**FEATURE LIST**

**1 Authentication & Authorization**

**1.1 User Authentication**

* ✅ User Registration
  + Username, email, password validation
  + Automatic role assignment
  + Email uniqueness check
  + Password encryption (BCrypt)
* ✅ User Login
  + Credentials validation
  + JWT access token generation (15 min expiry)
  + JWT refresh token generation (7 days expiry)
  + Return user info and role
* ✅ Token Management
  + Refresh access token using refresh token
  + Token validation
  + Token revocation on logout
  + Store refresh tokens in database
* ✅ Password Management
  + Forgot password (generate reset token)
  + Reset password with token
  + Password confirmation validation

**1.2 Authorization**

* ✅ Role-Based Access Control (RBAC)
  + ADMIN: Full system access
  + STAFF: Operations management
  + CUSTOMER: Limited to own data
* ✅ JWT-based Stateless Authentication
  + Token in Authorization header
  + Automatic token validation per request
  + Security context management
* ✅ Method-Level Security
  + @PreAuthorize annotations
  + Role checking in controllers
  + Custom security utilities

**2 Customer Management**

**2.1 Customer Profile (All Roles)**

* ✅ View Customer List (ADMIN, STAFF)
  + Pagination support
  + Search by name, email, phone
  + View total vehicles and claims
* ✅ View Customer Details (ADMIN, STAFF, CUSTOMER-own)
  + Full profile information
  + Associated vehicles list
  + Recent warranty claims
  + Customer statistics
* ✅ View My Profile (CUSTOMER)
  + Own profile information
  + Vehicles owned
  + Warranty claims history
  + Recent activity

**2.2 Customer CRUD**

* ✅ Create Customer (ADMIN, STAFF)
  + Required: name, email, phone, address
  + Optional: date of birth
  + Link to user account
  + Auto-generate customer ID (UUID)
* ✅ Update Customer (ADMIN, STAFF, CUSTOMER-limited)
  + ADMIN/STAFF: All fields
  + CUSTOMER: Phone and address only
  + Email change requires approval
* ✅ Delete Customer (ADMIN only)
  + Only if no vehicles or claims
  + Cascade checks
  + Confirmation required

**2.3 Customer Features**

* ✅ Customer Statistics (ADMIN, STAFF)
  + Total customers count
  + New customers this month
  + Customers with active claims
  + Top customers by vehicles/claims
* ✅ Search Customers (ADMIN, STAFF)
  + By name, email, phone
  + Pagination support
  + Result sorting
* ✅ Get Customer by User ID (ADMIN, STAFF)
  + Link user account to customer profile

**3 Vehicle Management**

**3.1 Vehicle CRUD**

* ✅ View All Vehicles (ADMIN, STAFF)
  + Pagination support
  + Search by name, model
  + View customer information
* ✅ View Vehicle Details (ADMIN, STAFF, CUSTOMER-own)
  + Full vehicle information
  + Service history
  + Warranty claims
  + Owner information
* ✅ View My Vehicles (CUSTOMER)
  + List of owned vehicles
  + Basic information
  + Quick access to details
* ✅ Create Vehicle (ADMIN, STAFF)
  + Required: name, model, VIN, year, color, engine
  + Link to customer
  + VIN uniqueness validation
* ✅ Update Vehicle (ADMIN, STAFF)
  + Modify vehicle information
  + Change ownership
  + Update specifications
* ✅ Delete Vehicle (ADMIN, STAFF)
  + Only if no warranty claims
  + Cascade checks

**3.2 Vehicle Search & Filter**

* ✅ Search Vehicles
  + By model
  + By brand/name
  + By VIN (ADMIN, STAFF only)
  + Pagination support
* ✅ Get Vehicles by Customer (ADMIN, STAFF)
  + View customer's vehicle fleet
  + Pagination support
* ✅ Vehicles with Expiring Warranty (ADMIN, STAFF)
  + Configurable days threshold
  + Alert generation
  + Proactive customer notification

**4 Parts Management**

**4.1 Parts Inventory**

* ✅ View All Parts (ADMIN, STAFF)
  + Pagination support
  + Search by name, part number
  + Category filtering
* ✅ View Part Details (ADMIN, STAFF)
  + Full part information
  + Usage history
  + Stock levels
* ✅ Create Part (ADMIN, STAFF)
  + Auto-generate part ID with category prefix
  + Required: name, number, category, price, quantity, supplier
  + Warranty period specification
* ✅ Update Part (ADMIN, STAFF)
  + Modify part information
  + Update pricing
  + Adjust supplier details
* ✅ Delete Part (ADMIN only)
  + Only if not used in service history
  + Cascade checks

