

DEVELOPMENT AND IMPLEMENTATION OF THE FOLK CRAFT E-COMMERCE SOFTWARE SYSTEM

Valentyna PLESKACH^{1*}, Inga TUMASONIENE², Vladyslav AVRAMCHUK¹

¹*Department of Applied Information Systems of Faculty of Information Technology,
Taras Shevchenko National University of Kyiv, Volodymyrska Str., Kyiv, Ukraine*

²*Department Information Systems of Faculty of Fundamental Sciences,
Vilnius Gediminas Technical University, Saulėtekio al. 11, Vilnius, LT-10223 Lithuania*

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Abstract. The work considers the creation of an effective e-shop for convenient and efficient e-trade in folk crafts. A study of the theoretical aspects of the development of an online store was carried out; analyzed software and technical solutions for building an e-store of folk crafts; developed and implemented an electronic store specializing in the sale of handicrafts using a technology stack, including Spring Boot for backend implementation, Angular and TypeScript for creating a user interface, and Java for business logic programming. The main objective of this innovation online store is to help traditional crafts by offering a digital platform where skilled artisans and producers can showcase and sell their unique and authentic products, which will help to rise to a new level of e-commerce management for folk crafts and make the business more sustainable and competitive.

Keywords: digital business, e-commerce, e-trade, Internet/digital services, e-shop, client-server architecture.

JEL Classification: L81, L86, O33, Z1.

1. Introduction

The relevance of research on building an innovative e-commerce store for folk crafts is due, in particular, to such factors as the digital transformation of society, including e-commerce.

More and more people in the world use the global Internet to purchase goods or services. Therefore, building a modern e-shop with up-to-date solutions will allow folk crafts from different regions of the country to adapt to the digital economy in the e-markets of advanced technologically advanced countries by connecting cloud services and reach new customers through online platforms, promoting the talents of different nations of the world.

First of all, it means expanding the target audience and niche markets.

The e-shop allows folk crafts not to be limited to the local market, but to expand their audience to the international level, which will lead to an increase in sales and knowledge sharing of the world's cultural economies.

It should be noted that this is a convenience for consumers. E-commerce allows consumers to make

purchases anytime and anywhere, which makes shopping workflows convenient and attractive for customers, increasing the likelihood of repeat purchases.

The e-shop provides opportunities for effective digital marketing using social media, e-advertising, promotions and discounts, virtual and augmented reality, which will help attract new customers and retain existing ones.

An e-shop can help in accounting for goods or e-services, controlling balances, automating ordering and delivery processes, which will contribute to effective sales management and reduce sales costs. Of particular importance is the issue of ensuring the security and confidentiality of consumer personal information. The aim of the study is to increase the efficiency of electronic trade in folk crafts based on the developed software system of e-commerce using innovative technologies. The research object is the processes of electronic trade in folk crafts. The subject of the study is the approaches and means of building an e-shop for trade in folk crafts.

The research topic is transdisciplinary, as it encompasses knowledge related to the study of crafts, which covers a wide range of disciplines, art history, sociology, economics and design, etc. Crafts are often closely

* Corresponding author. E-mail: v_pleskach@ukr.net

intertwined with cultural heritage and identity (Risatti, 2009). Research in this area can focus on traditional craft techniques, materials, and their historical and cultural significance in specific communities or regions.

Crafts are often deeply intertwined with cultural heritage and identity, also technological development. Research in this area might focus on traditional craft techniques, materials, and their historical and cultural significance within specific communities or regions (Kofler & Walder, 2024; Pöllänen, 2015; Wherry, 2006).

Studies, devoted to economic impact, examine the economic importance of crafts, both in terms of their contribution to local economies and their role in global markets (Mignosa & Kotipalli, 2019).

There's growing interest in how traditional craft practices can be innovated and adapted to meet contemporary needs while preserving cultural traditions and promoting sustainable practices (Ariffin, et al., 2023; Banerjee & Mazzarella, 2022; Pansera & Sarkar, 2016). Research in this area explores topics such as eco-friendly materials, ethical production processes, and the intersection of craft with technology (Bardhan & Bhattacharya, 2022).

