DR. PETER BERON MATHEMATICS HIGH SCHOOL - VARNA

PROFESSION "481020 - SYSTEM PROGRAMMER"

SPECIALTY "4810201 - SYSTEM PROGRAMMING"

DIPLOMA PROJECT

to acquire a third degree professional qualification

TOPIC: Supply management system for e-store

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Class: 12th grade, 2025 release

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EXERCISE

FOR A GRADUATE PROJECT

STATE EXAMINATION FOR THE ACQUISITION OF THE THIRD DEGREE

OF

PROFESSIONAL QUALIFICATION – PROFESSIONAL THEORY PART

profession code 481020 "System programmer"

specialty code 4810201 "System programming"

Name of the student: Veselin Petrov Nikolaev

TOPIC:*Supply management system for e-store*

Requirements for the development of the diploma project:

E-stores are complex organizations that have to manage a large number of processes and resources. This includes supply, warehouse, sales, personnel and marketing management.

To create a management system to facilitate deliveries. The app will be able to manage deliveries from suppliers, including orders.

The application must be able to allow management of warehouses and their status, including stock, inventory and order management.

The developed product should allow all employees related to the supply management processes and the management team to create a user profile, monitor stock and view orders and their status, allow the preparation of reports and analyses.

The site must provide integration with secure payment methods and ensure the protection of customers' personal information.

Choose appropriate tools and technology for the implementation.

Execution schedule:

- Date of assignment of the diploma project – 12.12.2024.
- Control checks: January, February, March, April 2025.
- Consultations: 23.02, 15.03, 29.03, 17.04.2025
- Deadline for submitting the diploma project – 05/07/2025.

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INTRODUCTION

In today's digital world, e-stores play a key role in retail, providing consumers with the convenience of shopping from anywhere in the world. With increasing competition and customer expectations for fast and reliable deliveries, supply management is becoming a critical aspect of the successful operation of any e-commerce store.

Effective supply management not only improves customer satisfaction, but also optimizes operating costs and increases business competitiveness. In the face of globalization and dynamic markets, the ability of an e-store to manage its supply quickly and accurately can be a decisive factor in its success or failure.

Supply management systems allow e-stores to monitor the movement of goods in real time, optimize courier routes and ensure transparency and security of processes. This is particularly important in the context of increasing requirements for personal data protection and payment security, which are essential for customer trust.

In this context, the development of an effective supply management system is not only relevant, but also necessary to maintain a competitive advantage and meet the growing demands of modern consumers.

The object of the research is the supply management system designed for e-stores. This system is designed to optimize and automate the processes related to the management of orders, inventory and logistics, thereby improving the efficiency and reliability of supplies.

Subject of the study are the components and functionalities of the supply management system, which include:

1. Order Management: A module that allows users to create, track and manage orders. It includes functions for processing new orders, updating their status and generating reports.

2. Warehouse Management: This component provides inventory tracking, inventory and inventory management. The system automatically updates stock data with each new order or delivery.

3. Logistics and Courier Services: Includes functionalities for planning and optimizing courier routes, as well as real-time delivery tracking through integration with the OpenStreetsMap API.

4. User profiles and roles: The system supports different roles (root, admin, user, courier), each of which has specific rights and responsibilities. This provides flexibility and security in managing access to the system.

5. Integration with payment systems: To provide secure and convenient payment methods, the system is integrated with PayPal, which ensures protection of customers' personal information.

6. Reports and analyses: The system provides tools to generate statistical data and analyzes that support business management and informed decision making.

These components work together to provide a complete supply management solution that is adaptable to the needs of today's e-stores.

Main objective thesis is the development of an integrated supply management system for e-stores to optimize the processes of order management, inventory and logistics, while providing security and convenience for users. To achieve this goal, the following specific tasks have been formulated:

1. Requirements Analysis: Conduct a thorough analysis of functional and non-functional system requirements, including identification of key processes and user needs.

2. Architecture Design: Designing the system architecture to provide flexibility, scalability and security. This includes defining user roles and rights, as well as integration with external systems.

