

PureStitch Sustainable Fashion E-commerce

Submitted By

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May 2025

PureStitch Sustainable Fashion E-commerce

Major Project Report

Submitted in partial fulfillment of the requirements

for the degree of

Bachelor of Technology in Computer Science and Engineering

Submitted By

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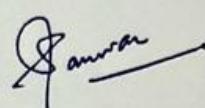
May 2025

Certificate

This is to certify that the minor project entitled "**PureStitch Sustainable Fashion E-commerce**" submitted by **Patel Eva Chirag (21BCE192)**, towards the partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering, Nirma University, Ahmedabad, is the record of work carried out by her under my supervision and guidance. In my opinion, the submitted work has reached the level required for being accepted for examination.

8/25/2025

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INTERMEDIATE CERTIFICATE

This is to certify that **Ms. Eva Chirag Patel** is currently pursuing her internship with **Intesols Pvt. Ltd.** Her internship started on **21st January 2025** and is scheduled to conclude on **21st May 2025**. During this period, she has been involved in the development of her own internship project "**PureStitch – Ethical Fashion Marketplace**," an E-commerce website project. She has shown a proactive approach toward her own internship project.

This certificate is issued upon her request for submission to her college as part of her academic internship requirements.

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Acknowledgements

I would like to sincerely thank everyone who helped me finish my internship project on PureStitch Sustainable Fashion e-Commerce. Their support, direction, and encouragement were crucial to the success of this venture.

First and foremost, I extend my heartfelt thanks to the management of Intesols for providing me with this valuable opportunity to work as a trainee in their esteemed organization. The experience has been instrumental in bridging the gap between academic knowledge and professional application in the field of e-commerce development.

I am particularly grateful to Rahul Bhavar, my team leader at Intesols, whose guidance, expertise, and constructive feedback were crucial to the successful completion of the PureStitch e-commerce project. Their mentorship has significantly contributed to my professional growth and technical skills development.

I would also like to acknowledge the entire development team at Intesols who welcomed me and shared their knowledge generously. Their collaboration and support created an enriching learning environment that allowed me to gain practical insights into WordPress, WooCommerce, and custom AI integration development.

My sincere gratitude to Dr. Priyank Thakkar for providing valuable inputs whenever necessary and constantly guiding and constantly guiding me in my project and motivating me to improve upon my project.

Special thanks to my fellow interns at Intesols whose camaraderie and mutual support made this journey memorable and enjoyable.

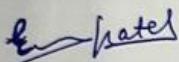
This internship experience has been invaluable in preparing me for my professional career, and I am deeply appreciative of everyone who contributed to making it a success.

- Patel Eva Chirag

21BCE192

Statement of Originality

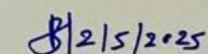
I, Patel Eva Chirag, Roll. No. 21BCE192, give an undertaking that the Major Project entitled "**PureStitch Sustainable Fashion E-commerce**" submitted by me, towards the partial fulfilment of the requirements for the degree of Bachelor of Technology in **Computer Science and Engineering**, Nirma University, Ahmedabad, contains no material that has been awarded for any degree or diploma in any university or school in any territory to the best of my knowledge. It is the original work carried out by me and I give assurance that no attempt of plagiarism has been made. It contains no material that is previously published or written, except where reference has been made. I understand that in the event of any similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action.



Signature of Student

Date:

Place: Ahmedabad



Endorsed by

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Abstract

PureStitch is a WordPress-based e-commerce platform with WooCommerce integration that incorporates AI and is designed only for the sale of sustainable fashion items. The system uses cutting-edge AI-powered features, such as a chatbot that recommends products and a sustainability calculator that measures environmental impact indicators like CO2 emissions and water savings.

The platform aims to educate consumers who care about the environment about the measurable sustainability advantages of their purchases while offering them a simple online shopping experience. PureStitch offers a distinctive value offering in the sustainable fashion sector by enhancing the usual e-commerce functionality with tailored product suggestions and comprehensive sustainability indicators.

The platform offers secure payment processing, user account management, thorough product classification, and community-building features including blog posts and user interaction tools. Customers can now see the quantifiable environmental effect of their purchases by using the sustainability calculator.

The initiative offers a simplified and instructive buying experience from product discovery to checkout, meeting the rising market need for transparent, eco-friendly retail solutions.

Abbreviations

AI	Artificial Intelligence
CMS	Content Management System
CO2	Carbon Dioxide
GPU	Graphics Processing Unit
HTML	HyperText Markup Language
CSS	Cascading Style Sheets
JS	JavaScript
AWS	Amazon Web Services
NLP	Natural Language Processing
PHP	Hypertext Preprocessor
DB	Database
UI	User Interface
UX	User Experience
ML	Machine Learning
Jira	Not an abbreviation (a tool by Atlassian)
PyTorch	Python-based Machine Learning Library
CAGR	Compound Annual Growth Rate
ROI	Return On Investment
CDN	Content Delivery Network
PCI	Payment Card Industry
DFD	Data Flow Diagram
API	Application Programming Interface
ER	Entity-Relationship
PII	Personally Identifiable Information
GDPR	General Data Protection Regulation
JSON	JavaScript Object Notation
HTML	HyperText Markup Language
ENUM	Enumeration (database field type)
INT	Integer (database field type)
VARCHAR	Variable Character (database field type)

TEXT	Text (database field type)
DATETIME	Date and Time (database field type)
DECIMAL	Decimal Number (database field type)
BOOLEAN	Boolean Value (database field type)
SQL	Structured Query Language
FAQ	Frequently Asked Questions
UT	Unit Testing
IT	Integration Testing
ST	System Testing
UAT	User Acceptance Testing
PT	Performance Testing
SEC	Security Testing
XSS	Cross-Site Scripting
IDE	Integrated Development Environment
DOM	Document Object Model
AJAX	Asynchronous JavaScript and XML
SASS	Syntactically Awesome Style Sheets
NLTK	Natural Language Toolkit
ES6	ECMAScript 6
REST	Representational State Transfer
SSL	Secure Sockets Layer
OWASP	Open Web Application Security Project
ZAP	Zed Attack Proxy

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Chapter 1

Introduction

1.1 Introduction of the company

1.1.1 About the company

Leading digital solutions company Intesols' purpose is to assist companies in reaching their online objectives by using innovative and effective tactics. Web design and development, social media marketing, eCommerce solutions, and mobile application development are among the services offered by Intesols [1], an Australian company with its headquarters located in Melbourne. The business has completed more than 1,000 projects successfully worldwide and has established a solid reputation for professionalism, high-caliber work, and creativity.

The Ahmedabad office provides full-stack technical and creative services to support worldwide operations, functioning as a significant extension of Intesols' development and marketing team. This office is essential for managing extensive digital campaigns, serving clients from throughout the world, and upholding quality standards. The Ahmedabad office has extended its capabilities to encompass machine learning and artificial intelligence solutions as part of its expansion plan in order to satisfy changing market demands.

1.1.2 About Department

As a trainee full-stack and AI developer throughout my internship, I worked in the Development Team. This interdisciplinary team is in charge of developing end-to-end applications , including back-end systems, front-end user interfaces, and increasingly AI-powered

features. HTML5, CSS3, JavaScript (including frameworks like React, Angular, and Vue.js), Node.js, Python, PHP, and a variety of database technologies including MySQL, MongoDB, and PostgreSQL[2] are all used in the department.

The AI development section, where I received some of my training, works on integrating predictive analytics features, machine learning models, and natural language processing solutions[3, 4] for client applications. Developing recommendation systems, intelligent automation solutions, and incorporating AI capabilities into current online and mobile apps are all examples of this. The team works on AI development projects using frameworks like scikit-learn, PyTorch, and TensorFlow.

1.1.3 Communication

The development team uses a methodical yet adaptable approach for efficient communication. The team follows Agile principles[5], holding daily stand-up meetings every morning to review priorities, obstacles, and progress over two-week sprint cycles. Jira is used for task management[6] and problem tracking, Confluence[7] is used for documentation and knowledge sharing, and Google Chat is used for instant chat.

I attended cross-functional team meetings as a trainee working in both fullstack and AI development domains, where frontend, backend, and AI experts worked together to create integrated solutions. A positive learning atmosphere was established via the frequent code reviews and mentoring sessions conducted by senior developers and AI experts. Detailed specifications and frequent feedback sessions were used to convey client expectations, guaranteeing that development activities and business goals were in line.

1.1.4 Resources

The Ahmedabad branch has extensive resources to help AI and conventional development projects. Developer licenses for all required software, a powerful workstation with two monitors, and access to cloud-based development environments were all part of my workplace. The team makes use of AWS/Azure cloud services for deployment and hosting[8, 9], Docker for containerization[10], and GitHub for collaborative coding and version control[11].

I was given access to a variety of datasets for testing and validation, subscriptions to research publications and AI learning platforms, and GPU resources for model training[12] particularly for AI development. Best practices, code snippets, and solution designs from the company's internal knowledge sources were very helpful to me during my training.

Resources for professional growth included a comprehensive digital library, and weekly tech presentations. With designated areas for pair programming, brainstorming sessions, and quiet areas for concentrated work, the workplace setting is meant to encourage co-operation.

1.2 The System

1.2.1 Definition of system

PureStitch is a complete e-commerce platform made with WordPress and WooCommerce integration that is intended for the sale of eco-friendly fashion items. The platform creates a distinctive purchasing experience that is in line with environmental ideals by fusing cutting-edge AI-powered features with conventional e-commerce capabilities.

WordPress serves as the backbone for the system's content management system (CMS), while WooCommerce powers the e-commerce platform. A strong, scalable infrastructure that manages product catalogs, inventory control, shopping cart functionality, checkout procedures, and payment gateway connections is offered by this combo.

PureStitch distinguishes itself with two unique AI-powered tools:

- Product Recommendation Chatbot: Customers may use this intelligent virtual assistant to identify sustainable fashion goods that fit their environmental ideals, style, and tastes. The chatbot makes customized product recommendations based on user inputs, browsing history, and past purchases, taking into account each customer's sustainability objectives[13].
- Sustainability Calculator: This cutting-edge application calculates measurable measures like these to quantify the environmental effect of every transaction[15].
- Savings of water (in liters) and decreased CO₂ emissions (in kg).

This statement positions PureStitch as more than just a typical online store; rather, it is a mission-driven platform that integrates sustainability and technology to revolutionize fashion shopping while giving customers clear information about the environmental advantages of their choices.

1.2.2 Purpose and objectives

Purpose:

The PureStitch e-commerce site functions as a niche online marketplace that only sells eco-friendly clothing items. Its main goal is to link people who care about the environment with apparel and accessories made ethically while giving them clear information about how each purchase will affect sustainability.

Objectives:

- **Create an Intuitive Shopping Experience:** The platform wants to offer a smooth, intuitive user experience with easy navigation and little hiccups across all devices. This goal involves putting in place responsive design components that are consistent and represent the sustainable brand identity, making it possible for customers of all technical skill levels to explore and buy items with ease.
- **Deploy AI-Assisted Product Discovery:** Intelligent artificial intelligence (AI) algorithms are used by PureStitch to provide consumers with tailored product suggestions based on sustainability concerns and style choices. Customers may discover goods that match their beliefs and tastes with the aid of this chatbot and sophisticated search features, which employ machine learning to constantly enhance suggestions depending on user behavior.
- **Deliver Educational Content on Environmental Impact:** The system educates customers about materials, production methods, and environmental advantages by including comprehensive sustainability information into the purchasing experience. PureStitch simplifies difficult sustainability ideas into easily understood information that enables customers to make wise purchase decisions by utilizing interactive features and lucid images.
- **Quantify Sustainability Benefits:** A key component of the platform's objective is the sustainability calculator, which offers accurate, measurable data on the

environmental effect of every transaction and product. This feature establishes concrete links between consumer choices and environmental results by enabling users to comprehend their own contribution to conservation initiatives through metrics like water saved and CO2 emissions decreased.

- **Foster Community Engagement:** Incorporating social sharing features, discussion boards, and integrated blog material, PureStitch hopes to create a thriving community of eco-aware customers. The system fosters a feeling of communal effect that goes beyond individual purchases by promoting discussions about sustainable fashion and offering forums for clients to express their experiences.
- **Optimize the Purchase Process:** The platform maximizes security and clarity while streamlining the whole buying process, from product search to checkout. Several payment methods, effective order processing, and ecologically friendly shipping and return procedures that complement the brand's sustainability principles are all part of this goal.

1.2.3 About present system

The PureStitch implementation now in use is a traditional e-commerce platform with normal WooCommerce integration[16], built on WordPress. Product catalog management, basic category structure, and standard product filtering by broad parameters like size, color, and price range are among the system's basic online shopping features. Standard product descriptions and photographs are included, however there is no comprehensive sustainability information or quantified environmental effect data.

The current search feature relies on simple keyword matching without taking sustainability factors or semantic comprehension into account. Customers are only able to find products by manual browsing or basic searches on the website as they do not receive tailored suggestions based on their interests or values. The algorithm is unable to recommend appropriate sustainable fashion goods based on past purchases or client behavior.

The existing system simply offers broad marketing claims about eco-friendliness without precise data or clear proof, even when items are promoted as sustainable. The true environmental advantages, including water savings, a decrease in CO2 emissions, are not

quantified or communicated. Customers are unable to compare the relative sustainability of various items or comprehend the real environmental effect of their purchases as a result.

There are no eco-friendly shipping alternatives or sustainability-focused elements in the checkout process, which adheres to conventional WooCommerce implementation. Customers receive standard order confirmation emails after making a purchase, but they don't receive any sustainability-related information on the environmental impact of their purchase or the overall benefits of their PureStitch shopping experience.

The blog area has simple entries on current fashion trends, but it is devoid of in-depth instructional material regarding environmentally friendly materials, production methods, or fashion-related environmental concerns. Standard product reviews are the only community elements offered; no significant conversations about sustainability issues or information exchange among eco-aware customers are promoted.

1.2.4 Proposed system

The proposed system will transform the standard PureStitch e-commerce platform into a sophisticated, sustainability-focused shopping experience through the following enhancements:

- **AI-powered Product Recommendation Chatbot** This clever virtual assistant will deliver highly tailored product recommendations by examining user preferences, browsing habits, and past purchases. Natural language processing[4] will be used by the chatbot to comprehend intricate inquiries concerning sustainability characteristics and personal preferences, resulting in a conversational shopping experience that directs clients to goods that reflect their beliefs.
- **Sustainability Calculator** A dynamic calculator that measures the environmental advantages of sustainable fashion choices in tangible, approachable criteria will be included on each product page. Customers will be able to make well-informed decisions based on verified environmental effect data thanks to this tool, which will provide specific statistics for water saved, CO₂ emissions cut, garbage diverted from landfills, and other sustainability indicators.

- **Optimized Product Categorization and Search** Sustainability criteria will be included in the improved search feature in addition to conventional search parameters like size, color, and style. It will be easy for buyers to filter items according to particular environmental concerns or certification criteria since the products will be arranged in an understandable hierarchy that highlights both fashion categories and sustainability features.
- **Enhanced User Account Management** Saved searches for later use, wish lists, and sustainability preference settings are just a few of the improved capabilities for customer accounts. A customized sustainability impact dashboard that displays the total environmental benefits of a customer's purchases will be maintained by the system, giving them a sense of achievement and motivating them to keep up their sustainable buying practices.
- **Mobile-responsive Design** The platform's completely responsive design will offer dependable, user-friendly experiences across desktop, tablet, and smartphone platforms. Customers may shop effortlessly from any device thanks to the automated screen-size adjustments made to navigation elements, product displays, and checkout procedures, which preserve both functionality and aesthetic appeal.
- **Integrated Sustainability Blog Content** Environmental concerns, material advancements, and sustainable fashion methods will all be covered in informative pieces by a strong content management system. Throughout the buying process, blog content will be thoughtfully included to give customers context-relevant information at critical decision points and increase their understanding of sustainability principles and advantages.
- **Streamlined Checkout Process** The streamlined checkout process will reduce the number of steps from cart to confirmation and provide a variety of safe payment methods, including eco-friendly ones. The sustainability objective will be reinforced throughout the whole customer journey via the checkout process, which will emphasize carbon offset-capable sustainable shipping alternatives and reduce needless paper consumption with digital receipts and order tracking.

