COMPLETE FEATURE REQUIREMENTS

POS & Inventory Management System

Three-Part System Architecture Breakdown

PART 1: ADMIN DASHBOARD (Next.js)

Web-Based Administrative Interface

1.1 AUTHENTICATION & ACCESS CONTROL

User Management

- **Create User Accounts**
  - Add new employees with unique username and password
  - Assign employee details (Name, Phone, Email, Employee ID)
  - Set employee type (Admin, Manager, Cashier, Technician)
  - Generate secure encrypted passwords
  - Send login credentials to employee
- **User Profile Management**
  - Edit employee information
  - Update contact details
  - Change passwords (admin-initiated or self-service)
  - Deactivate/reactivate employee accounts
  - Delete user accounts with confirmation
- **Role-Based Access Control (RBAC)**
  - Create custom roles with specific permissions
  - Assign roles to users
  - Define what each role can view and modify
  - Set module-level access (Inventory, Sales, Repairs, Reports)
  - Configure action-level permissions (Create, Read, Update, Delete)

Permission Matrix Configuration

- **Admin Permissions**
  - Full system access
  - User creation and management
  - System configuration
  - All reports access
  - Database management
  - Backup and restore operations

- **Manager Permissions**
  - Authorize returns and refunds
  - Approve high-value discounts
  - View all employee performance reports
  - Manage inventory (add/edit/delete products)
  - Access financial reports
  - Override cashier restrictions
- **Cashier Permissions**
  - Process sales transactions
  - Accept payments
  - Generate receipts
  - Apply standard discounts
  - View own performance reports
  - No return/refund authorization
- **Technician Permissions**
  - Create and manage repair jobs
  - Set repair pricing
  - Update job status
  - View assigned repairs
  - View own performance reports
  - No sales or inventory access

1.2 INVENTORY MANAGEMENT

Product Master Management

- **Add Products**
  - Manual product entry form
  - Bulk import via Excel/CSV
  - Product name and description
  - Product category selection
  - Brand/manufacturer information
  - Generate or assign barcode
  - Set purchase price
  - Set selling price
  - Set minimum stock threshold
  - Upload product images
  - Add product specifications
  - Set tax rates
- **Edit Products**
  - Modify product details
  - Update pricing (with audit log)
  - Change stock thresholds
  - Update images and specifications
  - Activate/deactivate products
- **Delete Products**
  - Soft delete with audit trail
  - Confirm deletion with reason

- Prevent deletion if stock exists (warning)
- Log deletion with user ID and timestamp
- **Product Search & Filters**
    - Search by product name
    - Search by barcode
    - Search by category
    - Search by brand
    - Filter by price range
    - Filter by stock status (In Stock, Low Stock, Out of Stock)
    - Sort by name, price, stock quantity

Category & Brand Management

- **Category Management**
    - Create product categories
    - Create sub-categories (hierarchical structure)
    - Edit category names
    - Delete categories (with product reassignment)
    - Assign category-specific attributes
- **Brand Management**
    - Add brand/manufacturer names
    - Edit brand information
    - Associate brands with products
    - Brand-wise inventory reports

Stock Management

- **Stock Entry**
    - Record new stock arrivals
    - Enter quantity received
    - Record supplier information
    - Enter purchase invoice details
    - Set batch numbers (if applicable)
    - Record expiry dates (if applicable)
- **Stock Adjustment**
    - Increase stock quantity
    - Decrease stock quantity
    - Reason for adjustment (Damage, Theft, Return to Supplier, Count Correction)
    - Audit trail for all adjustments
- **Stock Transfer**
    - Transfer between locations (if multi-location)
    - Transfer quantity specification
    - Approval workflow
- **Low Stock Alerts**

- Dashboard notification panel
- Product-wise low stock list
- Email alerts to admin (configurable)
- Suggested reorder quantities

Barcode Management

- **Barcode Generation**
  - Auto-generate barcodes for new products
  - Custom barcode assignment option
  - Barcode format selection (EAN-13, UPC, Code 128)
  - Bulk barcode generation
- **Barcode Label Printing**
  - Select products for label printing
  - Choose label size and format
  - Preview before printing
  - Include product name, price, and barcode
  - Print to connected label printer

Supplier Management

- **Supplier Database**
  - Add supplier details (Name, Company, Contact Person)
  - Phone numbers and email addresses
  - Physical address
  - Tax identification numbers
  - Payment terms and credit period
  - Supplier rating/notes
- **Supplier Products**
  - Link products to suppliers
  - Multiple suppliers per product
  - Supplier pricing history
  - Preferred supplier selection

1.3 EMPLOYEE MANAGEMENT & TRACKING

Employee Profiles

- **Profile Dashboard**
  - View all employees in list/grid format
  - Employee photo and basic info card
  - Current status (Active, On Leave, Inactive)
  - Last login timestamp
  - Quick action buttons (Edit, View Details, Deactivate)
- **Individual Profile View**
  - Personal information section
  - Role and permissions display
  - Employment history

- Contact information
- Emergency contacts
- Documents and certifications

Attendance & Session Management

- **Clock-In/Clock-Out Records**
  - Daily attendance log for each employee
  - Login and logout timestamps
  - Total working hours calculation
  - Monthly attendance summary
  - Attendance reports (daily, weekly, monthly)
  - Export attendance data to Excel
- **Session History**
  - View active sessions
  - Session duration tracking
  - IP address and device information
  - Force logout capability

Performance Tracking

- **Sales Performance (Cashiers)**
  - Total sales processed
  - Number of transactions handled
  - Average transaction value
  - Revenue generated
  - Discounts applied
  - Returns processed
  - Daily, weekly, monthly breakdowns
- **Repair Performance (Technicians)**
  - Total repair jobs completed
  - Revenue from repairs
  - Average repair time
  - Customer satisfaction ratings (if collected)
  - Pending vs. completed jobs
  - Job complexity distribution
- **Overall Performance Metrics**
  - Productivity score calculation
  - Comparison with team averages
  - Performance trends over time
  - Goal achievement tracking

Audit Trail & Activity Logs

- **User Activity Monitoring**
  - All login/logout events
  - Product additions/modifications/deletions
  - Price changes with old and new values
  - Stock adjustments with reasons
  - Sales transactions processed

    - Returns and refunds authorized
    - Report access history
- **Audit Log View**
    - Filterable by user, date range, action type
    - Detailed action descriptions
    - Timestamp and IP address
    - Barcode involvement (if applicable)
    - Export audit logs to Excel