3. Functionality development: Implementation of the main modules of the system, including order management, warehouses, logistics and user profiles.

4. Integration with external services: Provide integration with OpenStreetsMap API for real-time tracking of couriers and with PayPal for secure payments.

5. Testing and Validation: Conducting tests to verify the functionality and reliability of the system, as well as to evaluate the user experience.

6. Documentation and training: Create detailed system documentation and conduct training for users and administrators.

7. Evaluation of the results: Analysis of the achieved results and formulation of recommendations for future development and improvements of the system.

These tasks are aimed at creating an effective and reliable supply management solution that meets the needs of modern e-stores.

For the development of the supply management system is selected **a combination of modern methods and approaches**, which ensure efficiency, flexibility and quality of the final product. The main methods and approaches include:

1. Agile methodology: Using the Agile approach allows for iterative and incremental development of the system. This provides an opportunity to quickly adapt to the changing requirements and needs of users, as well as to continuously improve functionalities.

2. Modular design: The system is designed on a modular basis, which allows easy addition and modification of individual components without affecting the overall functionality. This provides flexibility and facilitates system maintenance and expansion.

3. Object Oriented Programming (OOP): Using OOP principles in system development allows for better code organization, reuse of components, and easier management of complexity.

4. Test-Driven Development (TDD): Applying the TDD approach ensures high code quality by writing tests before implementing functionalities. This ensures that every part of the system is working properly and makes it easier to find and fix errors.

5. Integration with external APIs: To provide additional functionalities such as courier tracking and secure payments, the system uses integration with external APIs such as OpenStreetsMap and PayPal. This allows the use of already existing and proven solutions.

6. Documentation and Training: Creating detailed documentation and conducting training for users and administrators are key to successful system implementation and use. This includes installation, configuration and system usage guides.

These methods and approaches have been chosen to ensure efficient and quality system development to meet the needs of modern e-stores.

Project limitations:

1. Technology limitations: Choosing specific technologies such as PHP, jQuery, and MariaDB may impose limitations on system scalability and performance. Although these technologies are widely used and well supported, they may not be the best fit for very large systems with extremely high performance requirements.

2. Integration with external services: Dependence on external APIs such as OpenStreetsMap and PayPal may result in limitations related to changes in these services or their accessibility. There may also be limitations regarding the speed and reliability of the integration.

3. Security and data protection: Although the system is designed with security in mind, there is always a risk of vulnerabilities, especially when dealing with personal data and financial transactions. The need for continuous security updates and monitoring is an important aspect.

4. Resource Limitations: Time and financial resources for system development and testing may be limited, which may affect the scope and quality of some functionality.

Information security:

1. Literature Sources: A variety of literature sources including books, articles, and online resources were used to develop the system, which provide theoretical foundations and practical guidelines for supply management and software development.

2. API Documentation: The detailed documentation of the external APIs used (OpenStreetsMap, PayPal, etc.) is a primary source of information on the integration and use of these services.

3. Online Communities and Forums: Participation in online communities and forums related to the technologies used provides valuable information and solutions to problems encountered during development.

4. Consultations with experts: Consultations were held with educators and specialists in the field of system programming and e-commerce, who provided guidelines and recommendations for system optimization.

These constraints and sources of information have been taken into account in the planning and execution of the project to ensure its successful completion.

CHAPTER ONE
THEORETICAL PART

1.1 Overview of existing solutions

Supply management is a key component of e-store operations, which requires efficient and reliable systems to optimize logistics processes. This chapter analyzes existing supply management solutions, emphasizing their features, advantages and disadvantages.

1. Warehouse Management Systems (WMS)

WMS are widespread in the industry and help optimize warehouse operations by managing inventory, tracking goods, and automating the receipt and dispatch of orders. Their main advantages include:

- Increased inventory accuracy;
- Reduction of operating costs;
- Improved efficiency.

Disadvantages include complexity in implementation and the need for significant investment in infrastructure and staff training.