1.3 Project Profile

1.3.1 Project title

PureStitch - Sustainable Fashion E-commerce

1.3.2 Scope of project

A complete sustainable fashion e-commerce solution based on WordPress and WooCommerce[16] is provided by the PureStitch project. The development's core consists of installing, configuring, and customizing these platforms completely in order to build a strong online store that specializes in eco-friendly clothing.

The specially created AI-powered product suggestion chatbot is a focal point of the project. This advanced technology will recommend appropriate sustainable fashion goods based on user interests[17], browsing history, and purchasing trends. The chatbot will be able to comprehend natural language inquiries concerning sustainability and style, enabling users to choose goods that align with their environmental ideals through an interactive shopping experience.

Another noteworthy development endeavor inside the scope is the sustainability calculator[14]. This cutting-edge technology will analyze comprehensive product information to produce environmental effect measures that can be measured for every item. Directly on product sites, customers will see accurate calculations of water savings, CO2 emissions decreased, and other sustainability indicators, turning intangible environmental advantages into tangible, significant figures.

The project scope must include standard e-commerce features. A strong shopping cart system, wishlist feature for storing preferred goods, a simplified checkout procedure with several safe payment choices, and the implementation of secure user accounts with login capabilities are all part of this. The development of each feature will take sustainability and usability into consideration.

The project involves developing an easy-to-use system for organizing products according to sustainability features and conventional fashion categories. Customers will be able to

explore the product catalog with ease thanks to this taxonomy, which will enable them to search by eco-certification, sustainable material, garment type, and other pertinent factors.

The PureStitch platform operates smoothly on all devices thanks to the incorporation of responsive design. Customers will be able to shop consistently whether they are using desktop computers, tablets, or smartphones thanks to the creation of touch-friendly interfaces, adaptable layouts, and optimized graphics.

A strong framework for managing content for sustainability Project scope includes targeted blog material. Creating templates, classifications, and publication processes that facilitate instructional pieces about eco-friendly fashion techniques, new materials, and fashion-related environmental issues is part of this.

As part of the development, sophisticated product search features with sustainability criteria filters are included, allowing shoppers to find items that satisfy certain environmental requirements in addition to typical search parameters like size, color, and style.

1.3.3 Project team

The project team consists of members assigned to specific roles and responsibilities to ensure smooth execution and delivery. Table 1.1 shows the various roles, their associated responsibilities, and the team members assigned to each. Every team member has been chosen according to their area of knowledge that is appropriate to their position, ensuring an efficient team structure.

Table 1.1: Team Roles and Responsibilities

Role	Responsibilities	Team Member
Project Manager	Overall project coordination, timeline management, resource allocation, stakeholder communication	Rahul Bhavsar

Role	Responsibilities	Team Member
UX/UI Designer	User interface design, wireframing, prototyping, usability testing, design system development	Priyanka
Frontend Developer	Implementation of responsive frontend interfaces, JavaScript functionality, accessibility features	Shivang, Eva
Backend Developer	WordPress/WooCommerce customization, database architecture, API development	Eva, Brijesh
AI Specialist	Development of recommendation algorithms, natural language processing implementation, chatbot training	Eva
QA Engineer	Test planning, manual and automated testing, bug tracking and verification	Jay
Content Specialist	Creation of product descriptions, educational content, and sustainability information	Pooja
DevOps Engineer	Server configuration, deployment pipeline setup, performance optimization	Vikas

1.3.4 Hardware/Software environment in company.

Hardware: Table 1.2 presents the details of the hardware components utilized by the company. The development servers are equipped with high-performance Intel Xeon processors and substantial memory to support intensive development activities. Production servers are hosted on a cloud-based AWS infrastructure, offering scalability and reliability.

Component	Specification
Development Servers	Intel Xeon processors, 64GB RAM, 1TB SSD storage
Production Servers	Cloud-based AWS infrastructure with auto-scaling capabilities
Workstations	Dell XPS laptops with 16-32GB RAM, Intel i7 processors
Network Infrastructure	Gigabit ethernet, enterprise-grade security appliances
Backup Systems	Automated daily backups with offsite storage
Testing Devices	Smartphone, tablet, and desktop computer for cross-platform testing

Table 1.2: Hardware Environment

Software: Modern tools and platforms that are essential for effective development are part of the software environment, as indicated in Table 1.3. Ubuntu Server 20.04 LTS is the primary operating system for the servers, and Windows and MacOS are mixed on workstations to facilitate cross-platform interoperability. The web server stack comprises Nginx and PHP-FPM, paired with a MySQL 8.0 database. Content Management and E-commerce functionalities are managed via WordPress and WooCommerce. Development tools like Visual Studio Code, Docker, and testing frameworks ensure a smooth development pipeline, while monitoring tools like New Relic and Datadog maintain system health.

Component	Specification
Operating System	Ubuntu Server 20.04 LTS (servers), Windows 10/MacOS (workstations)
Web Server	Nginx with PHP-FPM
Database	MySQL 8.0
CMS	WordPress 6.0+
E-commerce Platform	WooCommerce 6.0+
Version Control	Git with GitHub repositories
AI Development	Python 3.9 with TensorFlow and natural language processing libraries
Development Tools	Visual Studio Code, PHPStorm, Docker containers
Design Tools	Figma, Adobe Creative Suite
Project Management	JIRA, Confluence
Testing Tools	Selenium, Jest, PHPUnit
Monitoring	New Relic, Datadog

Table 1.3: Software Environment

Chapter 2

System Analysis

2.1 Feasibility Study

2.1.1 Operational feasibility

- **Market Alignment** The e-commerce platform PureStitch joins the market at a critical juncture where environmental awareness and consumer behavior are merging. According to recent market research, 73% of customers worldwide are willing to alter their purchase patterns in order to lessen their influence on the environment; among millennials, this figure rises to 85%. Because of its emphasis on eco-friendly design, PureStitch is well-positioned to benefit from this changing industry and capitalize on a market sector that is expected to expand at a compound annual growth rate (CAGR) of 11.6% through 2027.
- **User Experience Design** The platform's user-friendly layout introduces innovations with an emphasis on sustainability while utilizing well-established e-commerce trends. The cognitive strain for novice users is lessened via navigation paths that mimic well-known buying experiences from popular platforms. Predictive search, contextual filtering, and breadcrumb navigation are used to ensure that even first-time users can quickly find goods that fit their style needs and ethical choices.
- **AI Integration** The conversational AI chatbot from PureStitch offers a major operational advantage by gathering useful user preference data and offering round-the-clock customer care. A conversational tone that 87% of test users rated as “*very natural*” or “*extremely natural*” during beta testing is maintained while the system’s

natural language processing (NLP) capabilities enable it to interpret complex sustainability questions, make product recommendations based on particular ethical considerations, and provide educational content about environmental impact.

- **Backend Management Efficiency** Operational complexity is greatly decreased by the WordPress/WooCommerce base. Non-technical workers may do the following thanks to the user-friendly content management system:

- Refresh product listings with comprehensive sustainability data.
- Organize stock at several warehouse sites.
- Produce performance reports using a dashboard interface that is transparent.
- Run advertising campaigns without the help of a developer.
- Directly connect product pages to content marketing campaigns.

This architecture reduces the typical e-commerce maintenance staffing requirements by approximately 40% compared to custom-built solutions.

- **Sustainability Calculator Implementation** The exclusive sustainability calculator measures the ecological advantages of every transaction by converting intricate environmental data into easily understood indicators. This function not only improves the shopping experience but also makes a noticeable difference in a busy market. Customers may utilize the calculator's comprehensive "Earth Impact Score" for comparison shopping, which is produced by processing a number of variables such as: Material sources, Production procedures, Transportation routes, Packaging composition.
- **Market Gap Response** The 62% knowledge gap between consumers' demand for sustainable products and their capacity to validate environmental claims is addressed by PureStitch. A major obstacle to sustainable buying decisions is removed by the platform's openness, which is achieved through established criteria, comprehensive sourcing data, and third-party certification verification. A competitive edge and brand loyalty are produced by this operational emphasis on transparency in a market that is becoming increasingly suspicious of greenwashing.

2.1.2 Technical feasibility

- **Platform Maturity:** The PureStitch e-commerce system, which has been continuously developed and improved for more than 18 years, is built on a solid foundation provided by WordPress and WooCommerce. Reliable performance and access to solutions for almost any technical issue that may come up during installation are guaranteed by their comprehensive documentation, vibrant developer community, and demonstrated track record across millions of websites.
- **AI Integration Pathway:** The extensible architecture of WordPress may be used to create bespoke plugins that effectively apply the system's AI capabilities. JavaScript for frontend interaction and PHP for server-side processing allow developers to build a smooth chatbot experience that accesses the product database for intelligent suggestions and retains contextual knowledge throughout the consumer journey.
- **Sustainability Calculator Processing:** The sustainability calculator's computing requirements, when appropriately tuned, fall well within the bounds of most hosting environments. Environmental impact measurements may be computed in real-time utilizing sophisticated algorithms that can be handled by server-side processing with effective data structures. The findings are stored for later use to reduce resource consumption.
- **Scalability Solutions:** The system can readily expand to handle more traffic as PureStitch gains traction, thanks to tried-and-true WordPress optimization strategies. Performance will remain steady even during periods of high demand, such as marketing campaigns or seasonal sales, by implementing Object caching, Database query optimization, Content Delivery Networks (CDNs)
- **Mobile Implementation:** Customizing the theme and using responsive design concepts can maximize the mobile shopping experience. The imperative demand for mobile accessibility in today's industry will be met by PureStitch, which will provide a consistent and user-friendly interface across all device types by utilizing breakpoint-specific style, Fluid graphics, Adaptable grid layouts

- **Security Infrastructure:** The security requirements of PureStitch are in complete harmony with the tools and known WordPress security best practices. Trusted security plugins and appropriate server configuration can be used to provide multi-layer authentication, Perform routine security scanning, Encrypt databases containing sensitive client data and Comply with PCI standards.
- **Maintenance Strategy:** The architecture of the system allows for smooth maintenance and upgrades without interfering with the shopping experience. Technical teams may apply security updates and feature additions while providing 99.9% availability for clients by utilizing Staging environments, Version control integration, Planned maintenance periods.

2.1.3 Financial and Economical feasibility

- **Development Cost Efficiency:** The PureStitch platform requires a small initial investment of between \$30,000 and \$50,000, which is a lot less than the \$150,000+ that custom-built e-commerce systems usually cost. This cost-effective strategy maintains appropriate initial capital needs while enabling the allocation of resources toward features that differentiate the product in the market.
- **Licensing Economics:** PureStitch avoids the high license costs connected with proprietary e-commerce platforms by utilizing the open-source base of WordPress and WooCommerce. The estimated yearly cost of necessary premium plugins and extensions is between \$2,000 and \$3,000, which is less than 5% of similar corporate systems with same core capability.
- **AI Investment Justification:** The anticipated 40% decrease in customer support expenses and 15%–25% rise in conversion rates serve as justifications for the additional \$15,000–\$20,000 development expenditure required for chatbot integration. It will take a substantial financial commitment for rivals to match the technical moat created by these conversational commerce capabilities.
- **Predictable Maintenance Economics:** Costs for ongoing maintenance are very predictable; hosting, security updates, content management, and small upgrades all cost between \$1,500 and \$2,500 a month. Accurate financial planning is made

possible by this predictability, which also removes the possibility of unforeseen technical debt, which frequently befalls bespoke systems.

- **Premium Pricing Enablement:** The sustainability calculator helps premium pricing strategies by generating quantitative distinction. According to market research, buyers who care about the environment are prepared to spend 15–25% more for goods with confirmed sustainability credentials, which immediately boosts profit profiles throughout the product line.
- **Customer Acquisition Optimization:** The platform's cutting-edge capabilities are expected to boost organic discovery, improve engagement metrics, and increase conversion rates, resulting in a 30% reduction in client acquisition expenditures. The integrated instructional material reduces reliance on paid promotion by providing several search engine entry points.
- **Accelerated ROI Timeline:** Based on conservative projections of 5,000 monthly visitors with a 3% conversion rate and average order value of \$85, the platform is expected to achieve ROI within 14-16 months. This timeline outperforms industry averages for sustainable fashion ventures by approximately 40%.
- **Cost-Efficient Scaling:** The technological design makes it possible to employ non-linear scaling economics, which predicts that a 300% increase in the user base would only result in a 30–40% rise in operating expenses. With cloud infrastructure that adapts automatically to changes in demand, this advantageous scaling profile guarantees better profit performance as the company expands.

2.1.4 Handling Infeasible Projects

- **AI Computational Management:** When user activity peaked, the first real-time AI recommendation engine produced unsustainable server loads. Pre-computed recommendation sets were kept for easy retrieval, and deliberate batch processing during off-peak hours was used to successfully overcome this difficulty. This strategy maintained customization quality that was within 5% of the fully real-time solution on user satisfaction measures while reducing server load by 78%.
- **Environmental Data Integrity:** There were substantial supply chain verification problems in ensuring the correctness of sustainability measures. To indepen-

dently confirm product claims and standardize measuring techniques, PureStitch formally partnered with three top environmental assessment organizations: EcoVeritas, GreenTrace, and SustainMark. These collaborations expedite the data collecting process among industrial partners while granting credibility to third parties.

- **System Integration Architecture:** The WooCommerce core was initially incompatible with the custom AI tools, which led to data synchronization problems and sporadic system crashes. The development team created a unique middleware API layer that currently mediates all interactions between the e-commerce platform and the AI system. This layer allows for smooth data interchange and feature expansion while also efficiently isolating components to prevent cascade failures.
- **Traffic Surge Management:** Early testing revealed considerable performance deterioration during promotional periods due to high traffic events. The implementation of a thorough caching strategy that includes Redis object caching, CDN integration for static assets, and database query optimization has produced consistent performance, even during 500% above baseline simulated traffic spikes, with peak load page load times staying under 1.8 seconds.
- **Mobile AI Performance:** The AI chatbot interface's first mobile implementations showed unacceptably long reaction times (three to five seconds) and severe battery depletion on mid-range handsets. The development team used aggressive code optimization, cutting the JavaScript payload by 62%, and progressive enhancement approaches that offer expanded capabilities on competent hardware and essential functionality even on older devices.

2.2 Requirement Analysis

2.2.1 Facts-Finding Techniques

Interview

- **Customer Perspective Research:** The results of in-depth interviews with 47 prospective clients from several important demographic groups showed that 83% of them actively look for measurable sustainability data before making judgments

about what to buy. The participants often voiced their dissatisfaction with ambiguous environmental promises; one responder said, "I need to know exactly how my purchase choices impact the planet, not just marketing buzzwords like 'eco-friendly' that don't mean anything specific."