**4.2 Inventory Management**

* ✅ Update Part Quantity (ADMIN, STAFF)
  + ADD: Increase stock
  + SET: Set absolute quantity
  + SUBTRACT: Decrease stock
  + Reason tracking
  + Audit trail
* ✅ Low Stock Alert (ADMIN, STAFF)
  + Configurable threshold
  + Real-time monitoring
  + Alert notification
* ✅ Part Usage Statistics (ADMIN, STAFF)
  + Usage by time period
  + Top vehicle models using part
  + Average usage per month
  + Demand forecasting

**4.3 Parts Search & Filter**

* ✅ Search by Category
  + BATTERY, MOTOR, BRAKE, SUSPENSION, etc.
  + Pagination support
* ✅ Search by Supplier
  + Filter by supplier name
  + Pagination support
* ✅ Part Categories
  + BATTERY
  + MOTOR
  + BRAKE
  + SUSPENSION
  + ELECTRONIC
  + BODY
  + INTERIOR
  + TIRE

**5 Service History Management**

**5.1 Service Records**

* ✅ View All Service Histories (ADMIN, STAFF)
  + Pagination support
  + Search by type, description
  + View associated vehicle and parts
* ✅ View Service History Details (ADMIN, STAFF, CUSTOMER-own)
  + Full service information
  + Technician details
  + Parts used
  + Labor hours
  + Costs
* ✅ View My Vehicle Service Histories (CUSTOMER)
  + Service records for owned vehicles
  + Filter by service type
  + Pagination support
* ✅ Create Service History (ADMIN, STAFF)
  + Record service date
  + Service type selection
  + Part association
  + Cost calculation
  + Technician assignment
  + Labor hours tracking
* ✅ Update Service History (ADMIN, STAFF)
  + Modify service details
  + Update costs
  + Add notes
* ✅ Delete Service History (ADMIN only)
  + Cascade checks

**5.2 Service Types**

* MAINTENANCE (Regular maintenance)
* REPAIR (Repairs)
* REPLACEMENT (Part replacement)
* INSPECTION (Checks and diagnostics)
* RECALL (Product recalls)
* WARRANTY (Warranty service)

**5.3 Service Analytics**

* ✅ Service Statistics (ADMIN, STAFF)
  + Total services count
  + Total and average costs
  + Services by type breakdown
  + Top parts used
  + Top technicians
  + Monthly trends
* ✅ Search by Date Range (ADMIN, STAFF)
  + Filter by start and end date
  + Pagination support
* ✅ Search by Type (ADMIN, STAFF)
  + Filter by service type
* ✅ Search by Vehicle (ADMIN, STAFF, CUSTOMER-own)
  + Vehicle service history
* ✅ Search by Part (ADMIN, STAFF)
  + Part usage tracking

**6 Warranty Claims Management**

**6.1 Warranty Claims CRUD**

* ✅ View All Warranty Claims (ADMIN, STAFF)
  + Pagination support
  + Search by description, claim number
  + View status and costs
* ✅ View Warranty Claim Details (ADMIN, STAFF, CUSTOMER-own)
  + Full claim information
  + Vehicle details
  + Customer information
  + Cost estimates and actuals
  + Status history
* ✅ View My Warranty Claims (CUSTOMER)
  + Own claims only
  + Filter by status
  + Pagination support
* ✅ Create Warranty Claim (ADMIN, STAFF, CUSTOMER)
  + Auto-generate claim number (WC-YYYY-XXX)
  + Link to vehicle
  + Estimated cost
  + Description and notes
  + Initial status: PENDING
* ✅ Update Warranty Claim (ADMIN, STAFF, CUSTOMER-limited)
  + ADMIN/STAFF: All fields
  + CUSTOMER: Description and notes only
  + Status restrictions (cannot modify completed/rejected)
* ✅ Delete Warranty Claim (ADMIN only)

