Abstract

This project aims to design and develop a comprehensive e-commerce website for Norwood Empire (PVT) Ltd, a company specializing in snacks and sweets. Because of its outdated features and limited scalability, the current website is less successful at serving clients and fostering the company's online expansion. AI-based product recommendation systems, a real-time customer service chatbot, a responsive user interface, and secure payment integration are all features of the suggested solution.

The system will be created in five sprints using an Agile methodology. Next.js will be used to build the front end, Node.js to build the back end, and MongoDB to handle the database. There will also be a secure admin panel for managing orders and products. The goal of this solution is to increase user experience, facilitate effective communication, and strengthen Norwood Empire's online presence.

Keywords: E-commerce, AI-based product recommendation, chatbot, responsive user interface, Agile, front end, back end, MongoDB, Secure payment integration, Admin panel, Next.js, Node.js

1. Introduction

1.1 Overview of the Problem

Norwood Empire (PVT) Ltd currently operates an outdated e-commerce website that lacks core functionality such as secure payment processing, intelligent product suggestions, and responsive design. In today's competitive digital market, these limitations limits both customer engagement and internal efficiency. To remain competitive and enhance its digital footprint, the company requires a fully revamped, scalable, and user-friendly e-commerce platform.

1.2 Report Structure

This proposal is organized as follows:

- Introduction: This includes the problems which are caused for this project, architecture diagram, project objectives and the deliverables.

- Requirement Gathering: The section deals with collecting user requirements to discover their needs using user stories, use case diagrams and analyzing similar applications.

- Methodology: The development process includes planning, requirement analysis, designing, implementation and finally the testing. This section also includes the Gantt chart, resources which are needed in both software and hardware, overall budget for the project, risk analysis and benefits.

1.3 Architecture Diagram

It should include:

- Client (Browser)

- Frontend (Next.js)

- Backend API (Node.js)

- Firebase (Authentication, Database, Hosting)

- AI Module (Recommendation Engine)

- Admin Panel

- Chatbot Layer

1.4 Problem Statement

The current Norwood Empire website is unable to satisfy the requirements of contemporary digital commerce. It has poor user experience and ineffective management skills since it lacks key features like integrated payments, recommendation systems, and real-time assistance. Lack of a scalable and interactive system limits the company's capacity to increase online sales and keep clients.

1.5 Justification of the Project

This project is justified by the need to:

- Replace the underperforming website with a modern, scalable, and feature-rich solution

- Introducing AI-driven personalization to boost customer engagement and sales

- Provide a secure and easy-to-use platform for both customers and admins

- Encourage Norwood Empire's long-term corporate objectives and digital transformation.

1.6 Project Objectives

- Deliver a responsive and modern e-commerce platform which meets all the clients' requirements.

- Implement AI-based product recommendation (content and collaborative filtering)

- Integrate a secure, real-time payment gateway

- Develop a chatbot to improve customer support

- Enable admin users to manage products and track analytics

- Follow Agile Scrum methodology with 5 clearly defined sprints

1.7 Project Deliverables

- Fully functional, hosted e-commerce website

- Admin dashboard for product, order management and career management.

- Secure login, cart, checkout, and payment processing system

- AI-powered recommendation

- Integrated chatbot for customer support

- Project documentation

- Final demonstration and deployment

2. Requirement Gathering

2.1 Introduction

The requirement gathering phase is foundational to developing the Norwood Empire (PVT) LTD e-commerce website, ensuring the platform meets business goals and user expectations. This phase involves collecting and analyzing functional and non-functional requirements through stakeholder collaboration, focusing on features like product pages, shopping carts, payment gateways, contact forms, chatbots, and recommendation systems. Using Agile methodology with Scrum, requirements are captured iteratively to accommodate evolving needs, enabling the team to deliver a user-centric, scalable solution.

2.2 Similar Applications

To inform the design and functionality of the Norwood Empire e-commerce website, a review of similar Sri Lankan e-commerce applications in the snacks and sweets sector was conducted. These applications were selected based on their relevance to the snacks and sweets market, target audience, and online presence in Sri Lanka. The analysis highlights their features, strengths, and weaknesses, providing insights into industry standards and opportunities for differentiation.