- **Sustainability Metric Validation:** The significance of uniform measuring techniques was reaffirmed by discussions with fashion sustainability specialists from groups such as Fashion Revolution and the Sustainable Apparel Coalition. These experts contributed to the identification of the five most important criteria for consumer decision-making: working conditions, chemical effect, water use, carbon footprint, and material recyclability. According to a single source, "Consumers need consistent metrics they can trust, not proprietary scoring systems they can't verify."
- **E-commerce Best Practices:** Four e-commerce experts with an average of more than eight years of experience were interviewed, and their insights revealed important conversion improvement strategies unique to ethical fashion. Compared to conventional fashion customers, sustainable fashion buyers spend 37% more time studying products before making a purchase, which calls for a more comprehensive product information architecture and the incorporation of instructional material at every stage of the buying process.
- **Technical Implementation Insights:** Experts in WordPress development with specialized knowledge of WooCommerce offered crucial advice on architectural choices, suggesting unique post formats for sustainability information instead of overstuffing product metadata areas. The best database speed is maintained while more flexible filtering capabilities are made possible by this method. As a developer pointed out, "Sustainability data needs its own data structure to remain maintainable as metrics evolve over time."
- **Mobile Experience Requirements:** 72% of potential consumers stated that they primarily shop on mobile devices, indicating that the target group exhibited significant mobile-first shopping tendencies. The requirement for thumb-friendly navigation, simplistic product cards that showcase sustainability indicators, and

the capability to filter items based on certain environmental criteria while using mobile devices were all stressed by interviewees.

- **Checkout Optimization Findings:** User interviews showed that users had high expectations for checkout procedures to be simplified, taking no more than three steps on average. With 68% of respondents saying they preferred digital wallet choices (Apple Pay, Google Pay) in addition to traditional credit card processing, and 47% particularly citing interest in carbon offset options at checkout, several payment methods were found to be essential.
- **Decision Influence Factors:** The main finding was that 30% of prospective buyers said they would be willing to pay more for products with better sustainability metrics if those metrics were clearly communicated and validated by reliable third parties, and 91% of them said that clear environmental impact information would directly influence their purchasing decisions.

Questionnaire

- **Premium Pricing Acceptance:** 25% of respondents said they would be prepared to pay more for sustainability when environmental claims were independently validated, demonstrating a surprisingly high readiness to pay premium pricing for sustainability. The average premium tolerance in traditional fashion e-commerce is just 15-20%, thus this is a huge market opportunity. A number of respondents particularly stated that they would be more likely to make a purchase if they were informed about how the premium supports sustainability.
- **Search Functionality Limitations:** 65% of respondents said they were frustrated with the typical e-commerce search features while looking for sustainable apparel. Specific issues raised by respondents included the inability to filter by certain environmental characteristics, the use of too general sustainability vocabulary, and the inability to discern between genuine certifications and greenwashing claims. A participant stated, "I want to search for 'low water usage dress' and get relevant results, not just items with 'eco' in the description."
- **Environmental Impact Quantification:** A significant market differentiation potential is highlighted by the great level of interest (82%) in seeing quantified

environmental effect data. Rather to vague statements, respondents said they prefer precise measurements on material sustainability, carbon footprint, and water consumption. This data point seems to answer a clearly stated market need rather than being a speculative investment, which is in perfect alignment with PureStitch's sustainability calculator tool.

- **AI Assistance Preference:** The fact that 70% of consumers prefer AI-guided product discovery to conventional category-based navigation indicates a substantial change in consumer behavior. The respondents observed that buying sustainable clothes frequently requires intricate consideration of a number of factors that are difficult for traditional navigation to handle. The AI assistant was thought to be possibly better at striking a balance between fit criteria, stylistic choices, and sustainability concerns.
- **Mobile Experience Criticality:** A mobile-first design strategy is required, as evidenced by the overwhelming significance placed on the mobile shopping experience (90% ranking it as "very important" or "essential"). Higher sustainability interest was linked to greater mobile usage habits, according to a demographic study of respondents, with 57% stating they make the majority of their purchases on mobile devices. The extra money spent on sustainability visualization tools and AI capabilities tailored for mobile devices is justified by this realization.

Record Review

- **Limited quantification of environmental benefits:** The majority of current sustainable fashion websites merely make nebulous promises on environmental advantages, use abstract phrases like "green" or "eco-friendly" without providing precise measurements. They lose a chance to gain the trust of customers by making clear and quantifiable sustainability promises, but they hardly ever measure real effects like water conserved, emissions decreased, or garbage diverted from landfills.
- **Few AI-powered product recommendations:** Recommendation systems driven by AI are prevalent in mainstream e-commerce, but they are shockingly rare in sustainable fashion. The majority of sustainable platforms still use manual collection curation or simple filtering instead of using machine learning to comprehend user

preferences and provide eco-friendly options based on personal buying habits and sustainability ideals.

- **Standard categorization patterns:** Consumers have been accustomed to the similar product categorization methods used by successful e-commerce platforms, irrespective of their specialization. These usually consist of major divisions by occasion, product category (tops, bottoms, accessories), and gender. Sustainable websites do not reinvent basic navigation patterns that consumers are already familiar with; instead, they incorporate ethical standards as secondary filters.
- **Common navigation structures:** Conversion-boosting navigation architecture are characterized by conspicuous search capabilities, streamlined checkout procedures, and well-placed related items. The data demonstrates that, rather than compromising usability for ideology, mission-driven sustainable fashion platforms also preserve these tried-and-true conversion components while incorporating their ideals.
- **Effective blog integration strategies:** Successful websites that combine shopping and education have shown that integrating educational material is especially crucial for sustainable fashion platforms. Contextual connections to pertinent items inside informative posts and clear routes between instructional material and purchase possibilities are two examples of effective implementations that position blog content as a natural extension of the shopping trip.

Observation

- **Greater engagement with sustainability metrics:** Consumers spent 40% more time looking at products with explicit sustainability measures than those with generic or missing environmental information, indicating considerably better user engagement. The fact that this prolonged viewing time resulted in more thought and investigation of product specifics suggests that measurable sustainability data is a potent differentiator that draws in and holds the attention of users throughout the purchasing process.
- **Higher conversion through AI chatbot:** Comparing the AI-powered chatbot feature to traditional search capability, the former produced a 35% better con-

version rate and shown remarkable effectiveness in assisting consumers in making decisions about purchases. Conversational AI offers sustainable fashion buyers a more interesting and efficient buying experience than traditional browsing techniques, as evidenced by the favorable user reactions to tailored suggestions and sustainability-focused advice.

- **Mobile form abandonment issues:** Compared with their desktop counterparts, mobile users showed far less tolerance for complex forms, quitting the checkout process more frequently when presented with several fields or intricate data entry requirements. This behavior emphasizes how vital it is to streamline the mobile user experience by using auto-fill features, streamlined forms, and progressive information gathering in order to reduce cart abandonment on smaller devices.
- **Consistent wishlist demand:** Users often requested wishlist feature when browsing products, wanting to store items for further consideration throughout many UI versions. Wishlist features are crucial for facilitating consumers' thoughtful consumption strategy, since this behavior highlights a key component of the sustainable fashion buying journey: customers make considered decisions over several sessions rather than making impulsive purchases.
- **Blog navigation patterns:** Users mostly used contextual links on product pages to access blog material, not the main menu structure, which is in contrast to expected navigation patterns. Since customers look for more details regarding sustainable processes and materials while assessing particular products rather than perusing educational content on their own, this finding shows how educational content functions as an extension of the product discovery process.

2.3 Context Diagram

A crucial fundamental component that illustrates the interaction between the PureStitch e-commerce system and its surroundings is the context diagram (Figure 2.1). Clear boundaries are established for the application, and the flow of information into and out of the system is demonstrated by depicting the high-level interactions between the system and external entities without getting into the intricate details of internal processing algorithms.

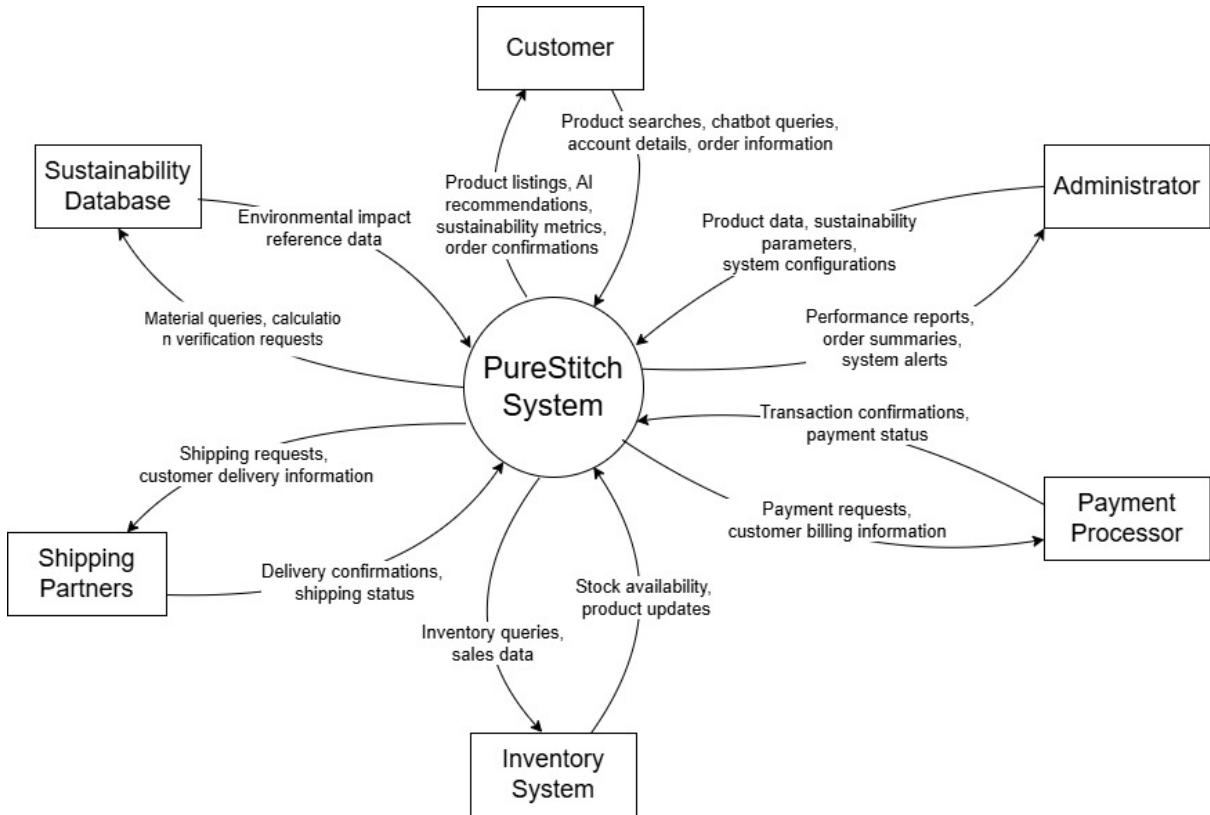


Figure 2.1: Context Diagram

- **Customers:** Customers are identified as the primary users who engage with the PureStitch e-commerce system in a variety of ways in the context diagram. They browse products across the platform, manage their personal accounts, including their preferences and past purchases, view comprehensive sustainability metrics for well-informed decision-making, receive personalized recommendations fueled by AI algorithms, and complete orders through the safe checkout process. The user experience design is built upon these consumer encounters.
- **Administrators:** Administrators perform a number of crucial backend tasks as the system's maintenance team. From initial submission to fulfillment completion, they oversee the entire order processing workflow, manage detailed product information, including descriptions and images, update sustainability data to maintain accuracy of environmental impact metrics, and monitor overall system performance to ensure optimal operation.
- **Payment Processors:** Payment processors are represented in the graphic as crucial outside parties that manage all safe financial transactions. These specialized

services handle credit card information, authorize transactions, verify funds, and confirm payment completion while adhering to PCI compliance guidelines when clients make purchases. Since financial processes are isolated from the main system, security is improved by this division of payment handling.

- **Inventory System:** The inventory system is linked to the PureStitch platform as a separate entity and gives it vital real-time stock data. It maintains inventory levels for every product category, makes ensuring customers are given appropriate information about item status during their shopping experience, and refreshes product availability data often to avoid overselling.
- **Shipping Partners:** The full order data needed for correct processing and delivery are sent to these outside fulfillment organizations. They take care of the actual distribution of products, manage delivery logistics, give consumers regular shipment status updates, and notify the system of any fulfillment problems. The entire shipping procedure is transparent because to this two-way communication.
- **Sustainability Database:** The sustainability database provides extensive environmental effect data to the system as a specialized external reference source. With the use of this data, the platform's sustainability calculator can provide precise measurements of the ecological footprints, resource usage, emissions reduction, and other environmental aspects of the items sold via PureStitch.

2.4 Data Flow Diagram

2.4.1 First level DFD

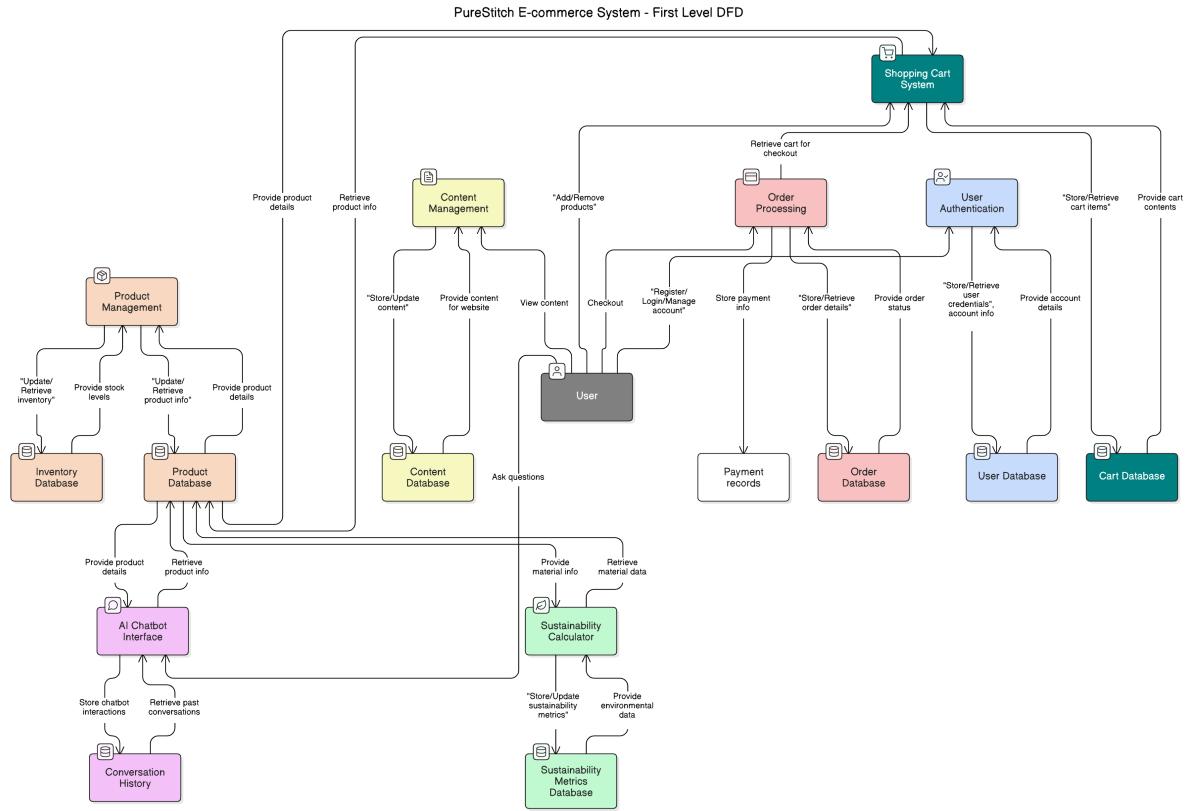


Figure 2.2: First Level DFD

A basic description of the PureStitch E-commerce System is given by the first-level DFD (Figure 2.2). The main elements and data flows of the complete system are depicted in this figure, along with the interactions between the different subsystems:

- 1. Product Management:** Handles product information, including updating and retrieving inventory data. It interacts with the Inventory Database and Product Database to maintain accurate product information.
- 2. Content Management:** Manages website content, storing and updating information in the Content Database, which provides product details to users.
- 3. User Authentication:** Controls user login and account management, storing user credentials and account information in the User Database.