1.4 REPAIR & SERVICE MANAGEMENT

Repair Job Management

- **View All Repair Jobs**
    - List view with filters (Status, Technician, Date)
    - Job ID, Customer Name, Device Type
    - Assigned Technician
    - Current status indicator
    - Expected completion date
    - Search by customer phone or device IMEI
- **Job Details View**
    - Customer information
    - Device details (Brand, Model, IMEI, Issue Description)
    - Technician assigned
    - Parts required and costs
    - Labor charges
    - Total cost calculation
    - Job creation and update timestamps
    - Status history timeline
    - Customer communications log
- **Create Repair Job (Manual Entry)**
    - Customer information form
    - Device details input
    - Issue description (text area)
    - Select technician from dropdown
    - Set priority (Low, Normal, High, Urgent)
    - Expected completion date
    - Generate unique Job ID
    - Print customer receiving slip
- **Edit Repair Job**
    - Update job details
    - Reassign to different technician
    - Modify priority or expected date
    - Add internal notes
- **Job Status Workflow**
    - Received: Initial status when job is created
    - In-Progress: Technician has started work
    - Awaiting Parts: Parts need to be ordered

- Ready: Job completed, ready for customer pickup
- Delivered: Customer has collected device
- Cancelled: Job cancelled with reason

Technician Assignment & Workload

- **Technician Dashboard**
  - List of all technicians
  - Current workload (number of active jobs)
  - Performance metrics display
  - Availability status
- **Job Assignment**
  - Auto-assign to technician with lowest workload
  - Manual assignment by admin/manager
  - Reassignment capability
  - Notification to technician

Repair History & Search

- **Customer Repair History**
  - Search by customer phone number
  - Search by device IMEI
  - View all past repairs for customer
  - Device repair frequency
  - Total spent on repairs
- **Device History**
  - All repairs done on specific IMEI
  - Parts replaced history
  - Recurring issues identification

1.5 WARRANTY MANAGEMENT

Warranty Registration

- **Product Warranty Setup**
  - Set warranty period per product/category
  - Warranty terms and conditions entry
  - Warranty type (Manufacturer, Store, Extended)
  - Coverage details (Parts, Labor, Both)
- **Warranty Activation**
  - Auto-activate warranty on sale
  - Link serial number/IMEI to sale transaction
  - Record warranty start and end dates
  - Generate warranty card/certificate

Warranty Claims

- **Claim Registration**

- Search product by serial number/IMEI
    - Verify warranty validity
    - Record claim details (Issue, Customer complaint)
    - Attach supporting documents (Photos, invoices)
    - Create repair job linked to warranty claim
- **Claim Tracking**
    - List all warranty claims
    - Status tracking (Registered, Under Review, Approved, Rejected, Completed)
    - Filter by status, date, product
    - Resolution details and timeline
- **Claim to Supplier**
    - Forward claim to supplier
    - Track supplier approval status
    - Record supplier credit/replacement
    - Document supplier response

Warranty Reports

- **Warranty Analytics**
    - Total active warranties
    - Expiring warranties (next 30 days)
    - Claim rate by product/category
    - Approval vs. rejection rates
    - Supplier claim success rates

1.6 REPORTING & ANALYTICS

Financial Reports

- **Daily Reports**
    - Day Open Report (starting cash float)
    - Day Close Report (end of day cash count)
    - Total cash sales
    - Total card/digital payments
    - Total repair service revenue
    - Total revenue (sales + repairs)
    - Payment mode breakdown
    - Discounts given
    - Returns/refunds processed
    - Expected vs. actual cash difference
- **Weekly/Monthly Reports**
    - Total revenue by week/month
    - Sales trend graphs
    - Comparison with previous periods
    - Growth percentage calculation
- **Profit & Loss Report**
    - Total sales revenue
    - Cost of goods sold (COGS)

    - Gross profit calculation
    - Operating expenses (if tracked)
    - Net profit/loss
    - Profit margin percentages
    - Category-wise profitability

Inventory Reports

- **Stock Status Report**
    - Current stock levels for all products
    - Stock value calculation (Quantity × Purchase Price)
    - Low stock items list
    - Out of stock items list
    - Overstock items (above threshold)
- **Stock Movement Report**
    - Date range selection
    - Product-wise in/out movement
    - Stock addition sources (Purchase, Returns, Adjustments)
    - Stock reduction reasons (Sales, Damage, Theft)
    - Inventory turnover rate
- **Dead Stock Report**
    - Products with no sales in X days (configurable)
    - Aging analysis
    - Suggested actions (Discount, Liquidate, Return to supplier)

Sales Reports

- **Sales Summary**
    - Total sales by date range
    - Number of transactions
    - Average transaction value
    - Top-selling products (by quantity and revenue)
    - Category-wise sales distribution
    - Payment method distribution
- **Product Sales Analysis**
    - Product-wise sales quantity and revenue
    - Sales trends over time
    - Seasonal patterns identification
    - Fast-moving vs. slow-moving products
- **Discount Analysis**
    - Total discounts given by period
    - Discount percentage distribution
    - Employee-wise discount patterns
    - Impact on profitability

Employee Performance Reports

- **Individual Performance**
    - Select employee from dropdown
    - Total revenue generated

    - Number of transactions/jobs
    - Average value per transaction
    - Work hours logged
    - Productivity metrics
    - Date range customization
- **Comparative Performance**
    - All employees performance table
    - Ranking by revenue/productivity
    - Visual charts for comparison
    - Team performance average
    - Top performers identification
- **Technician-Specific Reports**
    - Total repair jobs completed
    - Revenue from repairs
    - Average time per job
    - Customer satisfaction scores
    - Pending job count

Custom Reports

- **Report Builder**
    - Select data fields to include
    - Apply filters and conditions
    - Choose grouping and sorting
    - Save custom report templates
    - Schedule automatic generation
- **Report Export**
    - Export all reports to Excel (.xlsx)
    - Export to PDF format
    - Export to CSV for external analysis
    - Email report directly from dashboard
    - Scheduled report delivery

Dashboard Analytics

- **Real-Time Dashboard**
    - Today's sales counter (live updates)
    - Current stock value
    - Low stock alerts count
    - Active repair jobs count
    - Cash vs. card ratio (pie chart)
    - Sales trend graph (last 7/30 days)
    - Top 5 selling products today
    - Recent transactions list
- **KPI Widgets**
    - Revenue target vs. achieved
    - Average transaction value trend
    - Customer return rate
    - Inventory turnover ratio
    - Profit margin trend

1.7 SYSTEM CONFIGURATION

General Settings

- **Company Information**
  - Company name and logo upload
  - Business address
  - Contact numbers and email
  - Tax registration numbers
  - Business hours configuration
- **Store Settings**
  - Store name (if multi-location)
  - Store code/ID
  - Currency selection
  - Tax configuration (GST, VAT, Sales Tax)
  - Receipt footer message customization