**6.2 Claims Workflow**

* ✅ Claim Status Flow
  + PENDING → APPROVED/REJECTED → COMPLETED
  + Status transition validation
* ✅ Approve Claim (ADMIN, STAFF)
  + Set approved cost
  + Add approval notes
  + Update approved date
* ✅ Reject Claim (ADMIN, STAFF)
  + Provide rejection reason
  + Update rejected date
  + Notify customer
* ✅ Complete Claim (ADMIN, STAFF)
  + Set final cost
  + Add completion notes
  + Update completed date

**6.3 Claims Search & Filter**

* ✅ Search by Vehicle (ADMIN, STAFF)
  + View all claims for specific vehicle
* ✅ Search by Status (ADMIN, STAFF)
  + Filter by PENDING, APPROVED, REJECTED, COMPLETED
* ✅ Search by Customer (ADMIN, STAFF)
  + View customer claim history

**7 System Features**

**7.1 Security**

* ✅ JWT Authentication
  + Stateless authentication
  + Token-based security
  + Automatic expiration
* ✅ Password Security
  + BCrypt encryption
  + Strong password requirements
  + Password reset functionality
* ✅ Role-Based Access Control
  + Method-level security
  + Resource-based permissions
  + Custom authorization logic
* ✅ Audit Trail
  + Track all CRUD operations
  + User activity logging
  + Timestamp tracking
  + Created by / Updated by tracking

**7.2 Data Validation**

* ✅ Input Validation
  + Required fields checking
  + Format validation (email, phone, VIN)
  + Range validation (year, cost, quantity)
  + Uniqueness constraints (VIN, email, part number)
* ✅ Business Rule Validation
  + Customer ownership verification
  + Warranty period validation
  + Stock quantity checks
  + Status workflow enforcement

**7.3 API Features**

* ✅ RESTful API Design
  + Standard HTTP methods
  + Consistent URL structure
  + JSON request/response format
* ✅ Pagination
  + Page number and size parameters
  + Total elements and pages metadata
  + First/last page indicators
* ✅ Search Functionality
  + Full-text search
  + Multiple field search
  + Case-insensitive matching
* ✅ Error Handling
  + Standardized error responses
  + HTTP status codes
  + Detailed error messages
  + Validation error details

**7.4 Performance**

* ✅ Database Indexing
  + Indexed on commonly searched fields
  + VIN, email, phone, part\_number unique indexes
  + Date fields indexed for range queries
* ✅ Query Optimization
  + Pagination to limit result sets
  + Lazy loading for related entities
  + Selective field retrieval

**8 Integration Features**

**8.1 Cross-Module Integration**

* ✅ Customer-Vehicle Link
  + Customer can have multiple vehicles
  + Vehicle belongs to one customer
  + Cascading relationship rules
* ✅ Vehicle-Service History Link
  + Track all services per vehicle
  + Part usage tracking
  + Cost accumulation
* ✅ Vehicle-Warranty Claims Link
  + Claims linked to specific vehicle
  + Warranty eligibility validation
* ✅ Parts-Service History Link
  + Track part usage
  + Automatic inventory deduction
  + Usage statistics
* ✅ User-Customer Link
  + One-to-one relationship
  + Authentication to customer mapping
  + Role-based customer access

**8.2 Automated Processes**

* ✅ Auto-ID Generation
  + Customer ID (UUID)
  + Claim number (WC-YYYY-XXX)
  + Part ID (PART-CATEGORY-XXX)
* ✅ Inventory Management
  + Auto-deduct on service completion
  + Low stock alerts
  + Reorder level tracking
* ✅ Notification System (Ready for implementation)
  + Warranty expiration alerts
  + Low stock alerts
  + Claim status updates
  + Service reminders

**9 Reporting & Analytics**

**9.1 Customer Analytics**

* ✅ Customer Statistics
  + Total customers
  + New customers this month
  + Customers with active claims
  + Top customers by vehicles/claims

**9.2 Service Analytics**

* ✅ Service Statistics
  + Total services and costs
  + Services by type breakdown
  + Top parts and technicians
  + Monthly trends

**9.3 Parts Analytics**

* ✅ Part Usage Statistics
  + Usage by time period
  + Top vehicle models
  + Average usage per month
  + Demand forecasting data

**9.4 Warranty Analytics**

* ✅ Claims Statistics
  + Claims by status
  + Average claim cost
  + Approval rate
  + Processing time metrics