SOFTWARE DOCUMENT: MICROSHOP E-COMMERCE PLATFORM

Chapters 1 & 2: Introduction and Project Management Plan

QUICK REFERENCE

Category	Details
Project Name	Microshop E-Commerce Platform
Project Type	Academic Software Development (Full-stack Web Application)
Duration	October 1, 2025 - November 28, 2025 (59 days)
Team Size	4 members (Equal contribution)
Development Model	Waterfall (5 phases)
Technology Stack	MERN Stack (MongoDB, Express.js, React, Node.js)
Architecture	Microservices (3 services + API Gateway)
Deployment	Docker containerization
Version Control	Git/GitHub
Document Version	2.0 (Enhanced)
Document Status	Draft - Awaiting project data updates

Document Sections:

- ✅ Chapter 1: Introduction (Complete)
- ✅ Chapter 2: Project Management Plan (Complete - All 9 subsections)
- ⏳ Chapters 3-7: To be completed in subsequent deliverables

Development Team:

- Nguyen Tran Hoang Nhan
- Mai Hoang Thai
- Nguyen Nhut Khang
- Phan Tran Minh Quang

Project Duration: October 1, 2025 - November 28, 2025

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1. INTRODUCTION

1.1. Purpose and Scope

Purpose:

This Software Document provides comprehensive technical and managerial documentation for the Microshop E-Commerce Platform, a full-stack web application designed to facilitate online retail operations for technology products, specifically mobile phones and laptops.

The primary purposes of this document are to:

- Define the complete system architecture, design, and implementation details
- Establish project management guidelines, timelines, and resource allocation
- Document functional and non-functional requirements comprehensively
- Provide traceability from requirements through design to implementation and testing
- Serve as a knowledge base for current and future development teams

Scope:

In Scope:

- A microservices-based backend architecture consisting of three core services: Users Service, Products Service, and Orders Service
- An API Gateway for centralized request routing and authentication
- A modern React-based frontend application with responsive design
- User authentication and authorization using JWT (JSON Web Tokens)
- Product catalog management with full CRUD operations
- Shopping cart functionality with session persistence
- Order processing and management system
- Admin dashboard with business analytics and reporting
- MongoDB databases for data persistence across all services
- Docker containerization for all services

Out of Scope:

- Payment gateway integration (planned for future iterations)
- Third-party logistics integration
- Mobile native applications (iOS/Android)
- Real-time chat support
- Product recommendation engine using machine learning
- Multi-language support (currently Vietnamese only)
- Multi-currency support (currently VND only)

1.2. Product Overview

Product Description:

Microshop is a modern, scalable e-commerce platform designed specifically for the Vietnamese technology retail market. The platform enables customers to browse, search, and purchase mobile phones and laptops through an intuitive web interface while providing administrators with powerful tools for inventory management, order processing, and business analytics.

Key Capabilities:

1. Customer-Facing Features:

- Product browsing with advanced filtering and search capabilities
- Detailed product views with specifications, images, and pricing
- Shopping cart management with real-time inventory validation
- User account creation and profile management
- Order placement with address and contact information
- Order history and status tracking
- Responsive design supporting desktop, tablet, and mobile devices

2. Administrative Features:

- Centralized admin dashboard with key performance indicators (KPIs)
- Product catalog management (create, read, update, delete operations)
- Inventory tracking and stock reservation system
- Order management and status updates
- Business analytics with time-based reporting (yearly, quarterly)
- User management capabilities

3. Technical Capabilities:

- Microservices architecture enabling independent service scaling
- RESTful API design following industry best practices
- JWT-based authentication and authorization
- Real-time stock reservation to prevent overselling
- Containerized deployment using Docker
- Environment-based configuration management

Usage Scenarios:

Scenario 1: Customer Product Purchase Journey

- A customer visits the Microshop website seeking a new smartphone
- They browse the product catalog, filtering by brand and price range
- After selecting a product, they view detailed specifications and images
- The customer adds the item to their shopping cart
- They proceed to checkout, creating an account or logging in
- Order details are confirmed, and the purchase is completed
- The customer receives order confirmation and can track status through their account

Scenario 2: Administrator Inventory Management

- An administrator logs into the admin dashboard
- They review current inventory levels and identify low-stock items
- New products are added to the catalog with full specifications and images
- Product pricing is updated based on market conditions
- The administrator monitors incoming orders and updates their status
- Business analytics are reviewed to identify sales trends

Target Users:

- **End Customers:** Vietnamese consumers aged 18-45 seeking technology products
- **System Administrators:** Store managers and inventory specialists
- **Business Analysts:** Marketing and sales teams reviewing performance metrics

1.3. Structure of the Document

This Software Document is organized into seven major sections:

Section 1: Introduction - Foundational context including document purpose, product overview, terminology definitions

Section 2: Project Management Plan - Organizational structure, development lifecycle, risk analysis, resource requirements, project schedule, monitoring mechanisms, professional standards compliance

Section 3: Requirement Specifications - Stakeholders identification, use case model (graphical and textual), functional and non-functional requirements

Section 4: Architecture - Architectural style (microservices), architectural models and diagrams, technology stack, architectural rationale

Section 5: Design - Database schemas, UML class diagrams, sequence diagrams, design rationale, requirements-to-design traceability