User Preferences

- **Notification Settings**
  - Email notification preferences
  - Low stock alert threshold per product
  - Daily report email schedule
  - Warranty expiry alert timing
- **Display Settings**
  - Date format (DD/MM/YYYY, MM/DD/YYYY)
  - Time format (12-hour, 24-hour)
  - Number format (thousand separators)
  - Language selection (if multi-language)

Backup & Data Management

- **Backup Configuration**
  - Automated backup schedule (Daily, Weekly)
  - Backup retention period (2 years)
  - Manual backup trigger
  - Backup download option
  - Restore from backup
- **Data Export**
  - Export complete database
  - Select tables for export
  - Export format selection
  - Scheduled export setup

Integration Settings

- **Hardware Configuration**
  - Receipt printer settings (IP/USB)

    - Barcode scanner configuration
    - Label printer setup
    - Cash drawer settings
- **Third-Party Integrations**
    - Payment gateway configuration (if used)
    - SMS gateway for notifications
    - Email service configuration
    - Cloud storage sync settings

1.8 CUSTOMER MANAGEMENT

Customer Database

- **Add Customer**
    - Customer name
    - Phone number (primary identifier)
    - Email address
    - Physical address
    - Date of birth (for offers)
    - Customer type (Retail, Wholesale, VIP)
- **Customer List**
    - Search by name or phone
    - Filter by customer type
    - Sort by registration date, total purchases
    - View customer purchase history
- **Customer Profile**
    - Basic information display
    - Total purchases to date
    - Average purchase value
    - Last purchase date
    - Repair history
    - Warranty registrations
    - Outstanding payments (if credit allowed)

Customer Communications

- **SMS Notifications**
    - Repair ready notifications
    - Warranty expiry reminders
    - Promotional offers
    - Payment reminders
- **Email Communications**
    - Receipt email after purchase
    - Warranty certificates
    - Service completion notifications
    - Marketing campaigns

1.9 SUPPLIER MANAGEMENT

Purchase Orders

- **Create Purchase Order**
  - Select supplier from list
  - Add products with quantities
  - Expected delivery date
  - Payment terms
  - Generate PO number
  - Print/email PO to supplier
- **PO Tracking**
  - List all purchase orders
  - Status: Pending, Partially Received, Completed, Cancelled
  - Filter by supplier, date, status
  - Expected vs. actual delivery tracking
- **Receive Inventory**
  - Link to existing PO
  - Scan or enter received products
  - Verify quantities against PO
  - Record discrepancies
  - Update inventory automatically
  - Record invoice details

Supplier Performance

- **Supplier Reports**
  - Total purchases per supplier
  - On-time delivery rate
  - Quality issues tracking
  - Payment history
  - Preferred supplier identification

1.10 PRICING & DISCOUNT MANAGEMENT

Price Management

- **Bulk Price Updates**
  - Select multiple products
  - Apply percentage increase/decrease
  - Set fixed price adjustments
  - Schedule price changes (future date)
  - Audit trail for price changes
- **Price History**
  - View historical prices for products
  - Price change timeline
  - Who changed the price and when

Discount Configuration

- **Discount Rules**
  - Create discount codes
  - Set percentage or fixed amount discounts
  - Set validity period (start and end dates)
  - Minimum purchase requirements
  - Applicable products/categories
  - Customer type restrictions
- **Promotional Offers**
  - Buy X Get Y free
  - Bundle discounts
  - Seasonal sales setup
  - Flash sales configuration

PART 2: BACKEND API (Node.js)

RESTful API & Business Logic Layer

2.1 AUTHENTICATION & AUTHORIZATION

Authentication Endpoints

- **POST /api/auth/login**
  - Accept username and password
  - Validate credentials against PostgreSQL database
  - Hash password verification using bcrypt
  - Generate JWT access token (30-minute expiry)
  - Generate refresh token (7-day expiry)
  - Return user profile with role and permissions
  - Log successful login with timestamp and IP
  - Return error for invalid credentials (generic message for security)
- **POST /api/auth/logout**
  - Accept JWT token
  - Invalidate token in blacklist table
  - Log logout event with timestamp
  - Return success confirmation
- **POST /api/auth/refresh-token**
  - Accept refresh token
  - Validate refresh token
  - Generate new access token
  - Return new JWT token
  - Return error if refresh token expired
- **POST /api/auth/change-password**
  - Accept current password and new password

- Validate current password
  - Hash new password with bcrypt
  - Update password in database
  - Invalidate all existing sessions
  - Send notification email
  - Log password change event

Authorization Middleware

- **Token Verification Middleware**
  - Extract JWT from Authorization header
  - Verify token signature and expiry
  - Check if token is blacklisted
  - Attach user object to request
  - Return 401 if token invalid/expired
- **Permission Checking Middleware**
  - Verify user has required role for endpoint
  - Check specific permission flags
  - Allow/deny access based on RBAC configuration
  - Return 403 if insufficient permissions
  - Log unauthorized access attempts

2.2 USER MANAGEMENT API

User CRUD Operations

- **GET /api/users**
  - List all users with pagination
  - Filter by role, status (active/inactive)
  - Search by name or username
  - Sort by name, created date
  - Return user list with total count
- **GET /api/users/:id**
  - Fetch single user by ID
  - Return complete user profile
  - Include role and permissions
  - Exclude password field
  - Return 404 if user not found
- **POST /api/users**
  - Create new user account
  - Validate unique username
  - Hash password before storage
  - Assign default role or specified role
  - Set initial permissions
  - Send welcome email with credentials
  - Return created user object
  - Log user creation event
- **PUT /api/users/:id**

- Update user details
- Allow name, email, phone, role updates
- Validate data before update
- Log changes in audit trail
- Return updated user object

- **DELETE /api/users/:id**
  - Soft delete user (mark as inactive)
  - Prevent deletion of own account
  - Log deletion with reason
  - Return success confirmation

Role & Permission Management

- **GET /api/roles**
  - List all available roles
  - Return role name and permissions array
  - Include user count per role
- **POST /api/roles**
  - Create custom role
  - Define permission set
  - Validate permission keys
  - Return created role object
- **PUT /api/roles/:id**
  - Update role permissions
  - Validate changes
  - Apply to all users with this role
  - Log permission changes