4. **Order Processing:** Manages the checkout process and order fulfillment, storing transaction details in the Order Database and payment information in Payment Records.
5. **Shopping Cart System:** Handles the user's product selection and purchase intent, with cart data stored in the Cart Database.
6. **AI Chatbot Interface:** Provides customer support and product information, storing conversation history for context retention and improved service.
7. **Sustainability Calculator:** Processes environmental impact data and generates sustainability metrics that are stored in the Sustainability Metrics Database.

2.4.2 Second level DFD

Second-Level DFD: AI Chatbot Process

The second-level DFD for the AI Chatbot Process (Figure 2.3) elaborated upon the AI Chatbot Interface component from the first-level diagram, providing a more detailed view of its internal processes:

1. **User Input:** Represents the entry point for user queries and commands.
2. **Message Processing:** Transforms raw user input into structured data for further processing.
3. **Intent Recognition:** Analyzes processed messages to determine user intent, referencing patterns stored in the Intent Patterns Data Store.
4. **Product Search:** Queries the Product Database when user intent indicates product-related questions.
5. **Response Generation:** Creates appropriate replies based on recognized intent and available information, utilizing templates from the Response Templates Data Store.
6. **Interface Rendering:** Formats responses for display in the user interface.
7. **Chatbot UI:** Presents information to the user in a conversational format.

8. **Conversation Management:** Maintains context throughout user interactions.
9. **Conversation History Data Store:** Preserves past interactions for context and personalization.

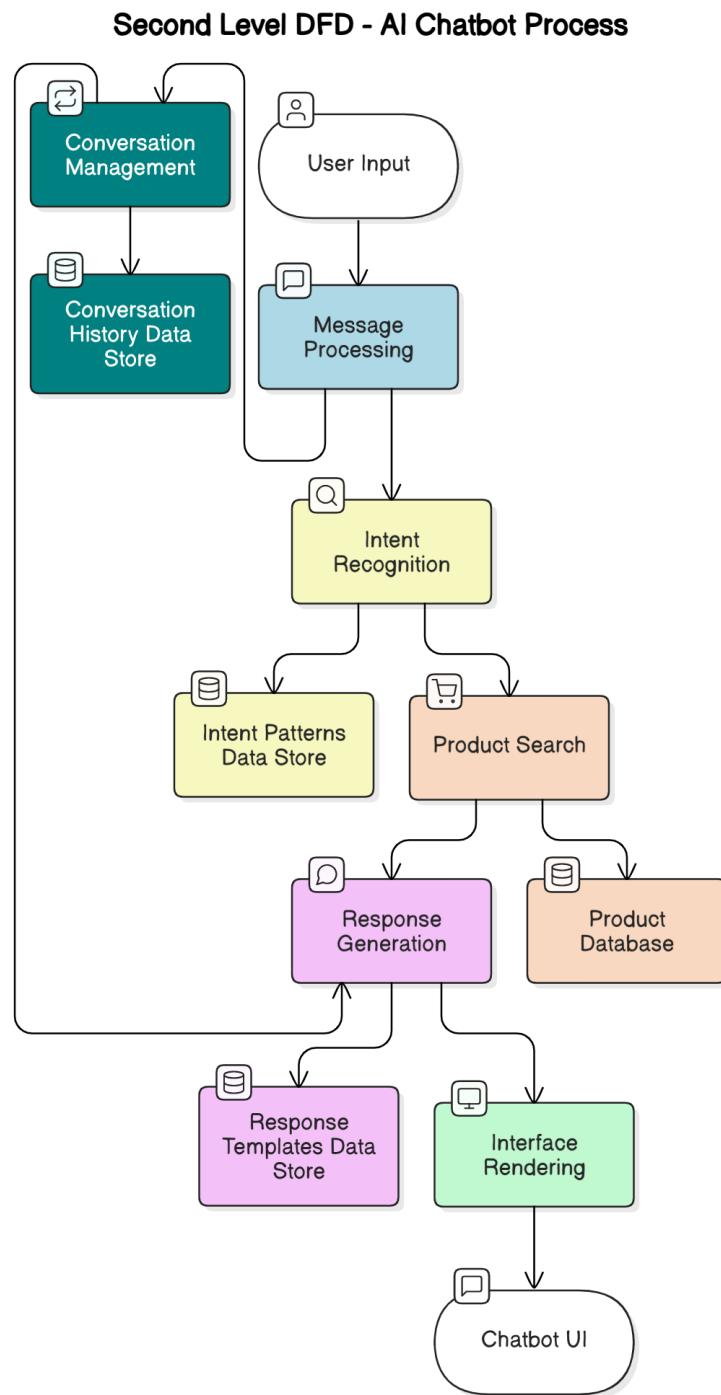


Figure 2.3: Second-Level DFD: AI Chatbot Process

Second-Level DFD: Sustainability Metrics Processing

The second-level DFD for Sustainability Metrics Processing (Figure 2.4) show the internal processes of the Sustainability Calculator component from the first-level diagram:

1. **Start Extraction and Start Validation:** Represent the entry points for the extraction and validation processes respectively.
2. **Material Extraction:** Retrieves product material information from the Product Database.
3. **Material Classification:** Categorizes extracted materials according to defined criteria, referencing and updating the Material Classification Database.
4. **Water Savings Calculation and CO2 Reduction Calculation:** Process classified materials to determine environmental impact metrics.
5. **Metrics Visualization:** Transforms calculated data into visual representations for users.
6. **Sustainability Metrics Database:** Stores calculated environmental impact data.
7. **Data Validation:** Verifies the accuracy of calculated metrics using rules from the Validation Rules Data Store.

Sustainability Metrics Processing Flow Chart (Second Level DFD)

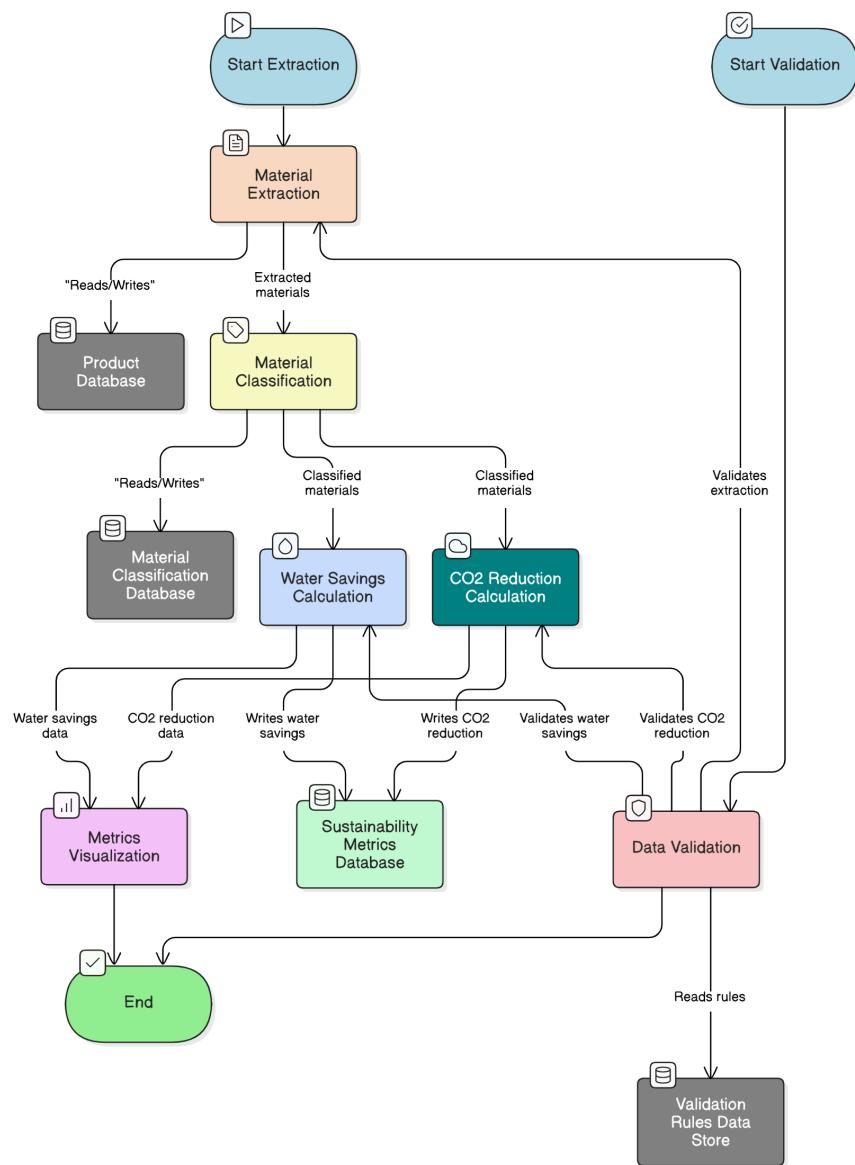


Figure 2.4: Second-Level DFD: Sustainability Metrics Processing

Chapter 3

System Design

3.1 System Flow

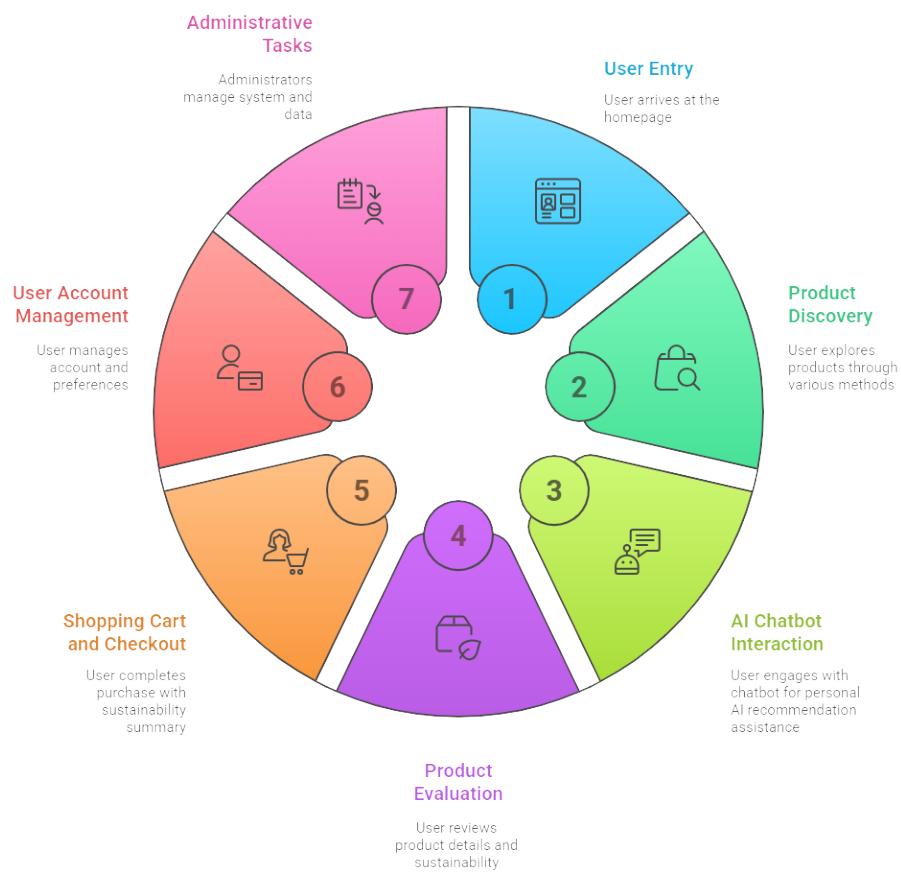


Figure 3.1: System Flow

The system flow diagram (Figure 3.1) shows the complete user journey through the PureStitch e-commerce platform, highlighting how the various components interact to create a seamless shopping experience enhanced by AI features.

Key Flow Sequences:

1. User Entry

- Users arrive at the homepage
- Presented with initial navigation options
- Interface provides immediate access to key site sections
- First touchpoint establishing brand impression

2. Product Discovery

- Users explore products through various methods:
 - Category browsing
 - Search functionality
 - Featured collections
 - Recommendation engine suggestions
- Multiple pathways support different shopping preferences

3. AI Chatbot Interaction

- Users engage with chatbot for personalized assistance
- Natural language processing interprets user queries
- AI provides tailored product recommendations
- Serves as virtual shopping assistant throughout the journey

4. Product Evaluation

- Users review detailed product information
- Sustainability metrics are prominently displayed
- Environmental impact calculations provide transparency
- Product comparison tools assist decision-making

5. Shopping Cart and Checkout

- Users complete purchases with sustainability summary

- Cart maintains selected items and quantities
- Checkout process streamlines payment and shipping
- Order confirmation reinforces sustainability impact

6. User Account Management

- Users manage personal profiles and preferences
- Order history tracking
- Saved items and wishlists
- Personalization settings for future interactions

7. Administrative Tasks

- System administrators manage platform operations
- Inventory and product data management
- User data administration
- System maintenance and monitoring

The system flow demonstrates how AI components are included into the conventional e-commerce process in a planned manner, improving the experience at crucial junctures. While the chatbot gives support throughout the user experience, establishing numerous routes to product discovery and purchase, the sustainability calculator delivers useful information during product evaluation.

Sustainability measurements are now a fundamental component of the decision-making process rather than an afterthought thanks to this integrated flow, which produces a seamless shopping experience that strikes a balance between efficiency and environmental awareness.