2. Transportation Management Systems (TMS)

TMSs focus on route planning, vehicle management and delivery tracking. Their benefits are:

- Optimization of transport costs;
- Improved delivery time;
- Increased customer satisfaction.

Challenges arise when integrating with other systems, especially with complex logistics networks.

3. Integrated Supply Chain Management Systems (SCM)

SCM combines the functionalities of WMS and TMS, providing comprehensive control over the flow of goods, information and resources. They offer:

- Centralized management;
- Reduced costs;
- Increased flexibility.

The disadvantage is the high complexity and cost of implementation, as well as the need for organizational changes.

4. Cloud solutions

With the growing popularity of cloud technologies, many companies are turning to such solutions because:

- High scalability and flexibility;
- Reduced infrastructure costs;
- Convenient access to real-time data.

Main risks are dependence on the Internet and vulnerability to cyber-attacks or service provider failures.

1.2 Concepts and models

1. Supply Chain Management (SCM) Model

This model integrates all links in the logistics chain in order to achieve maximum efficiency by synchronizing the flows of goods, information and capital.

2. Warehouse management model

It includes concepts such as inventory management, receiving/shipping automation and warehouse spatial optimization.

3. Transport management model

It focuses on logistics tasks: route optimization, fleet control and delivery traceability.

4. Object Oriented Programming (OOP)

Using OOP allows for better modularity, code reuse, and easier maintenance.

5. Role-Based Access Control (RBAC)

RBAC provides controlled access to the system through defined roles - for example "admin", "courier", "client", "owner". This increases security and facilitates rights control.

1.3 Technologies and Tools

1. PHP

PHP is a popular server-side language that offers rapid prototyping, good database integration, and extensive community support. It is suitable for web systems of medium to high complexity.

2. jQuery

A JavaScript library that accelerates working with DOM, events and AJAX requests. Although an older approach, jQuery remains effective for lightweight web interfaces and rapid development.

3. MariaDB

MariaDB is a fast, secure and MySQL-compatible relational database. It is suitable for web applications that require high reliability and easy migration.

4. Chart.js

Chart.js is a lightweight and powerful JavaScript library for visualizing data through various types of graphs, including line charts, bar charts, pie charts, and more. In the system, it is used to visualize dynamic data such as number of deliveries by date, delivery time, efficiency of couriers and other logistics indicators.

Advantages:

- High readability and interactivity of graphics;
- Easy integration with web applications;
- Responsive design support.

5. Router API

The Router API is used to calculate the optimal route between the courier's location and the delivery address. This allows the system to offer the shortest and most efficient routes in real time, improving logistics efficiency.

Advantages:

- Improved accuracy in navigation and route planning;
- Ability to update when traffic changes;
- Reduced delivery time and operating costs.

CHAPTER TWO
ANALYTICAL PART

2.1 Requirements analysis

Requirements analysis is a key step in the development of any information system. It aims to define exactly what the system must do to meet user needs and business objectives. This section examines the functional and non-functional requirements for the supply management system.

Functional requirements

1. **Order management**
    - Ability to create, edit and delete orders.
    - Users can track the status of their orders in real time.
    - Admins can approve or reject orders.
2. **Warehouse management**
    - Stock tracking and inventory management system.
    - Ability to update warehouse data and generate reports.
3. **Logistics and delivery tracking**
    - Support planning and optimization of courier routes.
    - Integration with OpenStreetMap API to track the location of couriers in real time.
4. **User profiles and roles**
    - Support for different roles: root, admin, user, courier.
    - Ability to register, login and manage user profiles.
5. **Integration with payment systems**
    - Secure payments through PayPal.
    - Confirmation of successful transactions to users.
6. **Reports and analyses**
    - Tools for generating statistics and analytical reports to support business decisions.