- **Amazon (Grocery & Snacks Category)**
  - **Features**: Extensive product catalog, advanced recommendation algorithms, multiple payment methods, and chatbot support.
  - **Strengths**: Scalable platform, fast performance, and sophisticated AI-driven recommendations.
  - **Weaknesses**: Generic interface not tailored to niche brands, complex navigation for new users.

- **Kapruka (kapruka.com)**

  o **Features**: Offers a wide range of groceries, including snacks and sweet

  o **Strengths**: Well-established brand with a large product catalog and reliable delivery across Sri Lanka. User-friendly interface for browsing and ordering.

  o **Weaknesses**: Lacks personalized recommendations and AI chatbot support.

- **Onlinekade.lk**

  o **Features**: Specializes in snacks and sweets, including chocolates, crisps, and Sri Lankan confectionery.

  o **Strengths**: Simple, focused platform with affordable pricing. Mobile-friendly design for easy access.

  o **Weaknesses**: No advanced features like recommendation systems or chatbots. Basic search functionality and limited product details

- **CandyClub (candyclub.com)**

  o **Features**: Personalized candy subscriptions, detailed product pages with nutritional info, and a mobile-responsive design.

  o **Strengths**: Strong branding with vibrant visuals, effective upselling through recommendations.

  o **Weaknesses:** Slow page load times, no integrated payment gateway variety (e.g., only credit cards), and limited customer support options.

2.3 Gap Analysis

Feature	Amazon	Kapruka	Onlinekade.lk	CandyClub	Norwood Empire (Proposed)
Personalized Recommendations	√	×	×	√	√
AI Chatbot Support	√	×	×	×	√

Fast Page Load	√	×	×	×	√
Advanced Search & Filtering	√	×	×	×	√
Real-Time Inventory Management	√	×	×	√	√

User Stories

User Role	User Story	Priority	Acceptance Criteria
Customer	As a customer, I want to create an account and log in securely, so that I can order products.	High	Users can sign up, log in, and view profile/order.
Customer	As a customer, I want to browse snacks and sweets, so that I can explore products to purchase.	High	Products are listed with images, descriptions, prices, and category filters.
Customer	As a customer, I want to add products to a cart to purchase items.	High	The chart allows quantity changes, and checkout secured with payment gateway.
Customer	As a customer, I want product suggestions, so that I can discover new items.	Medium	System shows personalized product recommendations based on behavior or preferences.

Customer	As a customer, I want to ask questions through a chatbot, so that I can get instant help.	Medium	Chatbot responds to common queries and provides assistance.
Admin	As an admin, I want to log into a dashboard, so that I can manage products.	High	Admin panel has secure login and displays product management options.
Admin	As an admin, I want to add or remove products, so that I can update the product catalog.	High	Admin can add/edit/delete products with instant reflection on the site.
Admin	As an admin, I want to view the people who have applied for careers and opportunities	Medium	The dashboard includes how many people have applied for careers
Visitor (Guest)	As a visitor, I want to contact the company so that I can make inquiries.	Low	"Contact Us" page includes contact form or company contact details.

Methodology

3.1 Introduction

The development of the e-commerce web application for Norwood Empire (PVT) LTD will follow the **Agile software development methodology using the Scrum framework** to ensure iterative progress, flexibility, and stakeholder collaboration. Scrum facilitates short, focused sprints (typically 1-2 weeks) to produce deliverables, with regular feedback to ensure alignment with stakeholder expectations. The methodology is structured into five key phases: Planning, Requirement Analysis, Designing, Implementation, and Testing.

3.1.1 Planning

The planning phase establishes the foundation for the project by defining objectives, scope, and timelines. Key features include,

- Conduct a meeting with client to align on project goals

- Team Formation and Role Assignment

- Sprint planning - The project will be broken into **2-week sprints**, with tasks assigned during sprint planning meetings using tools like **Jira**

- Backlog Creation

- Risk Management – identifying potential risks and finding mitigation strategies to resolve them.

- Select tools and technologies - Use **Next.js** for the front-end and server-side rendering, **Node.js** for the back-end , **MongoDB** for the database, and **Vercel** for hosting.

- Utilized the resources – selecting the technology stack for the front end and backend

3.1.2 Requirement Analysis

This phase focuses on gathering and analyzing requirements to ensure the website meets user and business needs. Following are the tasks that are doing within this phase,

- Stakeholder meetings - Collaborate with Norwood Empire's management to understand product categories (snacks and sweets) and target audience

- User Stories – Creating user stories clearly understand and capture the client's expected outcomes.