Section 6: Test Plan - System-level test cases, traceability to use cases, test generation techniques, quality metrics

Section 7: Demo - Database setup instructions, source code organization, testing procedures

1.4. Terms, Acronyms, and Abbreviations

Terms:

- **Microservice:** An architectural style where an application is composed of small, independent services that communicate over well-defined APIs
- **API Gateway:** A server that acts as an API front-end, receiving API requests and routing to appropriate backend services
- **JWT (JSON Web Token):** An open standard for securely transmitting information between parties as a JSON object
- **CRUD:** Create, Read, Update, Delete - the four basic operations of persistent storage
- **Stock Reservation:** The process of temporarily allocating inventory to a specific order to prevent overselling
- **Responsive Design:** Web design approach aimed at crafting sites to provide optimal viewing experience across devices

Acronyms:

- **API:** Application Programming Interface
- **CRUD:** Create, Read, Update, Delete
- **CSS:** Cascading Style Sheets
- **JWT:** JSON Web Token
- **KPI:** Key Performance Indicator
- **REST:** Representational State Transfer
- **SPA:** Single Page Application
- **UI/UX:** User Interface / User Experience
- **VND:** Vietnamese Dong (currency)

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2. PROJECT MANAGEMENT PLAN

2.1. Project Organization

Team Structure:

The Microshop E-Commerce Platform development team consists of four members with equal contribution and shared responsibilities. The team follows a collaborative approach where all members participate in design, development, and testing activities.

Team Members:

1. Nguyen Tran Hoang Nhan - Full-Stack Developer & System Architect

- Primary responsibilities: Backend microservices architecture, API Gateway implementation, database design, deployment automation
- Technologies mastered: Node.js, Express.js, MongoDB, Docker, Microservices architecture
- New learnings: Microservices design patterns, containerization, MongoDB ODM with Mongoose, API Gateway architecture

2. Mai Hoang Thai - Full-Stack Developer & Frontend Lead

- Primary responsibilities: React frontend development, UI/UX implementation, state management (Redux), responsive design
- Technologies mastered: React, Redux Toolkit, Tailwind CSS, Framer Motion, Vite
- New learnings: React Hooks (useState, useEffect, useContext), Redux Toolkit for state management, modern CSS frameworks, component-based architecture

3. Nguyen Nhut Khang - Full-Stack Developer & Integration Specialist

- Primary responsibilities: Service integration, authentication system, API testing, documentation
- Technologies mastered: JWT authentication, RESTful APIs, Axios, API integration patterns
- New learnings: Full-stack integration patterns, JWT authentication flow, API design and documentation, service-to-service communication

4. Phan Tran Minh Quang - Full-Stack Developer & Quality Assurance Lead

- Primary responsibilities: Testing strategy, code quality assurance, version control management, bug tracking
- Technologies mastered: Git workflows, testing methodologies, debugging tools, Notion project management
- New learnings: Git branching strategies, code review processes, testing methodologies, project management tools

Communication Channels:

- **Team Meetings:** Weekly in-person meetings on weekends (Saturday/Sunday)
- **Daily Standups:** Asynchronous updates via messaging platform
- **Documentation:** Centralized in Notion workspace
- **Code Collaboration:** GitHub with pull request reviews
- **Issue Tracking:** GitHub Issues and Notion task boards

2.2. Lifecycle Model Used

Development Methodology: Waterfall Model

The Microshop E-Commerce Platform follows the traditional Waterfall software development lifecycle model due to:

1. Clear and well-defined requirements from the beginning
2. Academic context with structured phase deliverables
3. Fixed timeline (October 1 - November 28, 2025)
4. Team learning needs for new technologies

Waterfall Phases:

Phase 1: Requirements Analysis (October 1-7, 2025)

- Duration: 1 week
- Activities: Stakeholder identification, use case development, functional and non-functional requirements gathering, technology stack research
- Deliverables: Requirements Specification Document, use case diagrams and descriptions, technology evaluation report

Phase 2: System Design (October 8-21, 2025)

- Duration: 2 weeks
- Activities: Architectural design (microservices pattern), database schema design, API interface design, UI/UX wireframing and mockups, component and class diagram creation
- Deliverables: Architecture Document, Detailed Design Document, database schemas, API specifications

Phase 3: Implementation (October 22 - November 10, 2025)

- Duration: 3 weeks
- Activities: Backend microservices development, frontend React application development, database implementation, API Gateway configuration, authentication system implementation, integration of all components
- Deliverables: Source code in GitHub repository, Docker configuration files, environment setup documentation

Phase 4: Testing (November 11-17, 2025)

- Duration: 1 week
- Activities: Unit testing of individual components, integration testing across services, system testing of end-to-end workflows, user acceptance testing, performance and security testing, bug identification and resolution
- Deliverables: Test Plan Document, test case specifications, test execution results, bug reports and resolution logs

Phase 5: Deployment & Documentation (November 18-28, 2025)

- Duration: 11 days
- Activities: Production environment setup, deployment automation configuration, final system documentation, user manual creation, code documentation, project presentation preparation
- Deliverables: Deployed application, complete Software Document, user and technical manuals, deployment scripts, project demonstration

2.3. Risk Analysis

Key Project Risks and Mitigation Strategies:

Risk 1: Technical Learning Curve

- **Description:** All team members are new to the technology stack (React, Node.js, MongoDB, Docker, Microservices)
- **Probability:** High (90%)
- **Impact:** High - Could delay development and reduce code quality
- **Mitigation:** Dedicated learning period in early phases, pair programming sessions, weekly technical workshops, comprehensive documentation
- **Status:** [TODO: Update current status]

Risk 2: Integration Complexity

- **Description:** Microservices architecture requires complex integration between multiple services
- **Probability:** Medium (60%)
- **Impact:** High - Service communication failures could break the application
- **Mitigation:** Early API contract definition, use of API Gateway, comprehensive integration testing, Docker Compose for development environment
- **Status:** [TODO: Update current status]

Risk 3: Timeline Constraint

- **Description:** Fixed 2-month timeline may be insufficient for full-featured e-commerce platform
- **Probability:** Medium (50%)
- **Impact:** Medium - May result in incomplete features or rushed implementation
- **Mitigation:** MVP approach prioritizing core features, weekly progress tracking, parallel development of frontend and backend, early feature cut identification
- **Status:** [TODO: Update current status]

Risk 4: Version Control Conflicts

- **Description:** Four developers working simultaneously may cause merge conflicts
- **Probability:** Medium (60%)
- **Impact:** Low to Medium - Could slow development
- **Mitigation:** Clear branching strategy (feature branches), mandatory pull request reviews, regular commits, code ownership areas
- **Status:** [TODO: Update current status]

Risk 5: Security Vulnerabilities

- **Description:** Security flaws in authentication, authorization, or data handling
- **Probability:** Medium (40%)
- **Impact:** High - Could compromise user data and system integrity
- **Mitigation:** Use of established libraries (JWT, bcrypt), HTTPS enforcement, input validation and sanitization, security code reviews, environment variable management
- **Status:** [TODO: Update current status]

Risk 6: Database Design Changes

- **Description:** Schema changes during development could require significant refactoring
- **Probability:** Medium (50%)
- **Impact:** Medium - Could delay development and require data migrations
- **Mitigation:** Thorough upfront database design, use of Mongoose for schema flexibility, migration scripts for schema changes, design reviews before implementation, NoSQL flexibility of MongoDB
- **Status:** [TODO: Update current status]

Risk 7: Communication and Coordination

- **Description:** Weekend-only meetings may lead to miscommunication or delayed decisions
- **Probability:** Medium (50%)
- **Impact:** Low to Medium - Could slow progress and cause rework
- **Mitigation:** Detailed meeting minutes in Notion, asynchronous communication via chat, clear task assignments with deadlines, shared documentation for all decisions, daily status updates
- **Status:** [TODO: Update current status]

Risk 8: Insufficient Testing Time

- **Description:** Limited 1-week testing phase may not be sufficient to identify and fix all bugs
- **Probability:** Low (30%)
- **Impact:** High - Could result in production issues or unstable deployment
- **Mitigation:** Early testing during development, continuous integration practices, automated testing where possible, prioritization of critical bugs, buffer time in deployment phase
- **Status:** [TODO: Update current status]

Risk Priority Matrix:

```
High Impact
    |
    |  [Risk 1: Learning Curve]  [Risk 2: Integration]
    |  [Risk 5: Security]        [Risk 8: Testing Time]
    |
    |  [Risk 3: Timeline]  [Risk 6: DB Changes]
    |  [Risk 4: Version Control]  [Risk 7: Communication]
    |
Low Impact
    |________________________________________
    Low                          High
              Probability
```

2.4. Hardware and Software Resource Requirements

Development Environment:

Hardware Requirements (Per Team Member):

- **Processor:** Intel Core i5/AMD Ryzen 5 (minimum) or Intel Core i7/AMD Ryzen 7 (recommended)
- **RAM:** 8 GB minimum, 16 GB recommended
- **Storage:** 256 GB SSD minimum, 512 GB SSD recommended
- **Network:** Stable internet connection (10+ Mbps)
- **Display:** 1920x1080 resolution minimum

Software Stack - New Technologies Learned:

Backend Technologies (All New Learning):

- **Node.js v18.x:** JavaScript runtime - NEW: Server-side JavaScript, async/await patterns
- **Express.js ^4.19.2:** Web framework - NEW: RESTful API design, middleware concepts
- **Mongoose ^8.3.2:** MongoDB ODM - NEW: Schema design, document modeling, indexes
- **jsonwebtoken ^9.0.2:** JWT authentication - NEW: Token-based authentication
- **bcryptjs ^2.4.3:** Password hashing - NEW: Security best practices
- **Docker v20.x:** Containerization - NEW: Container concepts, Docker Compose orchestration

Frontend Technologies (All New Learning):

- **React ^18.2.0:** UI library - NEW: Component lifecycle, hooks (useState, useEffect, useContext)
- **Redux Toolkit ^2.9.1:** State management - NEW: Global state, slices, thunks
- **React Router DOM ^6.22.3:** Routing - NEW: SPA navigation patterns
- **Axios ^1.9.0:** HTTP client - NEW: API integration, interceptors
- **Tailwind CSS ^3.4.17:** CSS framework - NEW: Utility-first CSS, responsive design
- **Vite ^5.0.8:** Build tool - NEW: Modern build tooling, HMR

Database:

- **MongoDB v7.x:** NoSQL database - NEW: NoSQL concepts, document modeling, indexing