Non-functional requirements

1. **Productivity**
    - Fast processing of requests and low response time.
    - Ability to work with large volumes of data.
2. **Security**
    - Protection of personal data and financial operations.
    - User authentication and authorization mechanisms.
3. **Reliability**
    - Stable operation of the system without interruptions.
    - Recovery features in case of errors or data loss.
4. **Scalability**
    - Ability to expand with new modules and functionalities without major changes in the architecture.
5. **Convenience for the user**
    - Intuitive and easy to use interface.
    - Quick access to essential functions and information.

2.2 System Architecture

1. Architectural model: MVC (Model-View-Controller)

MVC is an established architectural pattern that separates application logic into three main components:

- **Model:**
  Represents the business logic and data structure. Basic objects such as orders, products, users and stock are managed here. The model connects to the database (MariaDB) and performs CRUD operations.
- **View (Appearance):**
  Responsible for information visualization. Represents the user interface through HTML, CSS, and JavaScript, displaying the data provided by the model.
- **Controller (Controller):**
  Mediate between the view and the model. It processes the input data, performs

the necessary actions through the model, and prepares the results for visualization. The controller manages the interaction logic in the application.

2. Roles and rights in the system

The system defines four main types of users with different access levels:

- **Root**
  - Highest level of access.
  - Can create/delete users, change roles and manage all configurations.
  - Root cannot be removed by other users.
- **Admin**
  - Manage orders, products, users and couriers.
  - Can set system parameters (fees, time zone, date format, etc.).
- **User**
  - Limited access - can create and monitor their own orders.
  - It is possible to communicate with couriers and view the history of orders.
- **Courier**
  - Access the orders it has to deliver.
  - It can update delivery status and provide information about its current location.