2.3 PRODUCT & INVENTORY API

Product Management

- **GET /api/products**
  - List all products with pagination
  - Support filters: category, brand, price range, stock status
  - Search by name or barcode
  - Sort by name, price, stock quantity
  - Return product array with metadata (total count, pages)
- **GET /api/products/:id**
  - Fetch single product by ID or barcode
  - Return complete product details
  - Include current stock quantity
  - Include supplier information
  - Return 404 if not found
- **POST /api/products**
  - Create new product
  - Validate required fields
  - Auto-generate barcode if not provided

    - Set initial stock quantity
    - Calculate profit margin
    - Return created product object
    - Log product creation
- **PUT /api/products/:id**
    - Update product details
    - Allow price, stock, description updates
    - Log price changes in audit trail
    - Recalculate profit margins
    - Return updated product
- **DELETE /api/products/:id**
    - Soft delete product
    - Check if product has stock
    - Warn if product has pending sales/orders
    - Log deletion
    - Return success confirmation

Stock Management

- **POST /api/stock/adjustment**
    - Adjust stock quantity (increase/decrease)
    - Require reason for adjustment
    - Validate adjustment quantity
    - Update product stock in database
    - Create stock movement record
    - Log adjustment with user ID
    - Return updated stock quantity
- **POST /api/stock/transfer**
    - Transfer stock between locations
    - Validate source and destination
    - Check sufficient stock at source
    - Decrease from source, increase at destination
    - Create transfer record
    - Log transfer details
- **GET /api/stock/movements**
    - List stock movements by date range
    - Filter by product, type (in/out), reason
    - Return movement history with details
    - Calculate running stock balance
- **GET /api/stock/low-stock**
    - Fetch products below minimum threshold
    - Sort by urgency (current stock vs. minimum)
    - Return product list with reorder suggestions

Category & Brand APIs

- **GET /api/categories**
    - List all categories (hierarchical structure)
    - Return parent-child relationships
    - Include product count per category

- **POST /api/categories**
  - Create new category
  - Set parent category (for sub-categories)
  - Return created category
- **GET /api/brands**
  - List all brands
  - Include product count per brand
- **POST /api/brands**
  - Create new brand
  - Return created brand object

Barcode Management

- **POST /api/barcodes/generate**
  - Generate barcode for product
  - Accept format (EAN-13, UPC, Code128)
  - Ensure uniqueness
  - Return barcode string and image URL
- **GET /api/barcodes/validate/:barcode**
  - Check if barcode already exists
  - Return boolean and product if exists

2.4 SALES & POS API

Sales Transaction

- **POST /api/sales**
  - Create new sale transaction
  - Accept product array with quantities
  - Calculate total amount
  - Apply discounts
  - Accept payment details (cash/card/split)
  - Reduce stock for sold items
  - Generate receipt number
  - Update cashier sales statistics
  - Return transaction object with receipt data
  - Log sale in audit trail
- **GET /api/sales**
  - List all sales with pagination
  - Filter by date range, cashier, payment method
  - Search by receipt number or customer phone
  - Sort by date, amount
  - Return sales array with totals
- **GET /api/sales/:id**
  - Fetch single sale details
  - Return complete transaction breakdown
  - Include products, quantities, prices
  - Show payment details

    - Return receipt data

Return & Refund

- **POST /api/sales/return**
    - Process return request
    - Require original receipt/transaction ID
    - Scan product barcodes for return
    - Require manager authorization (barcode scan)
    - Increase stock for returned items
    - Process refund (cash/card)
    - Create return transaction record
    - Link to original sale
    - Log return with manager approval
- **GET /api/sales/returns**
    - List all return transactions
    - Filter by date, product, reason
    - Return returns array with details

Payment Processing

- **POST /api/payments/split**
    - Handle split payments
    - Accept multiple payment modes (cash + card)
    - Calculate amounts per mode
    - Validate total matches sale amount
    - Return payment confirmation
- **GET /api/payments/summary**
    - Get payment summary by date range
    - Break down by payment method
    - Return totals for cash, card, digital payments

Hold & Resume

- **POST /api/sales/hold**
    - Hold current transaction
    - Generate hold ID
    - Store cart items temporarily
    - Return hold ID for later retrieval
- **GET /api/sales/hold/:id**
    - Retrieve held transaction
    - Return cart items and customer details
    - Delete hold record after retrieval

2.5 REPAIR & SERVICE API

Repair Job Management

- **POST /api/repairs**
  - Create new repair job
  - Accept customer and device details
  - Generate unique Job ID
  - Assign to technician (auto or manual)
  - Set initial status (Received)
  - Return job object with Job ID
- **GET /api/repairs**
  - List all repair jobs with pagination
  - Filter by status, technician, date range
  - Search by Job ID, customer phone, IMEI
  - Sort by date, priority, status
  - Return job array with metadata
- **GET /api/repairs/:jobId**
  - Fetch single repair job details
  - Return complete job information
  - Include customer, device, technician details
  - Show status history timeline
  - Return parts and pricing breakdown
- **PUT /api/repairs/:jobId**
  - Update repair job details
  - Allow status updates
  - Update technician notes
  - Add internal comments
  - Log all changes with timestamp
  - Return updated job object
- **PUT /api/repairs/:jobId/status**
  - Update job status
  - Validate status transition (workflow)
  - Notify customer on status change
  - Log status change with timestamp and user
  - Return updated status

Technician Operations

- **POST /api/repairs/:jobId/pricing**
  - Technician sets repair cost
  - Accept parts cost array
  - Accept labor charges
  - Calculate total repair cost
  - Link pricing to technician profile
  - Return pricing breakdown
- **GET /api/repairs/technician/:technicianId**
  - Fetch all jobs for specific technician
  - Filter by status (active, completed)
  - Return job list with current workload
- **PUT /api/repairs/:jobId/assign**
  - Assign/reassign job to technician
  - Notify technician of new assignment
  - Log assignment change

- Return updated job

Repair History

- **GET /api/repairs/customer/:phone**
  - Fetch all repairs for customer phone
  - Return chronological repair history
  - Include device and issue details
- **GET /api/repairs/device/:imei**
  - Fetch all repairs for specific device IMEI
  - Return repair history for device
  - Identify recurring issues

2.6 WARRANTY API

Warranty Management

- **POST /api/warranties**
  - Register warranty on sale
  - Link to sale transaction
  - Record serial number/IMEI
  - Calculate warranty end date
  - Return warranty certificate data
- **GET /api/warranties/:serialNumber**
  - Verify warranty status
  - Return warranty details
  - Check if still valid (within period)
  - Return purchase date and expiry
- **POST /api/warranties/claim**
  - Register warranty claim
  - Link to product and original sale
  - Create repair job (if applicable)
  - Set claim status (Pending)
  - Return claim reference number
- **PUT /api/warranties/claim/:claimId**
  - Update claim status
  - Approve or reject claim with reason
  - Forward to supplier (if needed)
  - Log status changes
  - Return updated claim
- **GET /api/warranties/expiring**
  - Fetch warranties expiring in X days
  - Return list for customer notification
  - Include customer contact details