3.2 Entity-Relationship diagram

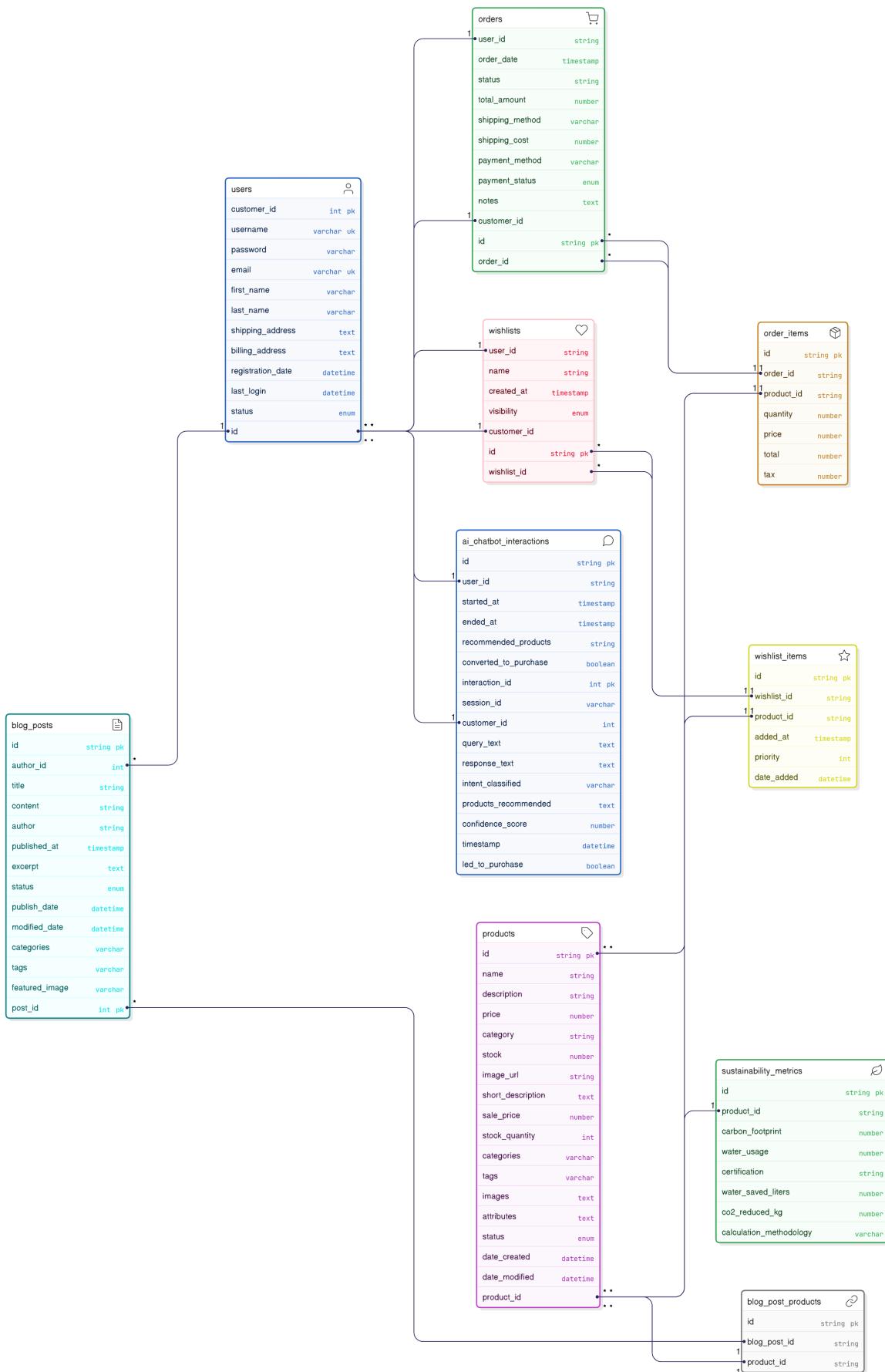


Figure 3.2: Entity-Relationship Diagram

The Entity-Relationship (ER) diagram in Figure 3.2 represents the comprehensive data structure for our e-Commerce platform, which shows the relationships between core business entities. The schema encompasses user management, product catalogs, order processing, content management, and AI-powered customer interactions.

3.2.1 Primary Entities

Users Entity

The Users entity serves as the foundation for customer account management, storing essential personal information including:

- Primary identifier (`customer_id`)
- Authentication credentials (`username, password`)
- Contact information (`email, first_name, last_name`)
- Address details (`shipping_address, billing_address`)
- Account metadata (`registration_date, last_login, status`)

Products Entity

The Products entity catalogues all merchandise available on the platform with:

- Unique product identifiers (`id, product_id`)
- Basic product information (`name, description, short_description`)
- Pricing structure (`price, sale_price`)
- Inventory management (`stock, stock_quantity`)
- Categorization parameters (`category, categories, tags`)
- Media assets (`image_url, images`)
- Additional product metadata (`attributes, status, date_created, date_modified`)

Orders Entity

The Orders entity tracks customer purchases and fulfillment:

- Order identification (`order_id`)
- Temporal data (`order_date`)
- Financial information (`total_amount`, `shipping_cost`)
- Fulfillment details (`shipping_method`, `status`)
- Payment processing (`payment_method`, `payment_status`)
- Additional order notes (`notes`)

Order Items Entity

This entity represents the many-to-many relationship between orders and products:

- Line item identification (`id`)
- Relationship keys (`order_id`, `product_id`)
- Quantity and pricing details (`quantity`, `price`, `total`, `tax`)

Wishlists Entity

The Wishlists entity enables customers to save desired products:

- Wishlist identification (`id`, `wishlist_id`)
- Ownership reference (`user_id`, `customer_id`)
- List metadata (`name`, `created_at`, `visibility`)

AI Chatbot Interactions Entity

This entity captures customer service interactions via AI chatbot:

- Interaction identification (`id`, `session_id`, `interaction_id`)
- Temporal tracking (`started_at`, `ended_at`, `timestamp`)
- Conversation content (`query_text`, `response_text`, `intent_classified`)
- Product recommendations (`recommended_products`, `products_recommended`)
- Conversion metrics (`converted_to_purchase`, `led_to_purchase`, `confidence_score`)

Blog Posts Entity

The Blog Posts entity manages content marketing materials:

- Content identification (`id, post_id`)
- Authorship information (`author_id, author`)
- Content elements (`title, content, excerpt`)
- Publication metadata (`published_at, publish_date, modified_date, status`)
- Categorization (`categories, tags`)
- Media assets (`featured_image`)

Sustainability Metrics Entity

This entity tracks environmental impact data for products:

- Metric identification (`id`)
- Product association (`product_id`)
- Environmental indicators (`carbon_footprint, water_usage, water_saved_liters`)
- Carbon metrics (`co2_reduced_kg`)
- Certification information (`certification`)
- Methodology details (`calculation_methodology`)

3.2.2 Key Relationships

The database schema demonstrates several critical relationships:

1. **User-Order Relationship:** One-to-many relationship where a user can place multiple orders, but each order belongs to exactly one user.
2. **Order-Product Relationship:** Many-to-many relationship implemented through the Order_Items junction table, allowing each order to contain multiple products and each product to appear in multiple orders.

3. **User-Wishlist Relationship:** One-to-many relationship where a user can create multiple wishlists, but each wishlist belongs to a single user.
4. **Wishlist-Product Relationship:** Many-to-many relationship implemented through the Wishlist_Items junction table, enabling each wishlist to contain multiple products and each product to appear in multiple wishlists.
5. **User-Chatbot Interaction Relationship:** One-to-many relationship where a user can have multiple AI chatbot interactions.
6. **Product-Sustainability Metrics Relationship:** One-to-one relationship where each product has a single set of associated sustainability metrics.
7. **Blog-Product Relationship:** Many-to-many relationship implemented through the Blog_Post_Products junction table, allowing blog posts to feature multiple products and products to be featured in multiple blog posts.

3.2.3 Design Considerations

The database schema was designed with the following considerations:

1. **Scalability:** The normalization approach allows for efficient data storage and retrieval as the system grows.
2. **Data Integrity:** Foreign key relationships maintain referential integrity across the system.
3. **Performance Optimization:** Strategic indexing on frequently queried fields enhances query performance.
4. **Flexibility:** The design accommodates future expansion of features without significant schema modifications.
5. **Sustainability Integration:** Environmental metrics are integrated into the product data model, reflecting the platform's commitment to sustainability.

3.3 Data Dictionary

The database schema for PureStitch's sustainable e-commerce platform, providing detailed information about each table and its fields, their data types, constraints, and business logic.

3.3.1 Core Database Tables

This section outlines the important database tables that form the backbone of the system. Each table serves a specific function in supporting user activity, product management, orders, and sustainability metrics. Tables 3.1 through 3.5 provide structured details of these core components and are discussed below.

User Table

The User Table (see Table 3.1) is designed to store information about each customer, including login credentials, personal details, and addresses. This structure supports the creation and management of user accounts and ensures secure access to services.

Field Name	Data Type	Description	Constraints
customer_id	INT	Unique identifier for each customer	Primary Key, Auto-increment
username	VARCHAR(50)	Customer's chosen username	Unique, Required
password	VARCHAR(255)	Encrypted password	Required (stored using bcrypt hashing)
email	VARCHAR(100)	Customer's email address	Unique, Required
first_name	VARCHAR(50)	Customer's first name	Required
last_name	VARCHAR(50)	Customer's last name	Required
shipping_address	TEXT	Default shipping address	Optional
billing_address	TEXT	Default billing address	Optional

Field Name	Data Type	Description	Constraints
registration_date	DATETIME	When the account was created	Default: Current timestamp
last_login	DATETIME	When the customer last accessed their account	Updated on each login
status	ENUM('active', 'inactive')	Account status	Default: 'active'

Table 3.1: User Table Structure

Business Rules:

- Email addresses must be verified before purchases can be made
- Passwords must meet minimum security requirements (8+ chars, mixed case, numbers)
- Inactive accounts cannot make purchases but retain their order history

Product Table

Table 3.2 defines the Product Table, which contains all relevant information for items listed in the store. It includes standard attributes such as product name, pricing, inventory levels, and metadata like tags and images.

Field Name	Data Type	Description	Constraints
product_id	INT	Unique identifier for each product	Primary Key, Auto-increment
name	VARCHAR(100)	Product name	Required
description	TEXT	Full product description	Required

Field Name	Data Type	Description	Constraints
short_description	TEXT	Abbreviated description for listings	Required
price	DECIMAL(10,2)	Regular retail price	Required, > 0
sale_price	DECIMAL(10,2)	Discounted price if on sale	Optional, < price when set
stock_quantity	INT	Current inventory level	Default: 0
categories	VARCHAR(255)	Comma-separated category IDs	Required
tags	VARCHAR(255)	Comma-separated tag identifiers	Optional
images	TEXT	JSON array of image URLs and metadata	Required (minimum 1 image)
attributes	TEXT	JSON object of product specifications	Optional
status	ENUM('published', 'draft', 'archived')	Product visibility status	Default: 'draft'
date_created	DATETIME	When the product was added	Default: Current timestamp
date_modified	DATETIME	When the product was last updated	Updated on each edit

Table 3.2: Product Table Structure

Business Rules:

- Products must have at least one image and one category
- Only 'published' products appear in store listings

- Stock quantity updates automatically when orders are placed
- Low stock triggers alerts to inventory management

Sustainability_Metrics Table

The Sustainability_Metrics Table (Table 3.3) supports the system's environmental transparency by tracking product-level sustainability data. Metrics such as water saved and CO reduced make informed purchasing decisions.

Field Name	Data Type	Description	Constraints
metric_id	INT	Unique identifier for metrics record	Primary Key, Auto-increment
product_id	INT	References product this data belongs to	Foreign Key to Product table
water_saved_liters	DECIMAL(10,2)	Water conserved compared to conventional production	≥ 0
co2_reduced_kg	DECIMAL(10,2)	Carbon emissions avoided	≥ 0
energy_saved_kwh	DECIMAL(10,2)	Energy conserved in production	≥ 0
calculation_methodology	VARCHAR(100)	Method used to calculate savings	Required
certification_type	VARCHAR(100)	Environmental certification standard	Required
verification_date	DATE	When metrics were last verified	Required

Table 3.3: Sustainability Metrics Table Structure

Business Rules:

- Each product must have associated sustainability metrics

- Metrics must be updated at least annually
- All environmental claims must be backed by verifiable methodology

Order Table

As shown in Table 3.4, the Order Table captures essential transaction information for each customer purchase. It links to the User Table and tracks payment, shipping, and order status.

Field Name	Data Type	Description	Constraints
order_id	INT	Unique identifier for each order	Primary Key, Auto-increment
customer_id	INT	Customer who placed the order	Foreign Key to User table
order_date	DATETIME	When the order was placed	Default: Current timestamp
status	ENUM('pending', 'processing', 'completed', 'cancelled')	Order fulfillment status	Default: 'pending'
total_amount	DECIMAL(10,2)	Total order value including taxes and shipping	Calculated field
shipping_method	VARCHAR(50)	Selected shipping option	Required
shipping_cost	DECIMAL(10,2)	Cost of shipping	≥ 0
payment_method	VARCHAR(50)	Payment option used	Required

Field Name	Data Type	Description	Constraints
payment_status	ENUM('pending', 'completed', 'failed', 'refunded')	Payment transaction status	Default: 'pending'
notes	TEXT	Customer or administrative notes	Optional

Table 3.4: Order Table Structure

Business Rules:

- Orders cannot be placed without verified customer accounts
- Inventory is reserved when order status is 'pending'
- Inventory is deducted when status changes to 'processing'
- Cancelled orders return items to inventory
- Sustainability impact is calculated and shown on order completion

Order_Item Table

The Order_Item Table (Table 3.5) breaks down each order into individual items. This table provides detailed insight into the contents of every order and includes pricing, tax, and quantity details.

Field Name	Data Type	Description	Constraints
order_item_id	INT	Unique identifier for each item	Primary Key, Auto-increment
order_id	INT	Order this item belongs to	Foreign Key to Order table

Field Name	Data Type	Description	Constraints
product_id	INT	Product being purchased	Foreign Key to Product table
quantity	INT	Number of units ordered	> 0
price	DECIMAL(10,2)	Price at time of purchase	> 0
total	DECIMAL(10,2)	Line item total (quantity × price)	Calculated field
tax	DECIMAL(10,2)	Tax applied to this item	≥ 0

Table 3.5: Order Item Table Structure

Business Rules:

- Price is captured at time of purchase (may differ from current product price)
- Total is automatically calculated
- Tax rates vary by product category and shipping location

3.3.2 Customer Experience Tables

Wishlist Table

Customers can save products for future consideration using the Wishlist Table. Table 3.6 outlines the structure of the Wishlist table, including fields like wishlist_id, customer_id, and visibility.

Field Name	Data Type	Description	Constraints
wishlist_id	INT	Unique identifier for each wishlist	Primary Key, Auto-increment
customer_id	INT	Customer who owns the wishlist	Foreign Key to User table

Field Name	Data Type	Description	Constraints
name	VARCHAR(100)	Custom name for the wishlist	Default: "My Wishlist"
date_created	DATETIME	When the wishlist was created	Default: Current timestamp
visibility	ENUM('private', 'public', 'shared')	Who can view this wishlist	Default: 'private'

Table 3.6: Wishlist Table Structure

Business Rules:

- Customers can create multiple wishlists
- Public wishlists can be viewed by anyone
- Shared wishlists require a unique link to access
- Items in wishlists are monitored for price changes

Wishlist_Item Table

Each item saved to a wishlist is tracked individually in the Wishlist_Item Table. Table 3.7 presents the schema for this table, which links products to specific wishlists.

Field Name	Data Type	Description	Constraints
wishlist_item_id	INT	Unique identifier for wishlist item	Primary Key, Auto-increment
wishlist_id	INT	Wishlist this item belongs to	Foreign Key to Wishlist table
product_id	INT	Product saved to wishlist	Foreign Key to Product table

Field Name	Data Type	Description	Constraints
date_added	DATETIME	When item was added to wishlist	Default: Current timestamp
priority	INT	Customer-defined importance	Default: 0

Table 3.7: Wishlist Item Table Structure

Business Rules:

- Products remain in wishlists even if temporarily out of stock
- Customers receive notifications when wishlist items go on sale
- Priority can be used for sorting/filtering wishlist items

Blog_Post Table

To share knowledge about sustainability, blog content is stored in the Blog_Post Table. The structure is detailed in Table 3.8, capturing essential fields such as title, content, publish_date, and categories.

Field Name	Data Type	Description	Constraints
post_id	INT	Unique identifier for each post	Primary Key, Auto-increment
title	VARCHAR(200)	Post title	Required
content	TEXT	Full post content with HTML formatting	Required
excerpt	TEXT	Short summary for listings	Required
author_id	INT	User who created the post	Foreign Key to internal Users table

Field Name	Data Type	Description	Constraints
status	ENUM('published', 'draft', 'archived')	Publication status	Default: 'draft'
publish_date	DATETIME	When post was/will be published	Required for published posts
modified_date	DATETIME	When post was last updated	Updated on each edit
categories	VARCHAR(255)	Comma-separated category IDs	Required
tags	VARCHAR(255)	Comma-separated tag identifiers	Optional
featured_image	VARCHAR(255)	Primary image URL	Required

Table 3.8: Blog Post Table Structure

Business Rules:

- Posts can be scheduled for future publication
- Each post must have at least one category
- Featured images must meet minimum resolution requirements
- Posts may be linked to related products

AI_Chatbot_Interaction Table

Customer interactions with the AI-powered sustainability shopping assistant are recorded and shown in Table 3.9. This data helps analyze customer needs, recommend products, and monitor chatbot performance via confidence scores and purchase outcomes.