2.3 Database Structure

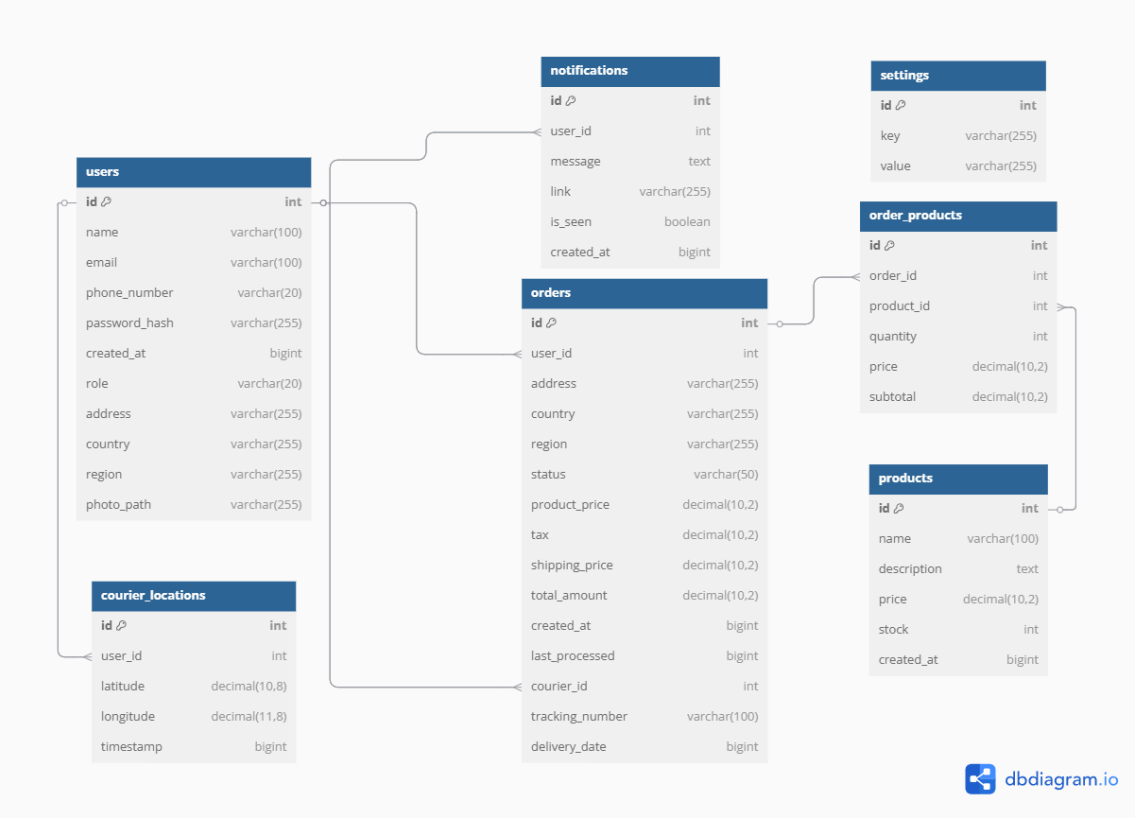

Fig. 1 Database ER diagram

The database is designed to store and manage data related to users, products, orders and logistics. Here is a description of the main tables and their fields:

Basic Tables and Fields

1. users (Users)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique identifier
name	VARCHAR	Username
email	VARCHAR	Email address
phone_number	VARCHAR	Phone number
password_hash	VARCHAR	Hashed password
created_at	BIGINT (UNIX_TIMESTAMP)	Creation date

Field	Type	Description
role	VARCHAR	Role – root, admin, user, courier
address	VARCHAR	Address
country	VARCHAR	Country
region	VARCHAR	Region
photo_path	VARCHAR	Path to profile picture

2. products (Products)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique identifier
name	VARCHAR	Product name
description	TEXT	Description
price	DECIMAL	Price
stock	INT	Availability
created_at	BIGINT	Date added

3. orders (Orders)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique identifier
user_id	INT, FK	User ID
address	VARCHAR	Shipping address
country, region	VARCHAR	Country and region
status	VARCHAR	Статус – pending, processing, shipped, delivered
product_price, tax, shipping_price, total_amount	DECIMAL	Amount breakdown

Field	Type	Description
created_at, last_processed, delivery_date	BIGINT	to give
courier_id	INT	Courier ID
tracking_number	VARCHAR	Tracking number

4. order_products (Products on order)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique record
order_id	INT, FK	An order
product_id	INT, FK	Product
quantity	INT	Quantity
price, subtotal	DECIMAL	Price and subtotal

5. courier_locations (Courier Locations)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique record
user_id	INT, FK	Courier ID
latitude, longitude	DECIMAL	Coordinates
timestamp	BIGINT	Date and time

6. settings (Settings)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique record
key, value	VARCHAR	Setting key and value

7. notifications(Izvestia)

Field	Type	Description
id	INT, PK, AUTO_INCREMENT	A unique record
user_id	INT, FK	User
message	TEXT	Message
link	VARCHAR	Link to page
is_seen	TINYINT	Status – 0 (unread), 1 (read)
created_at	BIGINT	Creation date

2.4 Integrations with External Systems

1. OpenStreetMap API

- **Justification:** Free, open source geolocation and routing.
- **Functionalities:**
  - **Real-time tracking:** Visualization of current location of couriers.
  - **Route optimization:** Calculation of shortest/fastest routes.

2. PayPal

- **Justification:** A reliable and popular online payment platform.
- **Functionalities:**
  - **Payment processing:** Users pay securely directly through the system.
  - **Security:** Data is protected with the highest security standards.

3. Mailtrap

- **Justification:** Safe testing of email messages.
- **Functionalities:**
  - **Testing:** Checking email notifications without actually sending them.
  - **Analysis:** Review email content for debugging and corrections.

4. Chart.js

- **Justification:** A lightweight JavaScript data visualization library suitable for dynamic real-time graphics.
- **Functionalities:**
    - **Line charts:** Presentation of number of deliveries by date, courier workload and other key logistics indicators.
    - **Interactivity:** Users can analyze the data in a visually accessible way.
    - **Real Time Update:** Ability to refresh data without reloading the page.

5. Router API

- **Justification:** An external routing API that works together with OpenStreetMap for more accurate and fast navigation.
- **Functionalities:**
    - **Route calculation:** Finding the optimal route from the courier's current location to the order's address.
    - **Visualization of the route:** Embed a route on the map with clear directions.
    - **Dynamic routes:** If necessary - recalculation in real time when the position or conditions change.

