	Recommendation Explanation	Customer Workshop	Low	UC-VIEW-REC-EXPLANATION	AI/ML Service	TC-015	Pending
REQ-16	Sales Analytics	Executive Team	Medium	UC-VIEW-REPORTS	Analytics Service	TC-016	Approved
REQ-17	Product Performance Reports	Seller Interview	Low	UC-VIEW-PRODUCT-ANALYTICS	Analytics Service	TC-017	Pending

D.2 Non-Functional Requirements Traceability Matrix

Req ID	Description	Source	Priority	Use Case	Module	Test Case	Status
NFR-1	Usability	User Testing	High	All UI Use Cases	Frontend Framework	TC-101	Approved
NFR-2	Language Support	Marketing Team	Medium	All UI Use Cases	Localization Service	TC-102	Approved
NFR-3	Data Encryption	GDPR Legal	High	UC-CHECKOUT, UC-LOGIN	Security Layer	TC-103	Approved

NFR-4	Response Time	Performance Requirements	High	UC-SEARCH, UC-BROWSE, UC-RECOMMEND	Performance Monitoring	TC-104	Approved
NFR-5	System Availability (99.9%)	SLA Requirements	High	All Critical Use Cases	Infrastructure	TC-105	Approved
NFR-6	Scalability	Technical Team	Medium	UC-RECOMMEND, UC-SEARCH, UC-CHECKOUT	Scalability Module	TC-106	Approved
NFR-7	Maintainability	Development Team	Medium	All Admin Use Cases	Code Architecture	TC-107	Approved
NFR-8	Browser Compatibility	Customer Survey	Medium	All UI Use Cases	Frontend Framework	TC-108	Approved

Appendix E: Questionnaires

The following brief questionnaires were used to collect high-level functional and non-functional requirements from key stakeholders of the GIHON AI-Enhanced E-Commerce Platform.

A. Customer Questionnaire

- What features do you expect from an online shopping platform?
- How important are personalized product recommendations?
- What payment methods do you prefer?
- How important is system speed and ease of use?
- Would you use an AI-based virtual shopping assistant?

B. Seller Questionnaire

- What product and inventory management features do you need?
- How frequently do you update product listings?
- Do you require sales analytics and reports?
- How important is system availability and reliability?
- What challenges do you face with existing e-commerce platforms?

C.Administrator Questionnaire

- What system monitoring features are required?

- What security controls should be enforced?
- How should system performance be measured?
- What administrative controls are essential?
- What scalability requirements do you anticipate?

Appendix F: Brief Interview Questions

Structured interviews were conducted to validate questionnaire responses and clarify system expectations.

A.Business Stakeholder Interview

- What are the primary objectives of the GIHON platform?
- What criteria define project success?
- What risks or constraints should be considered?

B. Technical Team Interview

1. What technical constraints must the system comply with?
2. What integration challenges are expected?
3. What performance and security standards are required?

C.End-User Interview

1. What problems do you face with current e-commerce platforms?
2. What features would improve your shopping experience?
3. How do you feel about AI-driven recommendations?