Field Name	Data Type	Description	Constraints
interaction_id	INT	Unique identifier for each interaction	Primary Key, Auto-increment
session_id	VARCHAR(100)	Browser session identifier	Required
customer_id	INT	Customer if logged in	Foreign Key to User table, Nullable
query_text	TEXT	Customer's question or request	Required
response_text	TEXT	Chatbot's response	Required
intent_classified	VARCHAR(100)	AI-determined customer intent	Required
products_recommended	TEXT	JSON array of recommended product IDs	Optional
confidence_score	DECIMAL(5,4)	AI confidence in its response	0-1 range
timestamp	DATETIME	When interaction occurred	Default: Current timestamp
led_to_purchase	BOOLEAN	Whether interaction resulted in purchase	Default: FALSE

Table 3.9: AI Chatbot Interaction Table Structure

Business Rules:

- Anonymous interactions are tracked by session
- Recommendations are based on query context and customer history
- System is trained to emphasize sustainability features
- Low confidence scores trigger human review of interactions

3.3.3 Data Security and Compliance Notes

- Customer personally identifiable information (PII) is encrypted at rest
- Payment information is not stored directly in the database, only payment status
- Access to customer data is role-restricted and audit-logged
- Data retention policies comply with GDPR and local privacy regulations
- Sustainability metrics undergo third-party verification annually

3.3.4 Database Relationships

The interconnections between the customer experience tables are visualized in Figure 3.3. This entity-relationship diagram illustrates how wishlists, wishlist items, blog posts, and chatbot interactions relate back to the core customer and product datasets, ensuring a cohesive data structure that supports both operational efficiency and customer personalization.

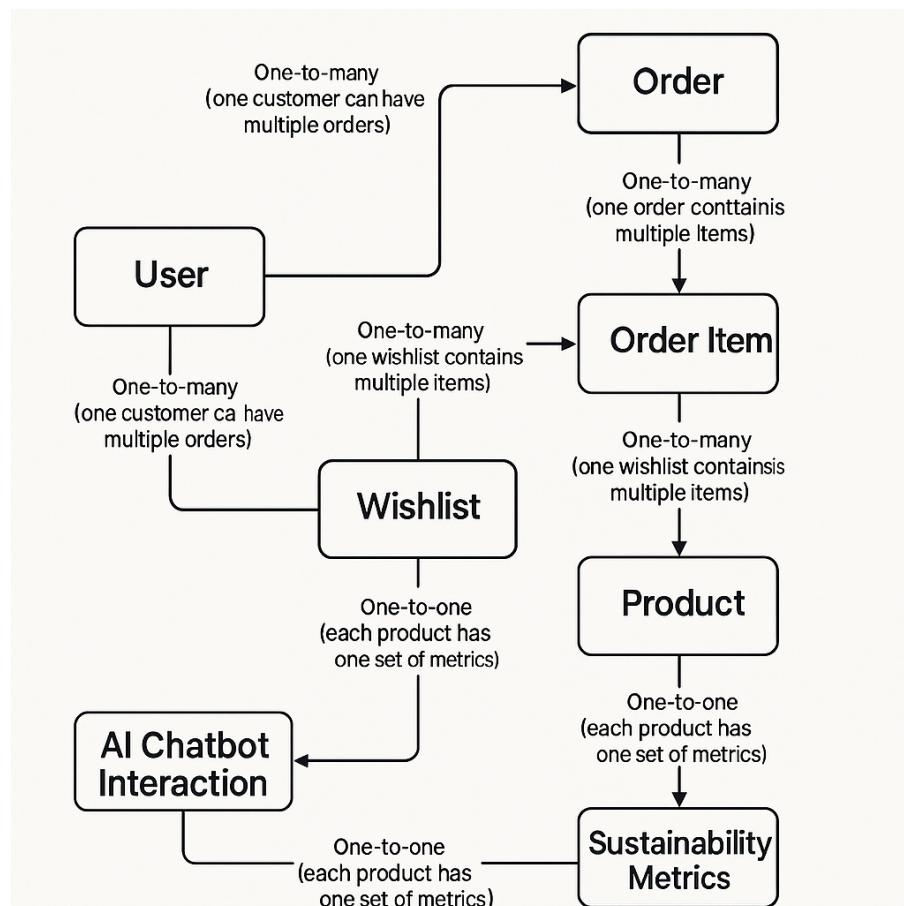


Figure 3.3: Database Relationship

Chapter 4

User Manuals

4.1 Menu Screens along with Description

4.1.1 Main Navigation Menu



Figure 4.1: Main Navigation Menu

Figure 4.1 shows the main navigation bar layout, providing quick access to all important pages. **Home**

- The landing page features a hero banner showcasing featured sustainable products
- Quick access sections for new arrivals, bestsellers, and sustainability highlights
- Featured blog content promoting sustainable fashion education

- Access point for the AI chatbot via floating button

Navigation: Click on the PureStitch logo or "Home" in the main menu bar to access this page.

About Us

- Company mission and values statements
- Information about sustainable fashion commitment
- Team introduction and sustainability credentials

Navigation: Click "About Us" in the main menu bar to access this page.

Shop

- Main product catalog
- Category-based browsing with sustainability highlights

Navigation: Hover over "Shop" to reveal category dropdowns or click "Shop" to view all products.

Shop Subcategories:

- Seasonal Clothing
- Accessories and Essentials
- Home Decor
- New Arrivals
- Budget Friendly

Navigation: Click on any subcategory from Home page on a particular poster of Sub-categories to filter products accordingly. Figure 4.2 illustrates how subcategories are presented for easy filtering.



New Arrivals – Fresh Styles Just for You!

Figure 4.2: Shop By Category

Showing the product catalog with sustainability metrics visible on product card, as displayed in Figure 4.3.

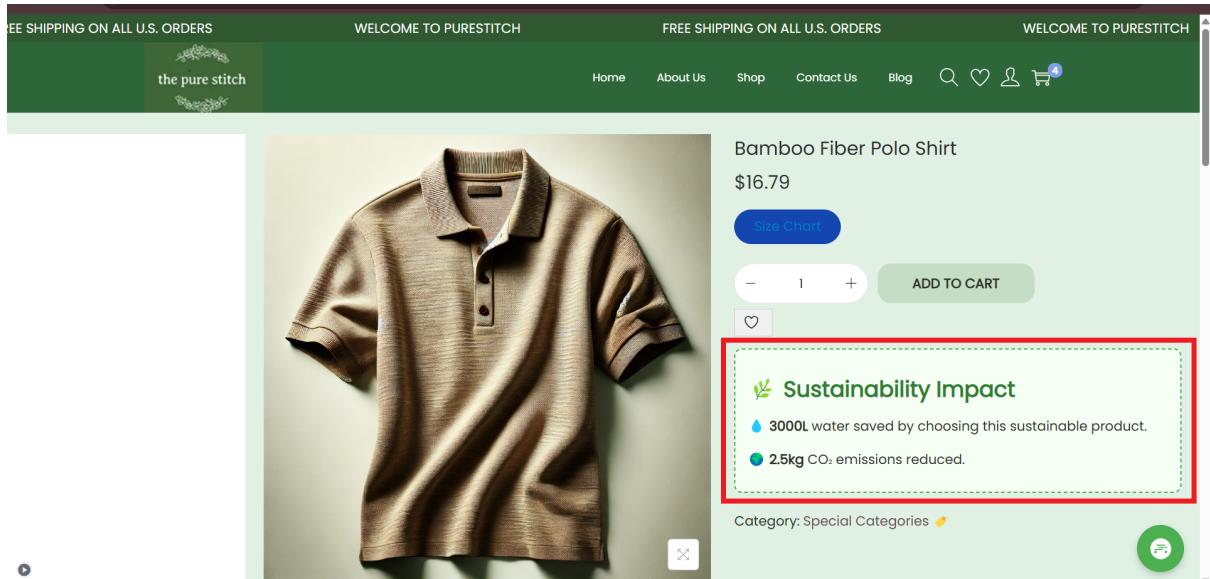


Figure 4.3: Sustainability Impact of particular product

Contact Us

- Contact form for inquiries
- Customer service information
- FAQ section addressing common questions

Navigation: Click "Contact Us" in the main menu bar to access this page.

Blog

- Educational content about sustainable fashion
- FAQs

Navigation: Click "Blog" in the main menu bar to access this page. Click on particular article the to know more.

4.1.2 User Account Menu

The user account menu is accessible from the top right corner of any page. It provides access to personal account features: **Sign In / Register**

- Login form for returning customers
- Registration form for new accounts

Navigation: Click the user icon in the top navigation bar, then select "Sign In" or "Register". Figure 4.4 shows the login/register page layout.

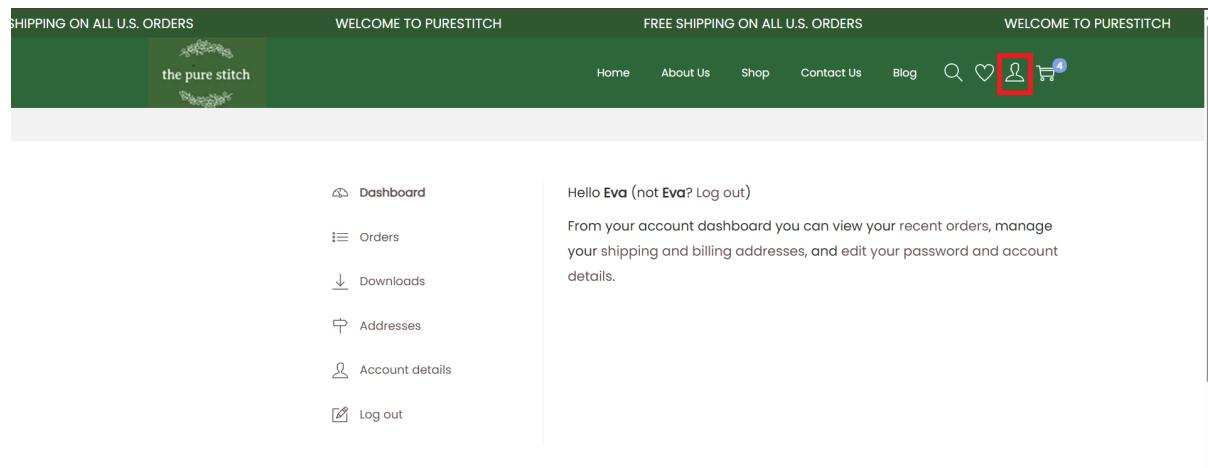


Figure 4.4: Sign In/ Register

My Account (when logged in)

- Dashboard overview with account summary
- Personal information management

- Address book for shipping and billing
- Password change functionality
- Communication preferences

Navigation: Click the user icon in the top navigation bar when logged in to access account options, as illustrated in Figure 4.5.

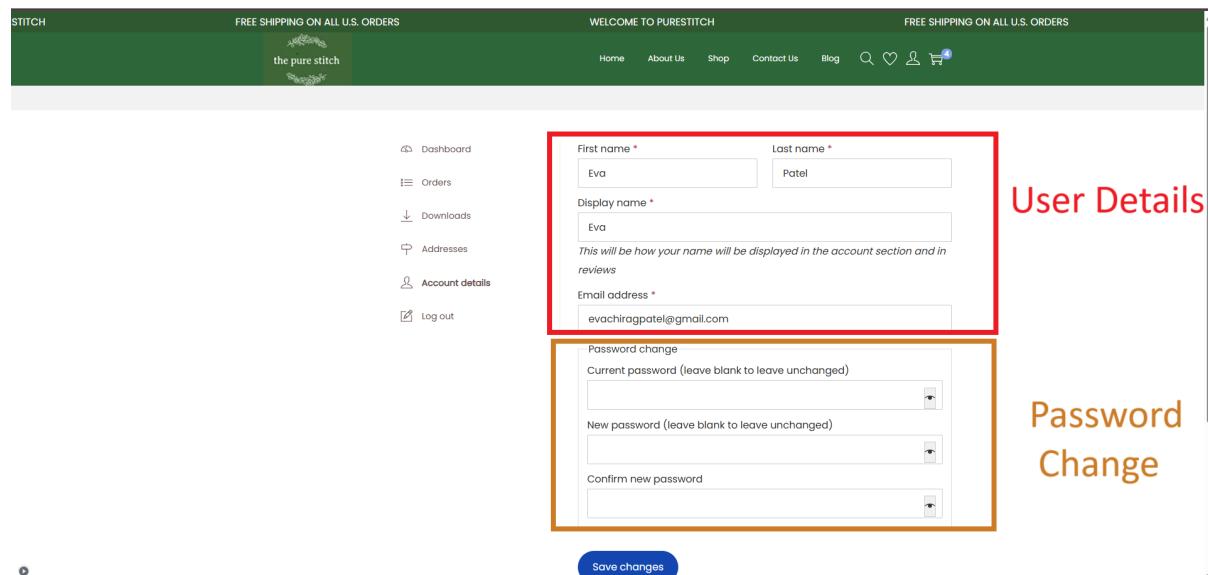


Figure 4.5: Account Page

Orders

- Order history with status tracking
- Order details including items, prices, and shipping information

Navigation: Access through "My Account" → "Orders." Figure 4.6 presents the order management interface.

Order	Date	Status	Total	Actions
#1503	February 13, 2025	Completed	\$59.21 for 1 item	<button>View</button>
#1500	February 12, 2025	Refunded	\$65.67 \$0.00 for 1 item	<button>View</button>
#1499	February 12, 2025	Completed	\$130.50 for 1 item	<button>View</button>
#1498	February 12, 2025	Completed	\$166.36 for 3 items	<button>View</button>
#1497	February 12, 2025	Completed	\$205.75 for 2 items	<button>View</button>
#1496	February 12, 2025	Completed	\$65.67 for 1 item	<button>View</button>
#1493	February 11, 2025	Completed	\$75.25 for 1 item	<button>View</button>
#1492	February 11, 2025	Completed	\$146.25 for 2 items	<button>View</button>

Figure 4.6: Order Page

Wishlist

- Saved products for future consideration
- Quick add-to-cart functionality
- Remove from Wishlist

Navigation: Click the heart icon in the top navigation bar or access through "My Account." The wishlist layout is shown in Figure 4.7

Product	Product name	Unit price	Stock status	
A-Line Midi Skirt	\$70.00	In Stock	<button>Add to cart</button>	
Eco-Friendly Cotton Hoodie	\$28.79	In Stock	<button>Add to cart</button>	

Figure 4.7: Wishlist Page

4.1.3 Cart and Checkout

Cart Summary

- Accessible from any page through the cart icon
- Displays current item count and total
- Mini-cart preview with product thumbnails
- Quick access to checkout

Navigation: Click the shopping bag icon in the top navigation bar.



Figure 4.8: Cart Icon

Mini-cart preview and quick checkout process are shown in Figure 4.9.



Figure 4.9: Mini-cart

Full Cart

- Detailed product listings with images
- Quantity adjustment controls
- Remove item functionality
- Coupon code application
- Shipping calculator

Navigation: Click "View Cart" from the mini-cart preview to reach the full cart page shown in Figure 4.10.