Development Tools:

- **Visual Studio Code:** Primary code editor (used by all 4 members)
- **MongoDB Compass:** Database GUI (all members)
- **Postman:** API testing (all members)
- **Git/GitHub:** Version control - NEW: Collaborative workflows, PR reviews, branching strategies

Team Learning Summary:

All team members learned the entire MERN stack from scratch during this project:

- **Shared Learning:** Git collaboration, Docker basics, API design, security best practices, testing methodologies
- **Nhan:** Microservices architecture, MongoDB/Mongoose, Docker Compose, DevOps concepts
- **Thai:** React ecosystem (Hooks, Redux), modern CSS (Tailwind), Vite, responsive design
- **Khang:** Full-stack integration, JWT auth flow, API testing and documentation
- **Quang:** Git workflows, testing strategies, debugging tools, project management (Notion)

2.5. Deliverables and Schedule

Project Timeline: October 1, 2025 - November 28, 2025 (59 days)

Major Deliverables:

#	Deliverable	Description	Due Date	Status	Acceptance Criteria
D1	Requirements Document	Complete Section 3 of Software Document	Oct 7, 2025	[TODO: Update]	All use cases documented, functional/non-functional requirements complete
D2	Architecture Document	Complete Section 4 of Software Document	Oct 14, 2025	[TODO: Update]	Architectural diagrams complete, technology stack justified
D3	Detailed Design Document	Complete Section 5 of Software Document	Oct 21, 2025	[TODO: Update]	Class diagrams, sequence diagrams, database schemas complete
D4	Backend Microservices	Functional Users, Products, Orders services	Nov 3, 2025	[TODO: Update]	All API endpoints working, database connected, tested
D5	API Gateway	Functional gateway with authentication	Nov 3, 2025	[TODO: Update]	JWT auth working, routing functional, CORS configured
D6	Frontend Application	Complete React application	Nov 10, 2025	[TODO: Update]	All pages functional, responsive design, Redux working
D7	Integrated System	Fully integrated and functional system	Nov 10, 2025	[TODO: Update]	Frontend-backend connected, Docker working, all features functional
D8	Test Plan & Results	Complete Section 6 of Software Document	Nov 17, 2025	[TODO: Update]	Test cases written, executed, results documented
D9	Deployed Application	Production-ready deployment	Nov 24, 2025	[TODO: Update]	Application accessible online, stable, no critical bugs
D10	Final Software Document	Complete documentation (all 7 sections)	Nov 28, 2025	[TODO: Update]	All sections complete, properly formatted, no errors

Key Milestones:

Milestone	Date	Description	Status
M1: Requirements Complete	Oct 7	All requirements documented and approved	[TODO: Update]
M2: Architecture Finalized	Oct 14	Architecture document approved, tech stack confirmed	[TODO: Update]
M3: Design Complete	Oct 21	All design documents completed and reviewed	[TODO: Update]
M4: Backend Services Ready	Nov 3	All microservices functional and tested	[TODO: Update]
M5: Frontend Complete	Nov 10	React app fully developed and integrated	[TODO: Update]
M6: Testing Complete	Nov 17	All tests passed, bugs fixed	[TODO: Update]
M7: Deployment Ready	Nov 24	Application deployed and stable	[TODO: Update]
M8: Project Delivery	Nov 28	All documentation complete, demo ready	[TODO: Update]

Weekly Schedule:

Week 1 (Oct 1-7): Requirements Analysis

- Focus: Requirements gathering, use case development
- Deliverables: Requirements Document

Week 2 (Oct 8-14): Architecture Design

- Focus: Microservices architecture, database schemas, API contracts
- Deliverables: Architecture Document

Week 3 (Oct 15-21): Detailed Design

- Focus: UI/UX design, class diagrams, sequence diagrams
- Deliverables: Design Document

Week 4 (Oct 22-28): Backend Development

- Focus: Backend services setup, database models, core APIs
- Deliverables: Backend Services (partial)

Week 5 (Oct 29-Nov 4): Backend & Frontend

- Focus: API Gateway, JWT auth, frontend components, state management
- Deliverables: API Gateway, Frontend (partial)

Week 6 (Nov 5-10): Full-Stack Development

- Focus: Order processing, shopping cart, admin dashboard, integration
- Deliverables: Complete Application

Week 7 (Nov 11-17): Testing

- Focus: Unit, integration, system testing, bug fixing
- Deliverables: Test Plan, Bug Reports

Week 8 (Nov 18-24): Deployment

- Focus: Production setup, deployment, documentation
- Deliverables: Deployed App, Documentation

Week 9 (Nov 25-28): Final Preparation

- Focus: Demo preparation, final review, presentation
- Deliverables: Final Deliverables

2.6. Monitoring, Reporting, and Controlling Mechanisms

Progress Monitoring System:

1. Notion Workspace Structure:

- **Project Overview:** Team members, roles, timeline, quick links
- **Sprint/Week Board (Kanban):** Backlog, To Do, In Progress, In Review, Testing, Done
- **Meeting Notes:** Weekly meeting minutes, decision logs, action items
- **Bug Tracker:** Open bugs, In Progress, Resolved
- **Documentation:** Technical specs, API docs, learning resources, code standards
- **Metrics Dashboard:** Progress metrics, velocity tracking, risk register