6. Other Integrations

- TCPDF
    - **Justification:** An open source PHP library for generating PDF documents directly from HTML and CSS.
    - **Functionalities:**
        - Generate invoices, bills of lading or reports in PDF format.
        - Supports various fonts, incl. Cyrillic, images, tables and codes.
        - Ability to automatically download or save to the server.

- SimpleXLSXGen
    - **Justification:** A lightweight PHP library for creating Excel (XLSX) files from arrays or tables.
    - **Functionalities:**
        - Export data from orders, deliveries, customer and courier lists.
        - Easy syntax - minimal dependencies and high performance.
        - Suitable for administrative inquiries and log archiving.

- PHPMailer
    - **Justification:** A reliable and flexible SMTP email library used in conjunction with Mailtrap for a test environment.
    - **Functionalities:**
        - Sending automatic email notifications when an order is placed, a status change or registration is made.
        - Connect to Mailtrap's SMTP server for simulated sending and debugging.
        - Support for HTML formatting, attachments and templates.

- Vendor Uploader
    - **Justification:** Manually built system for uploading profile pictures by users (couriers, customers, administrators).
    - **Functionalities:**
        - Allows uploading a profile picture via a profile form.
        - Saving the photo in a special directory (/web/uploads/).
        - **Validations:**

— Acceptable formats: JPG, JPEG, PNG.

— Maximum size: 5MB.

— Check for MIME type and real format (for security).

- Generate a unique filename (eg via uniqid() or timestamp) to prevent overwriting.
- Automatically linking the uploaded file to the user profile in the database.
- Display profile picture on profile page and admin panel.
- Possibility to replace the existing photo (when overwriting, the old one is deleted).

CHAPTER THREE
PROJECT PART

3.1 Implementation of the system

The supply management system is implemented through **modular approach**, providing flexibility, easy maintenance and expandability. Each module is developed with clear responsibilities and integrates seamlessly with other components.

1. User management module

Functionalities:

- User registration and authentication.
- Management of user profiles (data editing, password change).
- Role-based access control: root, admin, user, courier.

Implementation:

- PHP for server logic and request processing.
- MariaDB database - users table.
- Password hashing using built-in PHP functions.
- Authentication management sessions.

2. Order management module

Functionalities:

- Create, edit and delete orders.
- Track and update statuses in real time.
- Generate reports.

Implementation:

- MVC architecture (Model-View-Controller).
- Orders and order_products tables.
- PayPal integration for payments.
- AJAX for asynchronous UI refresh.

3. Warehouse management module

Functionalities:

- Inventory management: add and remove products.
- Stock tracking and automatic renewal.
- Generating inventory reports.

Implementation:

- Table products in the database.
- PHP inventory logic.
- HTML/CSS + Bootstrap for Responsive Visualization.

4. Logistics and courier tracking module

Functionalities:

- Track the current location of couriers in real time.
- Route optimization for faster and more efficient delivery.
- Management and visualization of delivery statuses (eg "in progress", "delivered", "failed").

Implementation:

- Using OpenStreetMap integrated via Leaflet.js - a lightweight and flexible JavaScript library for interactive map visualization.
- A courier_locations database has been created, in which the coordinates (latitude and longitude), the courier ID and the time of the last update are recorded.

- A JavaScript + Leaflet script periodically sends AJAX requests to the server to get the current locations and update the map markers.
- Route optimization uses external API services to calculate the shortest path between multiple points (optional: GraphHopper, OSRM or another OSM-based solution).
- Admin/operator panel showing courier map, shipment statuses and recommended routes.

5. Notifications and system settings module

Functionalities:

- Send notifications to users.
- Manage fees, tax rates and other configurations.

Implementation:

- Table notifications for storing events.
- Mailtrap for email testing.
- Settings table and settings interface.