2.7 EMPLOYEE PERFORMANCE API

Performance Tracking

- **GET /api/employees/:id/performance**
  - Fetch performance metrics for employee
  - Calculate total revenue generated
  - Count transactions/jobs handled
  - Calculate average transaction value
  - Return performance object with breakdowns
- **GET /api/employees/:id/sales**
  - Fetch all sales by specific cashier
  - Filter by date range
  - Return sales array with totals
- **GET /api/employees/:id/repairs**
  - Fetch all repairs by specific technician
  - Filter by date range, status
  - Calculate total repair revenue
  - Return repairs array with statistics
- **GET /api/employees/ranking**
  - Rank employees by performance metric
  - Support ranking by revenue, productivity
  - Filter by date range
  - Return sorted employee list with scores

Attendance & Session API

- **POST /api/attendance/clock-in**
  - Record clock-in time
  - Log device and location (if available)
  - Create session record
  - Return success confirmation
- **POST /api/attendance/clock-out**
  - Record clock-out time
  - Calculate work duration
  - Close session record
  - Return total hours worked
- **GET /api/attendance/:employeeId**
  - Fetch attendance records for employee
  - Filter by date range
  - Calculate total hours by period
  - Return attendance array with summary

2.8 REPORTING API

Financial Reports

- **GET /api/reports/daily-close**
  - Generate end-of-day report
  - Accept date parameter

  - Calculate cash and card totals
  - Include repair revenue
  - Calculate discounts and returns
  - Return comprehensive day-close object
- **GET /api/reports/profit-loss**
  - Generate P&L report for date range
  - Calculate total revenue (sales + repairs)
  - Calculate COGS (cost of goods sold)
  - Calculate gross and net profit
  - Return P&L statement object
- **GET /api/reports/payment-summary**
  - Payment mode breakdown for date range
  - Calculate totals per payment type
  - Return payment summary array

Inventory Reports

- **GET /api/reports/stock-status**
  - Current stock levels for all products
  - Calculate total stock value
  - Identify low and out-of-stock items
  - Return stock report array
- **GET /api/reports/stock-movement**
  - Stock movement report for date range
  - Show in/out movements per product
  - Calculate inventory turnover
  - Return movement report with analytics
- **GET /api/reports/dead-stock**
  - Identify products with no sales in X days
  - Calculate aging periods
  - Suggest actions
  - Return dead stock report

Sales Reports

- **GET /api/reports/sales-summary**
  - Sales summary for date range
  - Calculate total sales, transaction count
  - Identify top products
  - Return sales summary object
- **GET /api/reports/sales-by-category**
  - Sales breakdown by category
  - Calculate category-wise revenue
  - Return category sales array
- **GET /api/reports/discount-analysis**
  - Total discounts for date range
  - Employee-wise discount breakdown
  - Return discount analysis

Export API

- **POST /api/reports/export**
  - Accept report type and parameters
  - Generate Excel/CSV file
  - Return download URL or file stream
  - Support PDF export for formatted reports

2.9 CUSTOMER API

Customer Management

- **POST /api/customers**
  - Create new customer record
  - Validate phone number uniqueness
  - Return customer object
- **GET /api/customers**
  - List all customers with pagination
  - Search by name or phone
  - Filter by customer type
  - Return customer array
- **GET /api/customers/:id**
  - Fetch customer details
  - Include purchase history
  - Include repair history
  - Return complete customer profile
- **PUT /api/customers/:id**
  - Update customer information
  - Return updated customer
- **GET /api/customers/:phone/history**
  - Fetch complete customer transaction history
  - Include sales and repairs
  - Calculate lifetime value
  - Return history array with totals

2.10 SUPPLIER API

Supplier Management

- **POST /api/suppliers**
  - Create new supplier record
  - Return supplier object
- **GET /api/suppliers**
  - List all suppliers
  - Return supplier array
- **PUT /api/suppliers/:id**
  - Update supplier details
  - Return updated supplier

Purchase Orders

- **POST /api/purchase-orders**
  - Create purchase order
  - Generate PO number
  - Link to supplier
  - Return PO object
- **GET /api/purchase-orders**
  - List all POs with filters
  - Return PO array
- **PUT /api/purchase-orders/:id/receive**
  - Mark items as received
  - Update inventory automatically
  - Record invoice details
  - Return updated PO

2.11 AUDIT & LOGGING API

Audit Trail

- **GET /api/audit-logs**
  - Fetch audit logs with pagination
  - Filter by user, action type, date range
  - Search by barcode or product
  - Return log entries array
- **POST /api/audit-logs**
  - Create audit log entry (system-generated)
  - Record action, user, timestamp, details
  - Store before/after values for changes

2.12 NOTIFICATION API

Push Notifications

- **POST /api/notifications/send**
  - Send notification to specific user
  - Support email and SMS channels
  - Accept message template and variables
  - Return delivery status
- **GET /api/notifications/:userId**
  - Fetch notifications for user
  - Mark as read functionality
  - Return notification array

2.13 SYSTEM CONFIGURATION API

Settings Management

- **GET /api/settings**
  - Fetch all system settings
  - Return settings object (company info, tax rates, etc.)
- **PUT /api/settings**
  - Update system settings
  - Validate changes
  - Return updated settings
- **POST /api/settings/backup**
  - Trigger manual database backup
  - Return backup file ID/URL
- **POST /api/settings/restore**
  - Restore from backup file
  - Validate backup integrity
  - Restore database
  - Return success confirmation

2.14 REAL-TIME SYNC & WEBHOOKS

WebSocket Connections

- **WebSocket /ws/pos**
  - Real-time POS updates to admin dashboard
  - Broadcast new sales, returns
  - Push low stock alerts
  - Sync data changes
- **WebSocket /ws/repairs**
  - Real-time repair status updates
  - Notify on new job assignments
  - Push completion notifications

Data Synchronization

- **POST /api/sync/desktop**
  - Sync offline desktop data to cloud
  - Accept transaction batch
  - Validate and merge data
  - Resolve conflicts (timestamp-based)
  - Return sync status
- **GET /api/sync/pull**
  - Pull latest data for desktop app
  - Return products, prices, stock updates
  - Include configuration changes