- Identify functional and non-functional requirements

Functional Requirements	Non-functional requirements
Product pages with images, descriptions, prices	Performance – fast loading time and easy navigation
Shopping cart with add/remove items and calculate total.	Reliability
Chatbot for customer support	Security
Recommendation system using content based filtering and collaborative filtering	Error handling

3.1.3 Designing

The designing phase focuses on translating requirements into technical and visual designs. Effective design ensures the website is intuitive, scalable, and aligned with the company's branding, directly impacting customer satisfaction, engagement, and business success. The following steps will be followed within this phase,

- UI/UX Design
  - Create high-fidelity mockups using Figma, reflecting Norwood Empire's branding
  - Design intuitive navigation with a clean layout

- Database Design

- o The website will use **MongoDB** to manage and store data.

- o Collections and schema will be designed to support scalability, efficiency, and easy querying.

- Recommendation System Design

The system will support two types of recommendation algorithms as,

- o **Content-Based Filtering**: Recommends products based on their attributes such as ingredients and categories.

- o **Collaborative Filtering**: Recommends based on user preferences and the behavior.

3.1.4 Implementation

The implementation phase involves coding and integrating the website's components based on the approved designs.

- Front-end Development

  - o Implemented using Next.js with Tailwind CSS for styling

  - o Implement dynamic routing

  - o **Component Development:**

    - Header and navigation bar

    - Product listing and product detail pages

    - Shopping cart and checkout flow

    - Login/Register forms

    - Contact form and chatbot interface

- Back-end Development

  - o Develop APIs for CRUD operations on products, users, and orders using Node.js and Express.

  - o Develop recommendation algorithms using custom logic for filtering based on MongoDB data.

- Database Integration

  - o Set up MongoDB with Mongoose for schema validation and querying.

- **Chatbot Integration**

    o Configure the chatbot to handle user queries and integrate it with the front-end via a widget.

- **Deployment**

    o Deploy the application to Vercel for continuous integration and delivery

3.1.4 Testing

The testing phase ensures the website is functional, secure, and user-friendly before launch. Testing is conducted iteratively during each sprint and comprehensively before deployment.

- **Unit Testing**

    o Test individual components using Jest.

    o Verify recommendation algorithm accuracy with sample data.

- **Integration Testing**

    o Test how different parts of the system work together. (Example: Test interactions between front-end, back-end, and database)

- **End-to-End Testing**

    o Simulate user journeys using Cypress (Example: browsing products, completing a purchase)

    o Test chatbot responses for accuracy and relevance.

- Usability Testing

    o Testing whether the user interface is intuitive and user-friendly. (Example: Product browsing and checkout experience)

- **Performance Testing**

    o Optimize images and queries to meet performance requirements.

    o Measure page load times

- **User Acceptance Testing (UAT)**

    o Conduct UAT with Norwood Empire stakeholders to ensure the website meets business requirements.

o   Gather feedback on UI/UX and functionality for final refinements.

Phase	Task	Start Date	End Date	Dependencies	Milestone
Sprint1: Planning & Analysis	Get Project idea & confirm brief	June 9	June 10	None	Project Initiation
	Conduct a client meeting	June 10	June 11	Confirm brief	-
	Gather & document requirements	June 11	June 13	Client meeting	-
	Define user roles & features	June 13	June 14	Requirements gathered	-
	Create product & sprint backlog	June 14	June 15	User roles & features	Planning Completed
	Set up Jira, GitHub, and dev environment	June 14	June 15	None	-
Sprint 2: Design & Implementation	Design UI mockups	June 16	June 18	Sprint 1	-
	Develop login & signup pages	June 19	June 21	UI Design	-
	Develop Contact Us/ Our story pages	June 22	June 24	UI Design	-
	Implement content-based recommendation	June 25	June 27	Login Page	-