Research, devoted education and transmission, examines how craft knowledge and skills are transmitted across generations and cultures, as well as the role of education in preserving and revitalizing traditional crafts (Hofverberg et al., 2017; Kokko & Dillon, 2010). This includes studies on craft education programs, apprenticeship systems, and the dynamics of knowledge exchange within craft communities.

Scholars investigate the aesthetic qualities, design principles, and craftsmanship inherent in different types of crafts. This can include analyses of materials, techniques, and the creative processes involved in craft production (Zheng & Nitsche, 2017).

Crafts are often embedded in social practices and cultural rituals, and research in this area explores their role in shaping social relationships, identities, and cultural expressions. Topics may include the gender dynamics of craft production, the role of crafts in community development, and the use of crafts as forms of cultural resistance or activism (Bellver et al., 2023; Morais, 2022).

With the increasing globalization of markets, there's interest in how crafts are commodified, marketed, and consumed in different cultural contexts (Colloredo-Mansfeld, 2011). This researches address issues such as cultural appropriation, the impact of tourism on craft traditions, and the dynamics of power and representation in the global craft industry, etc (Hubert, 2021; Sudha et al., 2021).

So, the construction of an e-shop for trade in folk crafts can lead to a number of positive changes in the business processes of electronic economic activity and the development of the national economy sector through digital transformation, which will indicate an increase in the percentage of this activity in the country's GDP structure. Thus, the share of e-services in national economies will grow.

2. Materials and methods

The creation of an e-shop is based on a number of theoretical foundations, primarily covering modern concepts of digital economy, e-marketing, ICT and other areas of electronic economic activity.

Digital commerce is the process of buying goods or services online without human intervention.

E-commerce, as a subset of digital commerce, encompasses the concept of selling goods and services via the global Internet, where not all phases of the trade process are automated, unlike digital commerce.

Understanding the basics of e-commerce helps to understand the principles of creating and managing an e-shop, such as order processing, electronic payment systems, e-logistics, etc.

E-marketing, which includes strategies for promoting products and services in the digital environment, is becoming especially important. Important aspects of such marketing include digital marketing, content marketing, search engine optimization, SEM (paid search marketing), social media, etc.

The research methods employed in this study include system analysis and synthesis, generalisation, statistical analysis, and observation.

Creating a user-friendly and attractive web interface for users is critical to the success of an e-commerce store. The theoretical foundations of UI/UX allow you to understand how to provide easy navigation, clear structure, and attractive design of an e-commerce website.

Knowledge of technological aspects, such as web development, data bases (warehouses), data security, cloud technologies, etc., helps to ensure efficient and effective operation and security of the e-commerce site. In addition, the use of data to analyze customer actions, preferences, and purchasing habits allows you to improve sales strategies, personalize offers, and maintain customer loyalty (Laudon & Traver, 2019). In this study, the methods of system analysis and synthesis were used to build a system, generalize and model business processes.

Folk crafts play an important role in the development of national economies, cultural heritage, and society as a whole, and are therefore often supported and interested by various stakeholders, including governments, NGOs, and international organizations (Organisation for Economic Cooperation and Development, 2021).

Folk crafts are based on traditional technologies and craft skills that are passed down from generation to generation. They can stimulate the development of local economies, contributing to the preservation and development of traditional industries. Many handicrafts are associated with local culture, traditions and heritage. They help to preserve and transmit the values, history, and unique character of a region or nation.

And, most importantly, folk crafts can be a source of jobs for the local population, especially in regions with low levels of industrial development, which contributes to social stability and societal development through ICT.

Crafts can be an attractive attraction for tourists interested in authentic local products and crafts. This also contributes to the development of local tourism and support for local entrepreneurship. In addition to the social aspect, this is an economic potential due to the renewed interest and demand for “authentic” products made using special technologies.