3.2 User Roles and Rights

The system supports role-based access, which defines the rights and restrictions of each user:

1. Root

Description: Originally created user with full access.
Rights:

- Full control over the system.
- Manage users, roles and settings. **Restrictions:** It cannot be deleted by another user.

2. Admin

Description: An administrator with advanced rights to use system functions.
Rights:

- Management of users, orders, products, couriers.
- Configuration of shipping charges and additional, settings, formats.
  Restrictions: Cannot modify or delete root.

3. User

Description: End user of the system.
Rights:

- Access to personal orders.
- Track statuses, interact with couriers.
  Restrictions: No administrative access.

4. Courier

Description: Limited access provider.
Rights:

- It only sees the orders it has to deliver.
- Updates delivery status.
- Share your location.
  Restrictions: Access to your personal duties only.

Role and access management

- **Storage:** In the users table, in the role field.
- **Control:** All requests go through entitlement checks through middleware or controllers.
- **Changes:** Only root and admin can change roles through admin interface.
- **Security:** All role-related operations require authentication and rights.

3.3 Main functionalities of the system

1. Order Management

1.1 Creation of orders

- Users can create new orders through an intuitive interface by selecting products and specifying desired quantities.
- The system automatically calculates the total value of the order, including applicable taxes and delivery charges.

1.2 Order Tracking

- Users get the opportunity to track the status of orders in real time.
- Integration with courier services allows visualization of the route and current location of the delivery.

1.3 Order Status Management

- Admins can update order status (for example: *pending*, *shipped*, *delivered*, *returned*) and manage the entire process by implementation.

2. Warehouse management

2.1 Inventory

- The system provides real-time inventory tracking tools, with automatic updates for new orders or deliveries.
- It is possible to generate stock reports and track the movement of goods.

2.2 Product Management

- Administrators have the ability to add, edit and remove products from the catalog.
- Information such as price, description and availability can be updated.

3. Management of user profiles

3.1 Registration and Authentication

- The system supports registration and login through a secure mechanism including password hashing and session management.

3.2 Edit User Data

- Users can edit personal information such as name, email, phone and address.
- The ability to upload and manage a profile picture is supported.

3.3 Role Management

- Administrators can assign and modify user roles, defining their rights and access to various functionalities.

4. Logistics and courier tracking

4.1 Real-Time Tracking

- The system uses the OpenStreetMap API to track couriers in real-time, in order to optimize routes and improve delivery times.

4.2 Management of Couriers

- Admins can assign orders to couriers and monitor their performance and delivery status.

5. Financial Transactions and Reports

5.1 Payment Processing

- Integration with PayPal provides secure and convenient payment methods.
- The system automatically processes and confirms transactions.

5.2 Generation of Financial Statements

- Reporting and analysis tools are provided to support business management and informed decision making.

6. Notifications and Settings

6.1 News

- Users receive notifications of key events – order confirmations, delivery statuses and other system changes.

6.2 Managing System Settings

- Administrators can configure global parameters such as tax rates, shipping charges, and date formats.

3.4 Testing and Validation

Testing and validation are critical stages in software development. A variety of approaches and tools have been used to ensure the quality and reliability of the system.

Testing tools

XAMPP

- Used to run a local web server (Apache) and a MySQL database.
- Using phpMyAdmin, the database was managed and tests related to data and queries were performed.

NetBeans IDE

- Used as the main development environment for PHP code - with support for debugging, autocompletion and integration with version control systems.

Testing approaches

Functional testing

- Each module is independently tested to ensure that it fulfills its intended functionalities - orders, warehouse, users, etc.

Integration testing

- The interactions between the different modules have been checked.
- Integrations with external systems such as OpenStreetMap API and PayPal have been successfully tested.

Security tests

- Vulnerability checks have been performed - authentication, session management and personal data protection.
- Password hashing and access control are validated against best practices.

Performance tests

- The stability of the system under high load and large volumes of data has been tested.
- The response time when executing requests to the database was measured.