	Set up Database for authentication & data storage	June 25	June 27	Backend start	-
	Conduct unit testing	June 28	June 29	Development tasks	Sprint 2 review complete
Sprint 3: Implementation 2	Develop Home Page	June 30	July 02	Sprint 2	-
	Implement the admin panel	July 03	July 06	DB setup	-
	Develop Chatbot UI & logic	July 07	July 13	Backend ready	-
	Conduct unit testing	July 11	July 13	Feature complete	Sprint 3 review complete
Sprint 4: Implementation 3	Develop Product listing & product detail pages	July 14	July 16	UI components ready	-
	Implement search filter	July 17	July 19	Product pages	-
	Develop Add-to-cart page	July 20	July 22	Product pages	-
	Implement collaborative recommendation	July 23	July 25	Add-to-cart ready	-
	Conduct unit testing	July 26	July 27	Feature complete	Sprint 4 review complete

Sprint 5: Closing	Perform final testing	July 28	July 29	All sprints	-
	Collect client feedback & revise	July 30	July 31	Testing	-
	Final deployment to hosting (Versal)	August 01	August 01	Client approval	Deployment Complete
	Prepare user documentation/demo	August 02	August 03	Final system	Project completed

3.4 **Resources (Software and Hardware)**

The development of the Norwood Empire e-commerce website requires specific software and hardware resources to ensure efficient execution and deployment. These resources support the Agile methodology, enabling iterative development and collaboration within the Scrum framework.

Software Resources

- VSCode

- MongoDB

- Git hub (version control)

- Jira (For sprint planning and task tracking)

- Testing: Jest and cypress

- Hosting: Vercel

3.5 Budget

Item	Estimated Cost
Domain (1 year)	4000
Web Hosting	8000
UI/UX Designing	10,000
Development	30,000
Special Features	10,000
Testing	5000
Deployment	5000
Total	72,000

3.6 Identify Risks

Risk identification is a critical component of the Norwood Empire e-commerce website development process, ensuring potential challenges are proactively addressed to safeguard project success. By systematically identifying risks, the team anticipates issues that could impact the timeline, budget, or quality.

Risk	Severity	Likelihood	Countermeasure
Scope Creep: Additional feature requests from stakeholders may extend timeline.	High	Medium	Prioritize features in the product backlog. Use sprint reviews to manage stakeholder expectations. Approve changes via formal change requests.

UI/UX Design Misalignment: Designs may not align with Norwood Empire's branding or user expectations.	Medium	Medium	Validate Figma mockups with stakeholders in early sprints. Iterate based on feedback.
System Struggles with Increased Load or Traffic During Sales Periods	High	Medium	Conduct load testing to simulate peak traffic and optimize MongoDB queries.
AI Chatbot Malfunctions or Incorrect Responses	Medium	Medium	Train chatbot with comprehensive FAQs and test extensively in isolation.
Team Member Unavailability: Absence of group members could delay deliverables.	Medium	Medium	Use Jira to reassign tasks. Maintain detailed GitHub documentation.
Inadequate User Testing: Insufficient feedback could result in a platform misaligned with user needs.	Medium	Medium	Conduct user acceptance testing (UAT) in later sprints. Use early prototypes for feedback.
Uncertainty whether content-based and collaborative recommendation algorithms are supported by Next.js and Node.js	High	High	Conduct feasibility testing during early design.
Client may not attend the sprint review at the end of each sprint	Medium	High	Schedule meetings in advance and prepare async video demos.

Budget is not finalized	Medium	Medium	Follow up with client on budget confirmation.
Delay in receiving content from the client	Medium	Medium	Set deadlines for content delivery and send reminders.
Delays in UI/UX design finalization affecting sprint progress	Medium	High	Set clear deadlines for design handover and review drafts early.
Testing not completed before sprint review	Medium	High	Allocate a fixed testing buffer in sprint plans.

3.7 Anticipated Benefits

The anticipated benefits of the Norwood Empire e-commerce website highlight the value it will deliver to the business and its customers. This section outlines how the platform, developed using Agile methodology and Scrum, will drive growth, enhance user experience, and streamline operations through features.

- **Increased Sales and Revenue**

    - **Personalized Shopping: Recommending products using** Content-based and collaborative filtering

    - **Streamlined Checkout**: Secure payment gateway

- **Enhanced Customer Experience**

    - **User-Friendly Interface**

    - 24/7 access to support via chatbot

    - **Brand Visibility**: Strong brand identity

    - Scalability and reliability: Vercel's auto-scaling supports high traffic during sales periods, ensuring uptime and performance.

- **Cost Efficiency**: Reduces reliance on manual staff for orders, support, and customer engagement via automation.