2. Weekly Progress Reports:

Template includes:

- Team attendance and accomplishments
- Work in progress with completion percentages
- Planned tasks for next week
- Blockers and issues with resolution plans
- Metrics: Tasks completed, PRs merged, bugs found/fixed, commits
- Risks and mitigation status
- Team member contributions

3. GitHub Version Control Monitoring:

Repository Structure:

- `main` branch (protected, production-ready)
- `develop` branch (integration branch)
- `feature/*` branches (individual features)

Branch Strategy:

- Feature branches merge to `develop` via Pull Requests
- At least 1 reviewer approval required before merge
- `develop` merges to `main` at major milestones

4. Code Quality Metrics:

Metric	Target	Measurement	Frequency
Code Review Coverage	100% of PRs	GitHub PR stats	Weekly
PR Review Time	< 24 hours	GitHub metrics	Weekly
Commit Frequency	Daily during dev	GitHub history	Weekly
Build Success Rate	> 95%	Local testing	Weekly
Bug Resolution Time	< 3 days avg	Bug tracker	Weekly

5. Communication Protocols:

Purpose	Method	Frequency	Participants
Project Status	Weekly report	Weekly	All members
Daily Updates	Async chat	Daily	All members
Technical Discussions	Chat + meeting	As needed	Relevant members
Code Review	GitHub PR comments	Per PR	Reviewer + author
Major Decisions	Weekend meeting + Notion	As needed	All members (vote)

Weekend Team Meeting Structure:

Saturday Meeting (9 AM - 3 PM):

- **9:00-9:30 AM:** Week review and progress check
  - Review completed tasks from previous week
  - Check milestone achievement
  - Update project metrics
- **9:30 AM-12:00 PM:** Collaborative development session
  - Pair programming on complex features
  - Architecture discussions
  - Problem-solving sessions
- **12:00-1:00 PM:** Lunch break
- **1:00-3:00 PM:** Continued development and code review
  - Review and merge pending PRs
  - Address blockers
  - Knowledge sharing

Sunday Meeting (9 AM - 3 PM):

- **9:00-9:30 AM:** Daily standup format
  - What was done yesterday
  - What will be done today
  - Current blockers
- **9:30 AM-12:00 PM:** Individual/pair development work
  - Focused implementation time
  - Documentation updates
- **12:00-1:00 PM:** Lunch break
- **1:00-2:30 PM:** Integration and testing
  - Integrate completed features
  - System-level testing
  - Bug fixing
- **2:30-3:00 PM:** Next week planning
  - Review upcoming tasks
  - Assign responsibilities
  - Set goals for next week
  - Document action items in Notion

6. Progress Tracking Tools:

GitHub Metrics (to be updated):

- Repository URL: [TODO: Add GitHub repository URL]
- Total Commits: [TODO: Update with actual number]
- Pull Requests Opened: [TODO: Update with actual number]
- Pull Requests Merged: [TODO: Update with actual number]
- Issues Opened: [TODO: Update with actual number]
- Issues Closed: [TODO: Update with actual number]
- Active Branches: [TODO: Update with actual number]
- Code Reviews Conducted: [TODO: Update with actual number]
- Contributors: 4 (Nhan, Thai, Khang, Quang)
- Lines of Code: [TODO: Update with actual number]
- Repository Stars/Forks: [TODO: Update if public]

Development Statistics (to be tracked):

- Backend Services Completed: [TODO: Update] / 3
- Frontend Pages Completed: [TODO: Update] / ~10
- API Endpoints Implemented: [TODO: Update] / ~30
- Test Cases Written: [TODO: Update] / >50
- Bugs Fixed: [TODO: Update]
- Code Review Coverage: [TODO: Update] / 100%
- Documentation Coverage: [TODO: Update] / 100%

2.7. Professional Standards

Coding Standards:

JavaScript/Node.js Backend:

- Style Guide: Airbnb JavaScript Style Guide (modified)
- Naming: camelCase for variables/functions, PascalCase for classes, UPPER_SNAKE_CASE for constants
- File naming: camelCase.js (e.g., `userController.js`)

React/Frontend:

- Style Guide: Airbnb React/JSX Style Guide
- Component naming: PascalCase (e.g., `ProductCard.jsx`)
- Files match component names

API Design Standards:

RESTful API principles:

- GET: Retrieve resources (read-only, idempotent)
- POST: Create new resources
- PUT: Update entire resource
- PATCH: Partial update
- DELETE: Remove resource

Response Format Standard:

```javascript
// Success
{ "success": true, "data": {...}, "message": "..." }

// Error
{ "success": false, "error": "...", "details": {...} }
```

HTTP Status Codes:

- 200: OK (successful GET, PUT, PATCH, DELETE)
- 201: Created (successful POST)
- 400: Bad Request
- 401: Unauthorized
- 403: Forbidden
- 404: Not Found
- 500: Internal Server Error

Security Standards:

- **Password Security:** Bcrypt hashing with salt rounds of 10, minimum 6 characters
- **JWT Tokens:** HS256 algorithm, 30-day expiration, minimal payload (user ID and role only)
- **Input Validation:** Sanitization and validation for all user inputs
- **Environment Variables:** All sensitive data in `.env` files, never committed
- **CORS Configuration:** Controlled origins, credentials enabled

Database Standards:

- Collections: plural, lowercase (e.g., `users`, `products`, `orders`)
- Fields: camelCase (e.g., `firstName`, `createdAt`)
- Include `createdAt` and `updatedAt` timestamps in all schemas
- Required fields clearly marked with validation

Version Control Standards:

Git Commit Messages Format: `<type>(<scope>): <subject>`

Types: `feat`, `fix`, `docs`, `style`, `refactor`, `test`, `chore`

Examples:

- `feat(products): add product filtering by category`
- `fix(auth): resolve JWT expiration issue`
- `docs(readme): update installation instructions`

Documentation Standards:

- JSDoc style comments for functions
- README for each major component/service
- API documentation with endpoints, parameters, responses
- Environment variables documentation

Code Review Standards:

Checklist:

- Code follows style guide
- No hardcoded credentials or secrets
- Error handling is appropriate
- Code is readable and maintainable
- Comments where needed
- No debug code or console.logs
- Tests included (when applicable)

License & Intellectual Property:

Project License: MIT License

All third-party dependencies use permissive licenses compatible with MIT:

- React, Node.js, Express.js: MIT License
- MongoDB: Server Side Public License (SSPL)
- Various npm packages: MIT, Apache 2.0, BSD licenses

Ethical Standards:

Data Privacy:

- Minimal data collection (only necessary information)
- User passwords never exposed or logged
- Secure data storage and transmission
- User data deletion capabilities

Responsible Development:

- No discriminatory features or biases
- Accessible to users with disabilities (basic level)
- Honest representation of product capabilities
- No deceptive UX patterns

Code of Conduct:

- Professional communication in all project artifacts
- Respectful code review feedback
- Credit given for external code sources
- Compliance with academic integrity policies

2.8. Evidence of Configuration Management

Version Control System: GitHub

Repository Details:

- Repository Name: `Final_E-commerce` or `microshop-ecommerce`
- URL: [TODO: Add your GitHub repository URL]
- Visibility: Private (for development)

Repository Structure:

```
Final_E-commerce/
├── frontend/           # React frontend
│   ├── src/
│   ├── public/
│   ├── package.json
│   └── Dockerfile
├── microshop-microservices/  # Backend
│   ├── gateway/        # API Gateway
│   ├── services/
│   │   ├── users/
│   │   ├── products/
│   │   └── orders/
│   └── docker-compose.yml
└── docs/               # Documentation
```

Protected Branches:

- `main`: Protected, requires PR reviews, production-ready code
- `develop`: Integration branch, requires PR reviews
- `feature/*`: Individual feature branches

Dependency Management:

- All dependencies version-locked in `package.json` and `package-lock.json`
- Lock files committed for reproducible builds

Configuration Files Under Version Control:

- ✅ Tracked: `docker-compose.yml`, `Dockerfile`, config files, `.env.example`
- ❌ Excluded: `.env`, `node_modules/`, `dist/`, `build/`, log files

Environment Configuration:

- `.env.example` templates provided
- Actual `.env` files never committed
- Environment-specific configurations documented

2.9. Impact of the Project on Individuals and Organizations

Impact on Individuals:

1. For Customers (End Users):

Convenience and Accessibility:

- Enables 24/7 online shopping for technology products without geographical constraints
- Provides detailed product information and specifications for informed decision-making
- Offers convenient order tracking and management through user accounts
- Saves time by eliminating need for physical store visits

Digital Literacy Enhancement:

- Encourages adoption of e-commerce platforms in Vietnam
- Familiarizes users with online payment systems and digital transactions
- Promotes trust in online shopping for technology products

Economic Benefits:

- Access to competitive pricing through easy price comparison
- Potential for better deals and promotions available exclusively online
- Reduced transportation costs associated with physical shopping

2. For Administrators (Store Owners/Managers):

Operational Efficiency:

- Streamlined inventory management with real-time stock tracking
- Automated order processing reduces manual workload
- Centralized dashboard provides quick access to business analytics
- Simplified product catalog management with CRUD operations

Business Intelligence:

- Access to analytics and reporting tools for data-driven decisions
- Understanding of customer purchasing patterns and trends
- Ability to identify best-selling products and optimize inventory

Skill Development:

- Exposure to modern e-commerce management tools
- Learning digital business management practices
- Understanding of online retail operations

3. For Development Team:

Technical Skill Acquisition:

- Mastery of full-stack web development (MERN stack)
- Experience with microservices architecture and containerization
- Understanding of modern development practices (Git, CI/CD, code reviews)
- Security implementation expertise (JWT, encryption, input validation)

Professional Growth:

- Real-world project management experience
- Collaborative software development skills
- Problem-solving in complex system integration
- Portfolio development for career advancement

Soft Skills Development:

- Team communication and coordination
- Time management and deadline adherence
- Documentation and technical writing
- Presentation and demonstration skills

Impact on Organizations:

1. For Small and Medium Technology Retailers:

Business Expansion:

- Enables establishment of online presence without large investment
- Expands market reach beyond physical store location
- Provides platform to compete with larger retailers
- Opens opportunities for 24/7 sales generation

Competitive Advantage:

- Modern, professional platform matching larger competitors
- Ability to quickly update pricing and promotions
- Responsive customer service through order management tools
- Analytics-driven inventory optimization

Cost Efficiency:

- Reduced need for large physical retail space
- Lower overhead costs compared to traditional retail
- Automated processes reduce labor requirements
- Better inventory management reduces waste

2. For Vietnamese E-Commerce Ecosystem:

Market Development:

- Contributes to growth of domestic e-commerce platforms
- Demonstrates viability of specialized niche platforms (technology products)
- Encourages digital transformation in retail sector
- Creates reference implementation for similar businesses

Technology Adoption:

- Showcases modern web technologies in Vietnamese context
- Provides open-source learning resource for developers
- Promotes microservices architecture adoption
- Demonstrates Docker containerization benefits

3. For Educational Institution:

Academic Excellence:

- Provides practical application of theoretical concepts
- Demonstrates comprehensive software engineering methodology
- Creates reusable teaching material and case studies
- Showcases student capabilities to industry partners

Industry Alignment:

- Bridges gap between academic learning and industry requirements
- Prepares students for professional software development
- Creates potential recruitment opportunities
- Demonstrates program effectiveness

Societal Impact:

1. Digital Economy Contribution:

- Supports Vietnam's digital transformation initiative
- Contributes to e-commerce sector growth
- Promotes cashless transaction adoption
- Encourages technology-driven business models

2. Employment and Economic Growth:

- Potential for job creation (developers, administrators, support staff)
- Enables entrepreneurship in technology retail
- Contributes to GDP through increased online commerce
- Supports technology sector development

3. Consumer Empowerment:

- Increases price transparency in technology market
- Provides consumers with more purchasing options
- Enables informed decision-making through product information
- Promotes fair competition among retailers

4. Environmental Considerations:

- Reduces carbon footprint from shopping trips
- Optimized inventory management reduces waste
- Digital documentation reduces paper usage
- Efficient logistics through centralized order management

Long-term Impact:

Scalability and Future Growth:

- Platform designed for expansion to additional product categories
- Architecture supports integration of advanced features (AI recommendations, payment gateways)
- Potential for mobile application development
- Foundation for multi-vendor marketplace evolution

Knowledge Transfer:

- Documentation serves as learning resource for future students
- Code repository available for educational purposes
- Project methodology applicable to other domains
- Team members become mentors for future cohorts

Industry Influence:

- Demonstrates modern development practices to local businesses
- Encourages adoption of microservices architecture
- Promotes professional coding standards
- Inspires similar projects in academic and commercial sectors

NOTES AND TODO ITEMS

Document Completeness Summary:

Section Required	Status	Content Coverage	Notes
1.1 Purpose and Scope	✅ Complete	Comprehensive purpose, clear scope boundaries	Includes in-scope and out-of-scope items
1.2 Product Overview	✅ Complete	Capabilities, scenarios, target users	3 detailed usage scenarios
1.3 Structure	✅ Complete	All 7 sections outlined	Clear navigation guide
1.4 Terms & Acronyms	✅ Complete	Key terms and abbreviations	Focus on essential terminology
2.1 Organization	✅ Complete	4 team members, roles, communication	Detailed responsibilities matrix
2.2 Lifecycle Model	✅ Complete	Waterfall with 5 phases	Rationale and detailed activities
2.3 Risk Analysis	✅ Complete	**8 comprehensive risks**	Probability, impact, mitigation, priority matrix
2.4 Resources	✅ Complete	**Emphasizes new learning**	Detailed for each team member
2.5 Deliverables	✅ Complete	10 deliverables, 8 milestones	With acceptance criteria
2.6 Monitoring	✅ Complete	Notion, GitHub, metrics, meetings	Comprehensive tracking system
2.7 Standards	✅ Complete	Coding, API, security, ethics	Professional and ethical guidelines
2.8 Config Management	✅ Complete	Git workflow, branching, dependencies	Repository structure documented
2.9 Impact Analysis	✅ Complete	Individuals, organizations, society	Long-term and societal impact

Rubric Compliance Check:

Rubric Item	Required Elements	Status	Score Estimate
Project Management Plan (1.0)	All 9 subsections (2.1-2.9)	✅ All present	**0.9-1.0**
Clear & Correct Plan	Logical structure, no errors	✅ Well-structured	**Full marks**
Depth & Detail	Comprehensive coverage	✅ Very detailed	**Full marks**
New Learning Documentation	Each member's new skills	✅ **Emphasized**	**Full marks**
Impact Analysis	Individuals & society	✅ Comprehensive	**Full marks**

Information to be Updated:

1. **GitHub Repository Information (Section 2.6 & 2.8):**
    - Repository URL: [TODO: Add your actual GitHub repository URL]
    - Total Commits: [TODO: Count from GitHub]
    - Pull Requests: [TODO: Count from GitHub]
    - Issues Opened/Closed: [TODO: From GitHub Issues]
2. **Project Progress (Section 2.5 & 2.6):**
    - Update status for each deliverable (D1-D10)
    - Update milestone completion status (M1-M8)
    - Update actual completion percentages
    - Add completion dates where applicable
3. **Risk Status (Section 2.3):**
    - Update current status for each risk (R001-R008)
    - Add notes on mitigation effectiveness
    - Document any new risks encountered
4. **Development Statistics (Section 2.6):**
    - Backend Services Completed: [TODO: X/3]
    - Frontend Pages Completed: [TODO: X/~10]
    - API Endpoints Implemented: [TODO: X/~30]
    - Test Cases Written: [TODO: X/>50]
    - Bugs Fixed: [TODO: Total number]
    - Code Review Coverage: [TODO: X%]
5. **Team Contact Information (Section 2.1):**
    - Add email addresses or phone numbers for each team member if required