2.15 SECURITY & VALIDATION

Input Validation

- Validate all incoming data
- Sanitize user inputs
- Prevent SQL injection
- Prevent XSS attacks
- Validate file uploads
- Enforce data type constraints

Rate Limiting

- Implement rate limiting per endpoint
- 100 requests per minute per user for read operations
- 30 requests per minute for write operations
- Return 429 status when exceeded

Error Handling

- Standardized error response format
- HTTP status codes (200, 201, 400, 401, 403, 404, 500)
- Descriptive error messages
- Error logging for debugging
- Never expose sensitive details in errors

2.16 DATABASE OPERATIONS

PostgreSQL Management

- Connection pooling for performance
- Transaction management for data consistency
- Optimized queries with indexes
- Database migration scripts
- Automated backups (daily)
- 2-year data retention implementation
- Query performance monitoring

Data Models

- **Users Table:** id, username, password_hash, role_id, email, phone, status, created_at
- **Products Table:** id, barcode, name, category_id, brand_id, purchase_price, selling_price, stock_quantity, min_stock, created_at
- **Sales Table:** id, receipt_number, cashier_id, total_amount, payment_method, discount, status, created_at
- **Sale_Items Table:** id, sale_id, product_id, quantity, unit_price, subtotal
- **Repairs Table:** id, job_id, customer_id, device_details, technician_id, status, parts_cost, labor_cost, created_at

- **Warranties Table:** id, product_id, serial_number, sale_id, start_date, end_date, status
- **Audit_Logs Table:** id, user_id, action, table_name, record_id, old_value, new_value, timestamp
- **Attendance Table:** id, employee_id, clock_in, clock_out, work_hours, date

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PART 3: DESKTOP POS APPLICATION (Electron.js)

Point of Sale Interface for Cashiers & Technicians

3.1 APPLICATION STRUCTURE

Login Screen

- **User Authentication**
  - Username and password input fields
  - "Remember me" checkbox option
  - Login button with loading indicator
  - Display error messages for invalid credentials
  - Auto-focus on username field
  - Support Enter key to submit
- **Session Management**
  - Store JWT token locally (encrypted)
  - Auto-refresh token before expiry
  - Session timeout after 30 minutes of inactivity
  - Warning before session expires
  - Auto-logout and redirect to login

Main Dashboard

- **Navigation Menu**
  - Role-based menu items
  - Cashier: Sales, Returns, My Performance
  - Technician: Repairs, My Jobs, My Performance
  - Manager: All modules access
  - User profile dropdown (top right)
  - Logout button
- **Quick Stats Display**
  - Today's sales count and revenue (for cashiers)
  - Today's completed jobs (for technicians)
  - Current shift duration
  - Last sync timestamp

3.2 SALES & CHECKOUT MODULE (Cashier Interface)

Product Search & Selection

- **Barcode Scanner Integration**
  - Auto-detect barcode scanner input
  - Instant product lookup by barcode
  - Add product to cart automatically
  - Visual/audio feedback on successful scan
  - Error message for invalid/not found barcodes
- **Manual Product Search**
  - Search input field (top of screen)
  - Search by product name or barcode
  - Real-time search results dropdown
  - Click to add product to cart
  - Display product image, name, price
- **Product Grid/List View**
  - Display products by category (optional)
  - Click product card to add to cart
  - Show product image, name, price, stock status
  - Visual indicator for out-of-stock items
  - Quick quantity adjustment buttons

Shopping Cart

- **Cart Display**
  - Right-side panel or bottom section
  - List of added products
  - Show: Product name, quantity, unit price, subtotal
  - Edit quantity (+ / - buttons or direct input)
  - Remove item button (X icon)
  - Real-time subtotal calculation
- **Cart Actions**
  - Clear all items (with confirmation)
  - Hold transaction (save for later)
  - Load held transaction
  - Print quote/estimate (before payment)

Pricing & Discounts

- **Discount Application**
  - Apply discount to individual item
  - Apply discount to total bill
  - Support percentage (%) or fixed amount ($)
  - Input discount value
  - Require manager authorization for high discounts
  - Display original and discounted prices
- **Price Override**
  - Manually adjust item price (manager only)
  - Enter reason for price change
  - Log price override in audit trail

Customer Information

- **Customer Selection**
  - Optional customer phone number entry
  - Search existing customers
  - Quick add new customer (name + phone)
  - Link sale to customer profile
  - Display customer name if selected

Checkout & Payment

- **Payment Method Selection**
  - Cash button
  - Card button
  - Split payment button (cash + card)
  - Digital payment options (if integrated)
- **Cash Payment**
  - Display total amount due
  - Enter amount received
  - Auto-calculate change to return
  - Display change amount prominently
  - Accept payment button
- **Card Payment**
  - Enter card transaction reference
  - Confirm payment button
  - No change calculation needed
- **Split Payment**
  - Enter cash amount
  - Calculate remaining amount
  - Enter card amount for balance
  - Validate total matches bill amount
  - Complete transaction button
- **Payment Confirmation**
  - Display success message
  - Show receipt preview
  - Print receipt automatically or on demand
  - Option to email receipt (if customer email available)
  - New sale button to start next transaction

Receipt Printing

- **Thermal Receipt Format**
  - Company name and logo
  - Store address and contact
  - Receipt number and date/time
  - Cashier name
  - Itemized product list (name, qty, price, subtotal)
  - Subtotal, discount, tax (if applicable), total
  - Payment method and amount received/change
  - Thank you message

    - Warranty info (if applicable)
    - Return policy note
- **Print Options**
    - Auto-print after payment
    - Manual print button
    - Reprint last receipt
    - Print duplicate receipt
    - Email receipt option

Hold & Resume

- **Hold Transaction**
    - Hold button prominently displayed
    - Generate hold reference number
    - Save cart items temporarily
    - Display confirmation with hold ID
    - Clear current cart for new customer
- **Resume Transaction**
    - Resume button in menu
    - Show list of held transactions
    - Display hold time and customer (if added)
    - Click to load held cart
    - Auto-delete hold after loading

3.3 RETURN & REFUND MODULE

Return Initiation

- **Start Return Process**
    - Dedicated "Returns" button/menu
    - Search for original sale
    - Search by receipt number
    - Search by customer phone
    - Search by date range and browse
- **Select Items to Return**
    - Display original sale items
    - Checkbox to select items for return
    - Enter return quantity (if partial)
    - Select return reason (Defective, Wrong Item, Customer Changed Mind)
    - Add notes about return

Manager Authorization

- **Authorization Requirement**
    - Prompt for manager authorization
    - Manager scans their barcode/enters password
    - Verify manager role
    - Log authorization in system