Test results

- **Functionality**: All main functions work correctly - order creation and tracking, warehouse management, logistics and payments.
- **Integrations**: External systems (OpenStreetMap and PayPal) function stably and smoothly.
- **Security**: No critical vulnerabilities found. Data is protected according to modern standards.
- **Productivity**: The system demonstrates good performance and fast processing of requests.

CONCLUSION

Main results

The development of the supply management system achieved significant success, fulfilling all the set goals. Here is a summary of the key results:

1. Effective order management

- Intuitive interface for creating, tracking and managing orders.
- Ability to track statuses in real-time, which improves the user experience.

2. Optimization of warehouse operations

- Automated inventory and precise stock tracking.
- Reduce errors and increase operational efficiency.

3. Integration with external systems

- Successful integration with **OpenStreetMap API** And **PayPal**.
- Real-time courier tracking and secure online payments.

4. Security and access management

- Role-based management and password protection.
- Reliable protection of personal data and prevention of unauthorized access.

5. Modular and scalable design

- Used **MVC architecture** for easy maintenance and extensibility.
- Flexibility for future enhancements according to business needs.

6. Testing and Validation

- Conducted tests confirm the reliable operation of the system.
- Excellent performance under various load conditions.

Achieving goals

The objectives set for the development of an integrated supply management system are **fully achieved**. The system offers a complete solution that:

- Optimizes orders, inventory and logistics.
- It guarantees security, scalability and ease of use.
- It provides a solid foundation for future development and expansion.

Recommendations for improvements

1. User interface improvement

- Application of modern technologies such as **React** or **Vue.js**.
- Conduct UX testing to gather feedback and improve design.

2. Expanding analytical capabilities

- Construction of **dashboards** and analytics modules for forecasting and analysis.
- Integration with **BI instruments** for data visualization and processing.

3. Additional security measures

- Conduct regular **security audits**.
- Introduction of **two-factor authentication (2FA)**.

4. Performance optimization

- Implementation of **caching** and database optimization.
- Improve queries and use indexes for fast data access.

Opportunities for future development

1. Mobile application

- Developed with**React Native** or **Flutter**.

- Basic functionalities accessible via mobile devices.

2. Integration with additional services

- Connection with e-commerce platforms and **ERP systems**.
- Implementation of **AI and Machine Learning** for automation.

3. International support

- Support of **multiple languages and currencies**.
- Compliance with various regulations and standards.

4. Customer Feedback Management

- A system for collecting and analyzing opinions and recommendations.
- Improving the customer experience by responding to their needs.

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APPENDIX #1
INSTALLATION AND INITIAL SYSTEM SETUP GUIDE

This guide describes the steps required for installation and initial system configuration **DeliveryMS** in a local environment using **XAMPP**.

1. Prerequisites

1.1 Installing XAMPP

- Download the latest version of XAMPP from the official site: https://www.apachefriends.org.
- During installation make sure that **Apache** And **MySQL** are included.

1.2 Project preparation

- Download or clone the project to XAMPP's htdocs directory.
  Sample path:
  C:\xampp\htdocs\DeliveryMS

2. Installation steps

2.1 Starting XAMPP

- Open up **XAMPP Control Panel**.
- Start **Apache** And **MySQL**.

2.2 Access to the installation script

- Open a web browser and enter the following address:
  http://localhost/DeliveryMS

2.3 Database Configuration

On the first screen of the installation process, you will need to enter the following information:

- **Host**: localhost
- **Username**: root
- **Password**: leave blank if you have not set a password in MySQL
- **Database Name**: enter the desired name for the database

2.4 Creating a root profile

Enter the administrator details:

- **Name**
- **Email address**
- **Password**

2.5 PayPal Configuration

- Enter yours **PayPal business email**, which will be used to process online payments.

2.6 Mailtrap Configuration

Enter the following details from your Mailtrap account for test emails:

- **Host**
- **Port**
- **Username**
- **Password**

2.7 Completing the Installation

After filling in all the fields and confirming, the installation script will automatically set up the system and redirect you to the home page of the application.

3. Access to the system

After a successful installation, you can log into the system using the root profile you created and start using all available supply management functionalities.