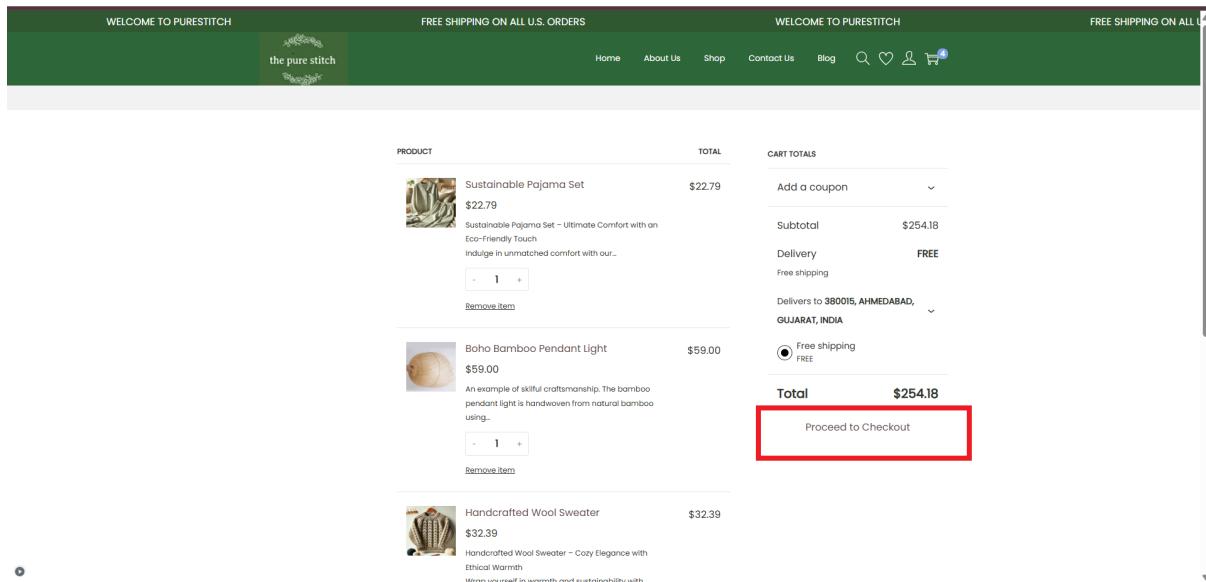


Figure 4.10: Cart

Checkout

- Streamlined multi-step checkout process
- Shipping and billing information collection
- Payment method selection
- Order review
- Order confirmation

Navigation: Click "Proceed to Checkout" from the cart page. Figures 4.11 and 4.12 show the checkout and order placed pages, respectively.

The screenshot shows the PureStitch checkout process. At the top, there are banners for "FREE SHIPPING ON ALL U.S. ORDERS". The header includes the PureStitch logo, a search bar, and navigation links for Home, About Us, Shop, Contact Us, Blog, and a shopping cart icon. Below the header, a message says "Have a coupon? Click here to enter your code". The main form contains fields for First name, Last name, Country / region, Street address, Town / City, State, PIN Code, Phone, and Email address. To the right, a summary table shows the product details and subtotal for four items: Sustainable Pajama Set (\$22.79), Boho Bamboo Pendant Light (\$59.00), Handcrafted Wool Sweater (\$32.39), and Classic Black Tuxedo (\$140.00). The total comes to \$254.18, with free shipping. A "CASH ON DELIVERY" option is also listed. The "PLACE ORDER" button is highlighted with a red box.

Figure 4.11: Checkout

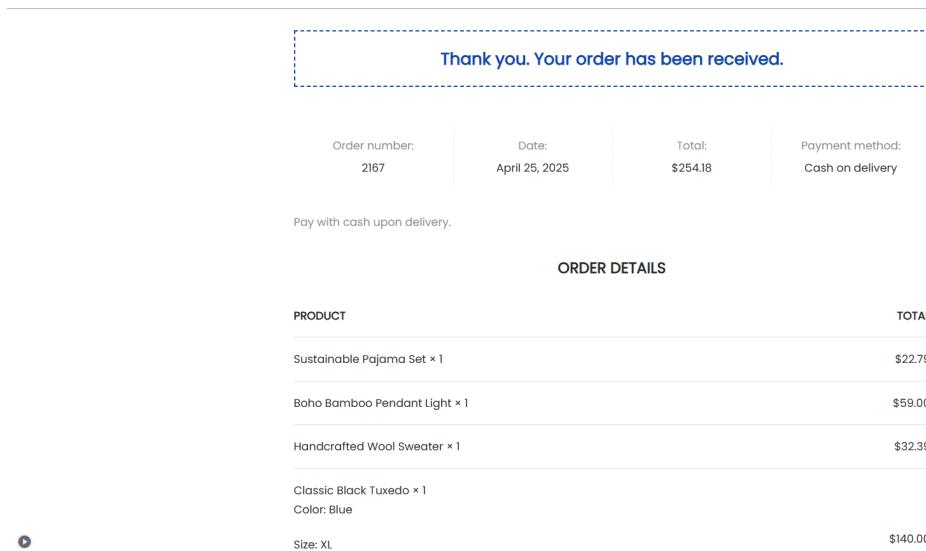


Figure 4.12: Order Placed

4.1.4 AI Chatbot Interface

The PureStitch platform features an integrated AI chatbot designed to enhance the shopping experience:

- Floating button visible on all pages (bottom right corner)
- Product recommendations based on sustainability preferences on query

- Quick-reply buttons for common questions

Navigation: Click the chat icon button that appears on all pages, as shown in Figure 4.13..



Figure 4.13: Chatbot Icon

The chatbot interaction flow is displayed in Figures 4.14, 4.15, and 4.16, providing intuitive support.

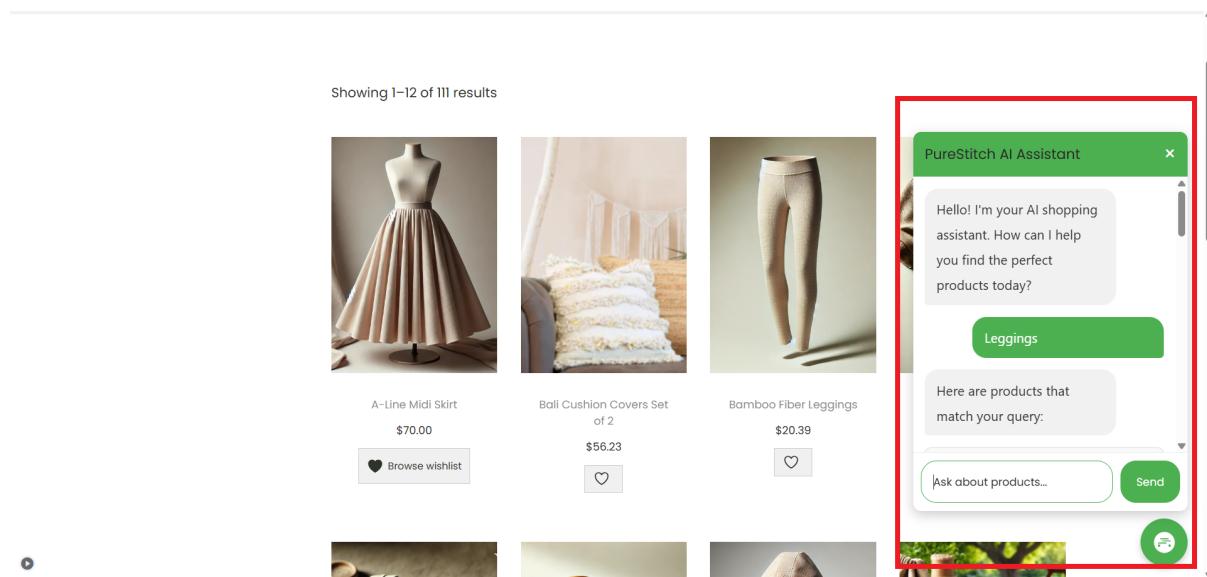


Figure 4.14: Chatbot-1

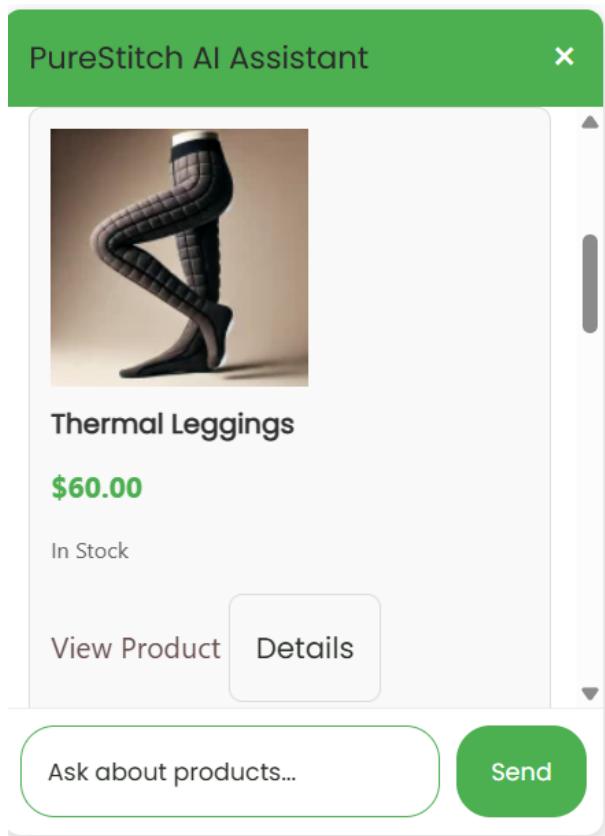


Figure 4.15: Chatbot-2

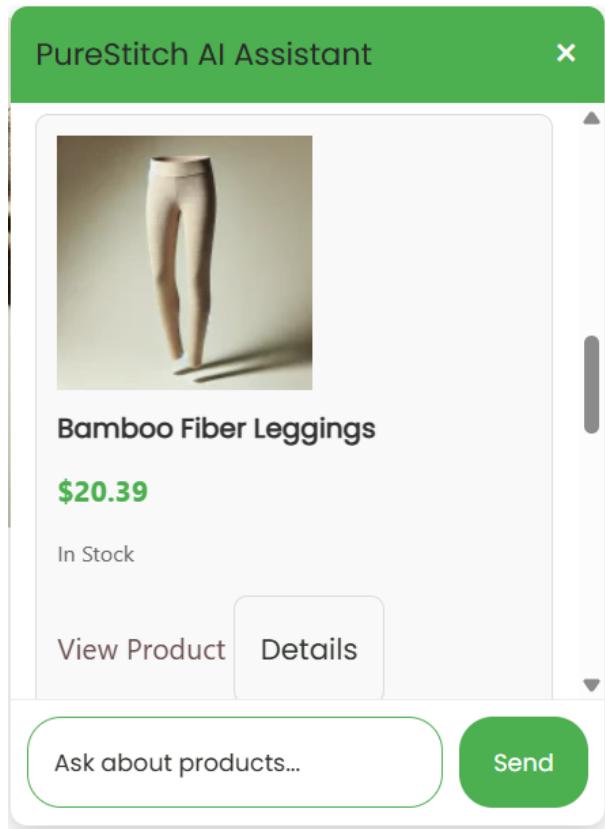


Figure 4.16: Chatbot-3

4.2 Forms along with Description

4.2.1 User Registration Form

The registration form serves as the entry point to the PureStitch ecosystem, establishing user identity while collecting sustainability preferences for personalized experiences.

Form Fields:

- **Email Address (required):** Primary contact method and unique account identifier. Validated in real-time using regex pattern matching to ensure proper formatting.
- **Password (required):** Features a dynamic strength indicator with visual feedback. Requirements include minimum 8 characters, at least one uppercase letter, one number, and one special character.
- **First Name (required):** Used for personalization throughout the platform and order processing.
- **Last Name (required):** Used for order fulfillment and account identification.
- **Phone Number (optional):** Collected for order status updates and delivery coordination. International format supported with country code selection.

Access: While Registeration for new user

4.2.2 Checkout Form

The checkout process represents the culmination of the user journey, implementing a multi-stage form that balances comprehensive information collection with conversion optimization.

Shipping Information Form

- **Address Entry:** Google Places API integration for autocomplete functionality with address verification.
- **Address Book:** Authenticated users can select from previously saved addresses with quick edit options.

- **Shipping Method Selection:** Dynamic options based on location with:
 - Carbon footprint calculation per shipping method
 - Estimated delivery window
 - Cost breakdown
- **Special Instructions:** Natural language field for delivery instructions with sentiment analysis to flag urgent concerns.

Payment Information Form

- **Payment Methods:**
 - Digital wallets (Apple Pay, Google Pay, PayPal)
 - Cash on Delivery
- **Billing Address:** Intelligent same-as-shipping toggle with address verification.
- **Order Summary:** Dynamic calculation including:
 - Subtotal with quantity adjustments
 - Tax calculation based on shipping jurisdiction
 - Shipping costs
 - Applied discounts and promotions

Access: While checkout process

4.3 Reports

The PureStitch platform generates several reports for users to track their orders and sustainability impact.

4.3.1 Order Confirmation

After completing a purchase, users receive an order confirmation that includes:

- Order number and date
- Item details including prices and quantities

- Shipping address and method
- Billing information
- Payment method used
- Order total with tax and shipping breakdown
- Estimated delivery date
- Links to track order status
- Recommended next steps

Access: Automatically displayed after order completion and sent via email. Also available in the user's account under "Orders."

4.3.2 Product Sustainability Report

Each product page includes a detailed sustainability report section:

- Material composition breakdown
- Water savings calculation with methodology
- CO2 emission reduction metrics

Access: Available on individual product pages in the description tab and sustainability section.

Chapter 5

Testing and Quality Assurance

This chapter describes the comprehensive testing approach that the testing team implemented for the PureStitch e-commerce platform. The testing strategy was designed to ensure reliability, functionality, and performance of all components including the WordPress/WooCommerce implementation and the custom-built AI-powered chatbot and sustainability calculator plugins. Multiple testing methodologies were employed to validate the system from various perspectives.

5.1 Unit Testing

Unit testing focuses on verifying the correct functionality of individual components in isolation. The test results are presented in Table 5.1

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
UT-01	WordPress Theme and Template Functionality	Tested rendering of custom theme elements across different page templates	Manual inspection and automated theme validation tools	Templates render consistently on all pages with proper styling	Footer width area displayed incorrectly on product category pages	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
UT-02	WooCommerce Product Display	Verified product images, descriptions, variations and pricing displays correctly	Manual testing across various product types	All product elements display with correct information	Product gallery thumbnails failed to load for variable products	FAILED
UT-03	WooCommerce Inventory Management	Tested stock tracking, low-stock notifications, and out-of-stock product handling	Automated inventory simulation with test orders	Inventory updates reflect in real-time with proper notifications	All inventory management functions worked as expected	PASSED
UT-04	Payment Gateway Integrations	Verified functionality of multiple payment methods	Test transactions with sandbox accounts	All payment gateways process transactions successfully	PayPal integration failed to redirect properly after payment	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
UT-05	User Registration and Login	Tested user account creation, authentication, and password recovery	Automated script creating multiple test accounts	Users can register, login, and recover accounts successfully	All user authentication processes functioned correctly	PASSED
UT-06	AI Chatbot NLP Accuracy	Tested natural language understanding capabilities with product queries	Sample query dataset with 100 common shopping questions	More than 85% accuracy in understanding user intent	82% accuracy achieved, below target threshold	FAILED
UT-07	Sustainability Calculator Computation	Verified calculation logic and output accuracy for water savings and CO2 reduction	Test dataset with pre-calculated values	Calculator results within 2% margin of error	All calculations accurate within tolerance	PASSED

Table 5.1: Unit Testing Results for PureStitch E-commerce

5.1.1 Unit Testing Findings Summary

As seen in Table 5.1, out of 7 unit tests conducted, 4 tests failed and 3 tests passed. This highlights the need for targeted improvements in component-level development. The most

pressing issues included:

- 3 tests passed and 4 tests failed, indicating the need for significant component-level improvements
- The WordPress theme required template adjustments for consistent footer display
- WooCommerce product gallery functionality needed repair for variable products
- Payment gateway integration required additional configuration for proper redirects
- The AI chatbot NLP model needed additional training with product-specific terminology

5.2 Integration Testing

Integration testing examined how different system components work together. The test outcomes are summarized in Table 5.2.