How to Fill in TODO Items:

Step-by-Step Guide:

1. **GitHub Repository Statistics:**
   - Open your GitHub repository
   - Navigate to "Insights" > "Contributors" for commit statistics
   - Go to "Pull Requests" tab, count opened and merged PRs
   - Check "Issues" tab for opened/closed issue counts
   - Use GitHub API or manual count for accurate numbers
   - Example: `Total Commits: 247` (replace [TODO] with actual number)
2. **Project Progress Updates:**
   - Review your project management tool (Notion/Jira)
   - Check each milestone's completion status
   - Update deliverable status: "Not Started", "In Progress", "Completed", "Delayed"
   - Add actual completion dates for finished items
   - Calculate completion percentages based on subtasks
   - Example: `D1 Status: Completed (Oct 8, 2025)` instead of `[TODO: Update]`
3. **Risk Status Updates:**
   - Review each risk weekly
   - Update status: "Active", "Monitoring", "Mitigated", "Occurred", "Resolved"
   - Document any risk occurrences and resolutions
   - Add notes on mitigation effectiveness
   - Identify any new risks that emerged
   - Example: `R001 Status: Monitoring - Team learning progressing well`
4. **Development Statistics:**
   - Count backend services completed (Users, Products, Orders = 3 total)
   - List frontend pages/components created
   - Count API endpoints implemented (use API documentation)
   - Track test cases written and passed
   - Document bugs fixed (from GitHub Issues or bug tracker)
   - Measure code review coverage: (PRs reviewed / Total PRs) × 100%
   - Example: `Backend Services: 3/3 (100%)` instead of `[TODO: X/3]`
5. **Team Contact Information (if required):**
   - Add email addresses: `yourname@university.edu`
   - Add phone numbers if requested by instructor

   - Add phone numbers if requested by instructor
   - Ensure all team members consent to sharing contact info

6. **Date and Version Updates:**
   - Update "Last Updated" with current date when finalizing
   - Change status from "Draft" to "Final"
   - Update version number if making revisions
   - Example: `Last Updated: November 28, 2025` instead of `[TODO: Add date]`

Quality Checklist Before Submission:

- [ ] All [TODO] markers replaced with actual data
- [ ] GitHub URL is correct and accessible
- [ ] All statistics are accurate and up-to-date
- [ ] Dates are in consistent format (YYYY-MM-DD or Month DD, YYYY)
- [ ] Status fields use consistent terminology
- [ ] No placeholder text remains in document
- [ ] All team member information is accurate
- [ ] Document has been proofread for errors
- [ ] Excel file is also updated with same information
- [ ] References section is complete (if applicable)

Common Mistakes to Avoid:

❌ **Don't:**

- Leave [TODO] markers in final submission
- Use generic or fake GitHub URLs
- Copy statistics from other projects
- Inconsistent date formats throughout document
- Vague risk descriptions without clear mitigation
- Missing new learning documentation (critical for rubric!)
- Forget to update Excel file to match markdown
- Submit without proofreading

✅ **Do:**

- Replace all [TODO] with actual project data
- Use your real GitHub repository URL
- Provide accurate, verifiable statistics
- Use consistent formatting throughout
- Detail specific risks with concrete mitigation plans
- Emphasize what each team member learned (required!)
- Keep Excel and markdown synchronized
- Proofread multiple times before submission

Excel File Created:

A comprehensive Project List Excel file has been created with 6 sheets:

- Project Overview - Team information and roles
- Timeline & Milestones - Project phases and key milestones
- Task Assignment - 53 detailed tasks with assignments
- Weekly Schedule - Week-by-week activities
- Risk Register - Risks and mitigation strategies
- Progress Tracking - GitHub stats and metrics

Next Steps:

1. Review and customize this document for your specific project details
2. Fill in all [TODO] items with actual data from your project
3. Update the Excel file with actual progress and dates
4. Complete Chapters 3-7 (Requirements, Architecture, Design, Test Plan, Demo)
5. Prepare final presentation and demo materials

Document Version: 2.0 (Enhanced)

Last Updated: [TODO: Add date when finalized]

Status: Draft - Awaiting TODO completion

DOCUMENT CHANGELOG

Version 2.0 (Enhanced) - Current Version

- ✅ Added 3 additional risks (R006, R007, R008) for comprehensive risk coverage (8 total)
- ✅ Enhanced GitHub metrics tracking with detailed categories
- ✅ Added License & Ethical Standards to Professional Standards section
- ✅ Included acceptance criteria for all deliverables
- ✅ Added detailed weekend meeting structure and schedule
- ✅ Created Document Completeness Summary table
- ✅ Added Rubric Compliance Check table
- ✅ Enhanced "How to Fill in TODO Items" with step-by-step guide
- ✅ Added Quality Checklist and Common Mistakes sections
- ✅ Improved Risk Priority Matrix visualization
- ✅ Updated Excel file with 8 comprehensive risks

Version 1.0 (Initial)

- Initial document with Chapters 1 & 2
- Basic structure following rubric requirements
- 5 initial risks identified
- Core sections complete