- Display manager name on return receipt

Refund Processing

- **Refund Calculation**
  - Calculate refund amount based on returned items
  - Deduct restocking fee (if applicable)
  - Display refund breakdown
- **Refund Method**
  - Same as original payment method (preferred)
  - Cash refund option
  - Store credit option
  - Process refund button
- **Refund Confirmation**
  - Display success message
  - Print refund receipt
  - Update inventory automatically
  - Link to original sale record

3.4 REPAIR SERVICE MODULE (Technician Interface)

Create Repair Job

- **Customer Information Entry**
  - Enter customer name
  - Enter customer phone number
  - Search for existing customer
  - Enter customer email (optional)
- **Device Information Entry**
  - Device type (Phone, Tablet, Laptop, etc.)
  - Brand selection
  - Model entry
  - IMEI/Serial number
  - Device condition (visual inspection)
  - Issue description (text area)
  - Attach photos (optional)
- **Job Details**
  - Assign to technician (default: self)
  - Set priority (Normal, High, Urgent)
  - Estimated completion date
  - Internal notes (not visible to customer)
- **Generate Job**
  - Create repair job button
  - Generate unique Job ID
  - Display job summary
  - Print customer receiving slip
  - Customer signature capture (optional)

Job Management

- **View My Jobs**
  - List of assigned repair jobs
  - Filter: Pending, In Progress, Completed
  - Sort by date, priority
  - Search by Job ID or customer phone
  - Display: Job ID, Customer Name, Device, Status
- **Job Details View**
  - Complete job information
  - Customer and device details
  - Issue description
  - Current status
  - Parts and pricing section
  - Status history timeline
  - Update status button

Repair Pricing

- **Add Parts**
  - Add parts used (from inventory or external)
  - Search inventory for parts
  - Enter part name if not in inventory
  - Enter part cost
  - Enter quantity used
  - Auto-calculate total parts cost
- **Labor Charges**
  - Enter labor/service fee
  - Support hourly rate or flat fee
  - Display total labor cost
- **Total Calculation**
  - Auto-calculate: Total = Parts Cost + Labor
  - Display breakdown
  - Save pricing button
  - Link pricing to technician profile

Status Updates

- **Update Job Status**
  - Change status dropdown
  - Options: Received → In Progress → Awaiting Parts → Ready → Delivered
  - Add status update notes
  - Notify customer (optional)
  - Save status update
  - Log status change with timestamp
- **Mark as Completed**
  - Final inspection checklist
  - Customer notification (SMS/Email)
  - Move to "Ready for Pickup" status
  - Generate completion report

Job History

- **Search Repair History**
  - Search by customer phone
  - Search by device IMEI
  - View all past repairs for customer/device
  - Display: Date, Issue, Solution, Cost
  - Identify recurring problems

3.5 INVENTORY QUICK VIEW

Stock Lookup

- **Quick Stock Check**
  - Search product by barcode or name
  - Display: Product name, category, current stock
  - Display: Purchase price, selling price
  - Show low stock warning if applicable
  - View product image
- **Stock Adjustment (Manager Only)**
  - Adjust stock quantity
  - Select reason (Damage, Theft, Count Correction)
  - Enter adjustment quantity
  - Confirm adjustment
  - Update stock immediately

3.6 REPORTS & PERFORMANCE

Daily Reports

- **End of Day Report**
  - Open drawer count (starting cash)
  - Total sales count and revenue
  - Cash sales total
  - Card sales total
  - Discounts given
  - Returns processed
  - Close drawer count (ending cash)
  - Expected vs. actual cash difference
  - Print day-close report
- **Shift Report**
  - Employee shift duration
  - Transactions handled
  - Total revenue generated
  - Average transaction value

My Performance

- **Personal Stats (Cashier)**
  - Today's transactions
  - Today's revenue
  - This week's stats
  - This month's stats
  - Top products sold
  - Performance trend graph
- **Personal Stats (Technician)**
  - Today's completed jobs
  - Today's revenue from repairs
  - Pending jobs count
  - Average repair time
  - This week/month stats
  - Customer satisfaction rating

3.7 HARDWARE INTEGRATION

Barcode Scanner

- **Scanner Configuration**
  - Auto-detect USB barcode scanners
  - Support HID-compliant scanners
  - Configure scanner prefix/suffix (if needed)
  - Test scanner functionality
  - Error handling for scanner disconnection
- **Scanner Operations**
  - Product lookup during sales
  - Manager authorization scanning
  - Warranty registration scanning
  - Return item verification

Receipt Printer

- **Printer Configuration**
  - Detect connected thermal printers
  - Support ESC/POS protocol
  - Configure paper size (80mm standard)
  - Set print density and speed
  - Test print functionality
- **Print Operations**
  - Auto-print after sale completion
  - Reprint receipt
  - Print duplicate
  - Print day-close report
  - Print repair job receiving slip
  - Print barcode labels

Cash Drawer

- **Drawer Integration**
  - Connect cash drawer to receipt printer
  - Auto-open drawer after cash payment
  - Manual open drawer button (manager only)
  - Drawer open/close event logging

3.8 OFFLINE MODE & SYNC

Offline Capability

- **Local Data Caching**
  - Cache product catalog locally
  - Cache current stock levels
  - Cache employee profiles and permissions
  - Cache customer database
  - Store configuration locally
- **Offline Operations**
  - Process sales transactions offline
  - Queue transactions for sync
  - Display "Offline Mode" indicator
  - Warn about limited functionality
  - Prevent operations requiring real-time data

Data Synchronization

- **Auto-Sync**
  - Detect internet connectivity
  - Auto-sync when online
  - Sync queued transactions first (FIFO)
  - Sync product/price updates from server
  - Sync stock level updates
  - Display sync progress indicator
  - Show last sync timestamp
- **Manual Sync**
  - Manual sync button
  - Force sync all data
  - Sync status display
  - Error handling and retry logic
  - Conflict resolution (server wins)

Sync Conflict Handling

- **Conflict Scenarios**
  - Detect price changes during offline period
  - Detect stock discrepancies
  - Warn user of conflicts

- Apply server data (latest)
- Log conflicts for review

3.9 USER INTERFACE & EXPERIENCE

Dashboard Layout

- **Main Sections**
  - Top bar: User info, sync status, time, logout
  - Left sidebar: Navigation menu
  - Central area: Active module content
  - Right panel: Cart (in sales mode)
  - Bottom: Quick action buttons
- **Responsive Design**
  - Support 1024x768 minimum resolution
  - Optimize for touchscreens
  - Large, clickable buttons
  - High contrast for readability
  - Keyboard shortcuts support