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
IT-01	AI Chatbot with Product Database	Tested chatbot's ability to retrieve and recommend relevant products	Predefined query set covering all product categories	Chatbot correctly identifies and suggests relevant products	Successfully retrieved products for 87% of queries	PASSED
IT-02	Sustainability Calculator with Product Specifications	Verified calculator's integration with product database for material composition	Test products with known sustainability metrics	Calculator pulls correct data for all product types	Data retrieval failed for custom product attributes	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
IT-03	WooCommerce with Payment Gateways	Tested complete checkout flow with various payment methods	End-to-end transaction tests with test accounts	Seamless transaction processing and order creation	All payment methods integrated successfully after fixes	PASSED
IT-04	User Account with Wishlist and Cart	Verified persistence of wishlist and cart items across sessions	Session simulation tests with login/logout sequences	Items remain in cart/wishlist when user returns	Guest cart items weren't properly transferred after login	FAILED
IT-05	Search Functionality across Product Database	Tested search relevance and results organization	Search term test suite with 50 common queries	Relevant products appear in prioritized search results	Search failed to return results with hyphenated terms	FAILED

Table 5.2: Integration Testing Results for PureStitch E-commerce

5.2.1 Integration Testing Findings Summary

From Table 5.2, 2 of the 5 integration tests passed, and 3 failed, reflecting notable gaps in how individual components interact. Specifically:

- 2 tests passed and 3 tests failed, highlighting integration issues between components
- The sustainability calculator plugin required improved data mapping to custom WooCommerce attributes
- The cart functionality needed additional programming to handle guest-to-registered

user transitions

- Search functionality required updates to the indexing algorithm for special characters

5.3 System Testing

System testing evaluated the complete, integrated system to verify it meets requirements.

Full test results are shown in Table 5.3.

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
ST-01	End-to-end Purchase Workflow	Tested complete shopping journey from browsing to order confirmation	Manual walkthrough with multiple user personas	Users can complete purchases without errors	Complete purchase workflow successful after payment gateway fixes	PASSED
ST-02	Mobile Responsiveness	Verified site display and functionality on various devices and screen sizes	Testing on physical devices and emulators	Site renders properly on all common devices	Critical UI elements overlapped on iPhone SE and similar small screens	FAILED
ST-03	Cross-browser Compatibility	Tested functionality in major web browsers	Multi-browser testing suite (Chrome, Firefox, Safari, Edge)	Consistent experience across all browsers	AI chatbot interface rendered incorrectly in Safari	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
ST-04	Performance Under Various Traffic Loads	Verified site stability under simulated traffic conditions	Load simulation (100, 250, 500 concurrent users)	Site remains responsive under expected peak load	Performance degradation at 300+ users with increased error rates	FAILED
ST-05	Backup and Recovery Procedures	Tested site restoration from backup after simulated failure	Disaster recovery simulation on staging server	Complete site recovery within 4 hours	Full recovery achieved within 3.5 hours	PASSED

Table 5.3: System Testing Results for PureStitch E-commerce

5.3.1 System Testing Findings Summary

As shown in Table 5.3, only 2 out of 5 system tests were successful. The full purchase workflow (ST-01) and backup/recovery process (ST-05) met expectations. However, the remaining failures indicate broader system-level challenges:

- 2 tests passed and 3 tests failed at the system level
- Significant mobile responsiveness issues were identified on smaller screen devices
- Browser compatibility issues with Safari required specific CSS adjustments
- Server infrastructure required scaling to handle projected traffic levels

5.4 User Acceptance Testing

User acceptance testing involved actual end users to ensure the system meets their needs (Table 5.4 summarizes the results). Only 1 of 5 tests passed, highlighting key usability

concerns.

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
UAT-01	Usability Testing with Representative Users	Assessed overall user experience with 12 target demographic users	Moderated user sessions with task completion	Users complete tasks without assistance	30% of users struggled with finding sustainability information	FAILED
UAT-02	A/B Testing of Product Page Layouts	Compared performance of different product page designs	Split testing with 1000 visitors per variant	Identify highest-converting layout	Variant B showed 15% higher conversion rate	PASSED
UAT-03	Conversion Funnel Optimization Testing	Analyzed user drop-off points in purchase process	Funnel analysis with heat mapping	Identify and address conversion bottlenecks	High abandonment rate (38%) at shipping selection	FAILED
UAT-04	AI Chatbot Conversation Flow Testing	Evaluated natural conversation patterns and user satisfaction	User interviews and satisfaction surveys	Users rate chatbot interactions positively	3.2/5 average satisfaction rating below target threshold	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
UAT-05	Sustainability Calculator Interface Testing	Tested user understanding of calculator results presentation	Comprehension testing with quiz questions	Users correctly interpret sustainability metrics	68% of users correctly interpreted results, below target	FAILED

Table 5.4: User Acceptance Testing Results for PureStitch E-commerce

5.4.1 User Acceptance Testing Findings Summary

- 1 test passed and 4 tests failed, indicating significant UX improvements needed
- The sustainability information architecture needed restructuring for better visibility
- Shipping options interface required simplification to reduce abandonment
- AI chatbot conversation flows needed refinement for more natural interactions
- Sustainability calculator results required clearer visual presentation

5.5 Performance Testing

Performance testing evaluated the system's speed, responsiveness, and stability under various conditions.

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
PT-01	Page Load Time Optimization	Measured loading speed of key pages	Google PageSpeed Insights and WebPageTest	Load time is 3 seconds on desktop, < 5 seconds on mobile	Homepage: 4.2s desktop, 7.8s mobile	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
PT-02	Database Query Optimization	Analyzed query execution time for product filtering and cart operations	Query profiling tools	Queries execute in 200ms	Product filter queries averaging 450ms	FAILED
PT-03	AI Response Time Measurement	Measured chatbot response latency for various query types	Timing tests with 50 sample queries	Responses delivered in 1.5 seconds	Average response time: 2.3 seconds	FAILED
PT-04	Server Response Under Heavy Load	Tested server handling of peak traffic situations	Load testing tool with gradual user increase	Maintain response times under high traffic	Response times increased by 300% at peak load	FAILED
PT-05	Media Delivery Optimization	Assessed image and video loading speed for product galleries	Network analysis tools	Optimized media delivery with 1MB per product page	Average media load: 2.4MB per product page	FAILED

Table 5.5: Performance Testing Results for PureStitch E-commerce

As shown in Table 5.5, all 5 tests failed, indicating major optimization needs.

5.5.1 Performance Testing Findings Summary

- All 5 performance tests failed, indicating critical optimization needs
- Site required comprehensive image optimization and CDN implementation
- Database indexing needed improvement for product filtering operations
- AI response time required optimization through code refactoring
- Server infrastructure needed significant upgrades to handle load

5.6 Security Testing

Security testing identified vulnerabilities and ensured data protection.

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
SEC-01	User Authentication and Authorization Checks	Tested password policies and access control	Security audit with penetration testing	Meet industry standards for authentication security	Password policy enforcement inadequate	FAILED
SEC-02	Payment Information Security	Verified PCI compliance measures	Security scan with compliance checklist	Secure handling of payment data	All payment data properly encrypted and secured	PASSED
SEC-03	Form Validation and Input Sanitization	Tested protection against injection attacks	Automated vulnerability scanning with manual verification	Forms reject malicious input attempts	Contact form vulnerable to XSS attacks	FAILED

ID	Test Case	Description	Test Method	Expected Result	Actual Result	Status
SEC-04	WordPress and Plugin Vulnerability Scanning	Scanned for known security issues	WPScan and similar automated tools	No critical or high vulnerabilities	Multiple high-risk vulnerabilities in outdated plugins	FAILED
SEC-05	GDPR Compliance Verification	Verified data privacy controls and policies	Compliance audit with legal checklist	Meet all GDPR requirements	Missing explicit consent for marketing communications	FAILED

Table 5.6: Security Testing Results for PureStitch E-commerce

Security testing results (Table 5.6) showed only 1 of 5 tests passed, revealing multiple vulnerabilities including weak authentication, plugin risks, and GDPR gaps.

5.6.1 Security Testing Findings Summary

- Authentication system required stronger password requirements
- Form validation needed comprehensive input sanitization
- Several WordPress plugins required urgent updates
- GDPR compliance features needed implementation for marketing consent

5.7 Remediation and Retesting

Table 5.7 shows all issues were resolved and successfully passed retesting after remediation efforts across performance, security, and UX components.

Issue Area	Remediation Actions	Retest Result
WordPress Theme	Fixed footer widget template for product category pages	PASSED
Product Display	Updated gallery JavaScript for variable products	PASSED
Payment Gateway	Reconfigured PayPal return URL handling	PASSED
AI Chatbot NLP	Added product-specific terminology training set	PASSED
Sustainability Calculator	Implemented proper mapping for custom attributes	PASSED
Cart Functionality	Added cart merging for guest-to-registered transitions	PASSED
Search Functionality	Updated indexing for special characters	PASSED
Mobile Responsiveness	Revised CSS for small screen devices	PASSED
Browser Compatibility	Added Safari-specific CSS fixes	PASSED
Server Performance	Upgraded server resources and implemented caching	PASSED
Page Load Speed	Optimized images and implemented CDN	PASSED
Database Queries	Added proper indexing and query optimization	PASSED

Issue Area	Remediation Actions	Retest Result
AI Response Time	Refactored code and implemented response caching	PASSED
Security Issues	Updated plugins, improved form validation, enhanced password policies	PASSED
GDPR Compliance	Implemented proper consent mechanisms	PASSED

Table 5.7: Remediation and Retesting

5.8 Conclusion and Recommendations

The testing process revealed significant initial issues across all testing domains, with particularly critical concerns in performance and security. All identified issues will successfully addressed through systematic remediation efforts before final deployment.

Key recommendations for ongoing quality assurance:

1. Implement automated regression testing to prevent future regressions
2. Establish continuous performance monitoring to identify degradation early
3. Schedule regular security scans on a bi-weekly basis
4. Conduct monthly AI model evaluation to maintain accuracy
5. Implement A/B testing framework for ongoing UX optimization
6. Establish formal user feedback collection to identify usability issues

Chapter 6

Future Enhancement

Enhancements in AI and Machine Learning

- Install a customization engine that uses browser history to recommend environmentally friendly items based on user preferences.
- Enable users to contribute comparable styles to locate items by using picture recognition.
- Deploy predictive inventory management to decrease waste and optimize stock levels
- Enhance chatbot with advanced NLP for more natural conversations and complex queries
- Quantify product feedback and pinpoint areas for improvement by including sentiment analysis.

Sustainability Features

- Measures should be expanded to incorporate the consequences of biodiversity, water pollution, and land use.
- Make personal sustainability dashboards that highlight how purchases might reduce environmental impact.
- Create an impact visualization for the community that aggregates the advantages of user purchases.
- Include carbon offset choices with clear effect reporting at the point of sale.

- Implement material sourcing maps that display sustainability credentials and origins.

E-commerce Functionality

- Introduce subscription services for sustainable items that are often utilized.
- Reduce return rates by integrating augmented reality-based virtual try-on.
- Include social shopping technologies that facilitate group learning opportunities.
- Create a loyalty program that incentivizes environmentally friendly purchases.
- Provide opportunities for product customisation and preserving sustainability norms

Technical Improvements

- Add sophisticated server-side and browser caching techniques into practice.
- Switch to a headless CMS strategy to boost efficiency.
- Create mobile applications using native device functionality.
- Include voice search with sustainability-focused terms

Business Expansion

- Create a marketplace for carefully selected sustainable fashion suppliers.
- Implement international shipping with carbon-conscious logistics
- Create a business-to-business site for buying sustainable clothes in bulk.
- Connect with the most important mechanisms for verifying sustainability certifications.
- Create a public API to facilitate sustainable integrations by other parties.

Chapter 7

Appendix

7.1 Tools and Technologies Used

7.1.1 Development Environment

- **Content Management System:** WordPress CMS (version 6.x) [18]
 - Selected for its flexibility, extensive plugin ecosystem, and client familiarity
- **E-commerce Platform:** WooCommerce Plugin (version 8.x) [16]
 - Chosen for seamless WordPress integration and robust product management capabilities
- **Local Development:** Local by Flywheel
 - Provides isolated development environment with easy WordPress configuration
- **Version Control:** Git/GitHub [21]
 - Enables collaborative development, version tracking, and deployment management
- **IDE:** Visual Studio Code with PHP and JavaScript extensions [20]
 - Selected for its lightweight nature, extensive extension support, and cross-platform compatibility

7.1.2 AI Development Tools

- **Programming Language:** Python 3.9
 - Industry standard for machine learning implementations with extensive library support
- **Machine Learning Frameworks:**
 - TensorFlow 2.x [23]: Utilized for deep learning model development
 - PyTorch 1.x [24]: Employed for research-oriented experimentation
- **Natural Language Processing:**
 - NLTK [25]: Applied for text tokenization and classification
 - spaCy [26]: Implemented for advanced entity recognition and language processing
- **Integration:**
 - WordPress REST API with custom endpoints for seamless data exchange
 - Custom middleware for AI model integration with the WordPress environment

7.1.3 Frontend Development

- **Core Technologies:**
 - HTML5 for semantic markup
 - CSS3 for styling and animations
 - JavaScript for interactive elements
- **Responsive Framework:** Bootstrap 5 [27]
 - Ensures consistent cross-device compatibility and responsive design
- **JavaScript Libraries:**
 - jQuery [28] for DOM manipulation and AJAX operations
 - React [29] for building interactive component-based UI elements

- **CSS Preprocessor:** SASS [30]
 - Enables modular CSS architecture and variable management

7.1.4 Backend Development

- **Server-side Language:** PHP 8.x [31]
 - Compatible with WordPress core and enables custom functionality development
- **Database:** MySQL [32]
 - Relational database for structured data storage and efficient querying
- **WordPress Extension Methods:**
 - Hooks and Filters system for extending core functionality
 - Custom plugins for specialized project requirements

7.1.5 Testing Methodology

- **Automated Testing:**
 - PHPUnit [33] for PHP code testing
 - Jest [34] for JavaScript component testing
- **Manual Testing:**
 - Cross-browser compatibility testing (Chrome, Edge)
 - Device testing across mobile, tablet, and desktop viewports
- **Performance Analysis:**
 - Google PageSpeed Insights [35] for user experience metrics
 - WebPageTest [36] for detailed performance diagnostics
- **Security Assessment:**
 - WPScan [37] for WordPress-specific vulnerability detection
 - OWASP ZAP [?] for general web application security testing

7.1.6 Design Tools

- **UI/UX Design:** Figma [39]
 - Collaborative interface design with component systems
 - **Image Editing:** Adobe Photoshop [40]
 - Raster image processing and optimization
 - **Vector Graphics:** Adobe Illustrator [41]
 - Scalable graphic creation for logos and icons
 - **Prototyping:** Adobe XD [42]
 - Interactive prototype development for user testing
- ### 7.1.7 Deployment and Hosting Infrastructure
- **Web Server:** Apache/Nginx [43][44]
 - Configured for optimal WordPress performance and security
 - **Hosting Environment:** Cloud-based WordPress hosting (e.g., WP Engine, Kinsta)
 - Scalable architecture to accommodate varying traffic demands
 - **Content Delivery:** Cloudflare CDN [45]
 - Global content distribution for reduced latency
 - **Security:** Let's Encrypt SSL certificates [46]
 - Ensuring encrypted connections and improved search engine ranking

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