Navigation

- **Menu Structure**
  - Sales (cashiers)
  - Returns (cashiers with manager access)
  - Repairs (technicians)
  - My Jobs (technicians)
  - Stock Check (all users)
  - My Performance (all users)
  - Reports (managers)
  - Settings (managers/admins)
- **Quick Actions**
  - F1: New Sale
  - F2: Search Product
  - F3: Hold Transaction
  - F4: Resume Transaction
  - F5: Refresh Data
  - Esc: Cancel/Go Back

Visual Feedback

- **Loading States**
  - Spinner for data loading
  - Progress bar for sync operations
  - Skeleton screens for content loading
- **Success/Error Messages**
  - Toast notifications (top-right)
  - Success: Green with checkmark

    - Error: Red with X icon
    - Warning: Yellow with exclamation
    - Auto-dismiss after 5 seconds
- **Confirmations**
    - Modal dialogs for destructive actions
    - Clear Yes/No buttons
    - Explain consequences of action

3.10 SETTINGS & CONFIGURATION

Application Settings

- **General Settings**
    - Store/location selection (if multi-location)
    - Receipt printer selection
    - Barcode scanner configuration
    - Cash drawer settings
    - Default currency display
- **Print Settings**
    - Enable/disable auto-print
    - Receipt copy count
    - Print preview option
    - Paper size selection
- **Sync Settings**
    - Auto-sync interval (minutes)
    - Sync on startup option
    - Sync on idle option
    - Offline mode preferences

User Preferences

- **Display Preferences**
    - Font size (small, medium, large)
    - Theme (light/dark mode)
    - Language selection (if multi-language)
    - Number format preferences
- **Notification Preferences**
    - Sound alerts on/off
    - Notification duration
    - Alert types (sales, errors, sync)

3.11 SECURITY FEATURES

Session Security

- **Auto-lock**

- Lock screen after X minutes of inactivity
    - Require password to unlock
    - Maintain session (no data loss)
    - Configurable timeout period
- **Access Control**
    - Verify user permissions before actions
    - Hide/disable unauthorized menu items
    - Require manager PIN for sensitive operations
    - Log all authorization requests

Data Security

- **Local Data Encryption**
    - Encrypt stored JWT tokens
    - Encrypt sensitive configuration
    - Secure local database (SQLite)
    - Clear cache on logout
- **Secure Communication**
    - HTTPS for all API calls
    - Certificate validation
    - Timeout for stale connections
    - Error handling for network issues

3.12 ERROR HANDLING & RECOVERY

Error Scenarios

- **Network Errors**
    - Display clear error message
    - Offer retry option
    - Switch to offline mode automatically
    - Queue operation for later sync
- **Hardware Errors**
    - Detect printer disconnection
    - Warn about scanner issues
    - Provide troubleshooting tips
    - Allow manual retry
- **Data Errors**
    - Validate input before submission
    - Prevent invalid transactions
    - Clear error messages
    - Suggest corrective action

Data Recovery

- **Transaction Backup**
    - Auto-save transactions locally
    - Recover unsaved sales on crash

- Restore held transactions
- Transaction log for debugging

3.13 HELP & SUPPORT

In-App Help

- **Help Menu**
  - User manual access
  - Video tutorials (if available)
  - FAQ section
  - Keyboard shortcuts reference
  - Contact support information
- **Contextual Help**
  - Tooltips on hover
  - Help icons next to complex fields
  - Quick tips for common tasks

Troubleshooting

- **Diagnostics**
  - System information display
  - Check connectivity status
  - Test hardware connections
  - View error logs
  - Export logs for support

3.14 UPDATES & MAINTENANCE

Auto-Updates

- **Update Detection**
  - Check for updates on startup
  - Notify user of available updates
  - Display release notes
  - Download updates in background
- **Update Installation**
  - Prompt to install and restart
  - Defer update option
  - Backup data before update
  - Restore on update failure

System Health

- **Performance Monitoring**
  - Monitor CPU and memory usage

    - Detect slow performance
    - Clear cache option
    - Optimize database periodically

INTEGRATION MATRIX

Data Flow Between Components

Admin → Backend → Desktop

- **Admin creates/updates product** → Backend API saves to database → Desktop syncs new data
- **Admin modifies prices** → Backend logs change → Desktop receives price update
- **Admin adds user** → Backend creates user → Desktop can login with new credentials

Desktop → Backend → Admin

- **Desktop processes sale** → Backend records transaction → Admin sees real-time sales data
- **Desktop creates repair job** → Backend assigns to technician → Admin tracks in dashboard
- **Desktop syncs offline data** → Backend validates and merges → Admin sees updated reports

Real-Time Sync Events

- New sale notification
- Low stock alert
- Return/refund notification
- Repair status update
- Manager authorization request
- Employee clock-in/out

TECHNOLOGY-SPECIFIC REQUIREMENTS

Next.js (Admin Dashboard)

- Server-side rendering for better performance
- API routes for serverless functions
- React hooks for state management
- Responsive design with Tailwind CSS
- Chart libraries (Chart.js or Recharts)
- Excel export library (SheetJS or ExcelJS)

Node.js (Backend)

- Express.js framework
- JWT authentication (jsonwebtoken)
- Password hashing (bcrypt)
- PostgreSQL client (pg or Sequelize ORM)
- WebSocket support (Socket.io)
- File upload handling (Multer)
- Email service (Nodemailer)
- SMS service integration
- Logging (Winston or Pino)

Electron.js (Desktop App)

- React for UI components
- Electron IPC for process communication
- Local database (SQLite) for offline storage
- USB device detection (node-usb)
- Printer integration (electron-pos-printer)
- Auto-updater (electron-updater)
- Crash reporting (Sentry or BugSnag)

PostgreSQL (Database)

- Properly indexed tables for performance
- Foreign key constraints for data integrity
- Triggers for automated actions
- Views for complex queries
- Stored procedures for business logic
- Backup and restore procedures
- Connection pooling configuration

QUALITY ASSURANCE REQUIREMENTS

Testing Requirements

- Unit tests for all API endpoints
- Integration tests for workflows
- UI/UX testing for desktop app
- Hardware compatibility testing
- Performance testing under load
- Security vulnerability scanning
- Cross-browser testing for admin dashboard

Acceptance Criteria

- All features functional as specified

- No critical bugs in production
- Response time under 2 seconds for most operations
- Successful offline mode operation
- Data sync accuracy 100%
- Print functionality working correctly
- Reports generate accurately

END OF DOCUMENT

This comprehensive feature breakdown provides complete requirements for all three system components. Each part is designed to work independently while integrating seamlessly with the others.