According to the Handicraft Market Outlook study for the period 2024–2034, the global handicraft market is estimated at \$387.07 billion in 2024, an increase from \$357.40 billion in 2023. Sales of handicrafts are expected to reach \$1050.53 billion by 2034, with an average annual growth of 11% over the forecast period (Future Market Insights, n.d.).

Modern information and communication technologies drive digital transformation and support digital markets.

It is service-oriented technologies that ensure the promotion and sale of goods and services by crafts.

One of the components of Industry 4.0 is its service-oriented architecture (SOA) (Xu et al., 2018) aimed at integrating applications.

SOA has attracted a lot of attention because it creates a cyber-physical production environment that provides communication and interaction between all participants in the market of goods and services by crafts (Erl, 2008).

The main idea behind web services is to provide a standardized way of exchanging data and functionality between different software systems (Erl, 2016), regardless of the programming language or operating system they are equipped with.

In the context of e-commerce in handicrafts, where there may be a variety of suppliers, producers, and customers, SOA allows for flexible and efficient systems that can meet diverse business needs and conditions.

SOA allows you to build a system from a set of different web services that can be implemented and maintained independently of each other.

This makes the system more modular and allows developers to focus on the development of specific components.

The SOA allows the e-commerce system to be integrated with other software systems, such as warehouse management systems, accounting systems, and electronic payment systems, which ensures efficient data exchange and simplifies e-business processes.

Also, SOA allows you to easily scale the software system by adding new services or distributing the load between existing web services.

And this is important for e-commerce systems that may face significant fluctuations in load depending on the time of day, season, weather, etc.

The SOA allows you to change and update individual components of the software system without the need to rebuild the entire software application, which makes such a system more flexible and simplifies e-business support processes.

SOA is based on the use of standard protocols and interfaces, such as SOAP (Simple Object Access Protocol), REST (Representational State Transfer) (Richardson

& Ruby, 2007), UDDI (Universal Description, Discovery, and Integration), protocols for registering and searching for web services, which helps to find available web services and their descriptions, which facilitates connection to them in a standardized way, and, most importantly, interoperability between different software systems.

Different organizational and economic business models can be used to organize e-commerce in handicrafts, depending on the specific conditions and goals of the enterprise. For example, marketplaces as platforms that bring together different producers and artisans and enable them to sell their goods through a joint e-shop and can consider into account different consumer behavior patterns (Pleskach et al., 2023).

Marketplaces can earn commission percentages from sales, fees for writing off goods, fees for subscribing to services, transaction fees, advertising fees, fees for using the platform services, etc. Commission percentages vary depending on the type of goods or services sold on the marketplace, as well as on the competition in the marketplace and the strategy of the marketplace itself. The manufacturer sells its products directly through its own website or e-shop, which allows the manufacturer to maximize control over the sales process and communicate directly with customers.

A model where customers can subscribe to receive regular deliveries of goods from a particular manufacturer is called a subscription. This can be useful for producers of handicrafts that offer regularly updated assortments.

The C2C model (client sells to client) is well-known.

There are other *platforms with a distributed level of ownership*. This is a business model where users can become partial owners of the platform, jointly solving strategic issues and receiving a share of their profits, which facilitates cooperation among the community of craft producers.

It is common to use crowdfunding platforms to finance the production and distribution of handicrafts, which can help raise funds and connect with stakeholders.

Finally, an important organizational and technological solution is the B2C (business-to-consumer) model, which is simply a developed website.

The above business models can be used separately or combined, depending on the specific goals and conditions of the e-commerce business.

Thus, the main principles and approaches to building an e-commerce site for folk crafts include: 1) research of the target audience (collectors, tourists, lovers of cultural heritage, etc.), their needs, behavior, because this is a specific sector and, accordingly, products; 2) the site should have an adaptive design that allows users to conveniently view and purchase goods on mobile devices, tablets, PCs, a friendly and easy navigation interface, with clear categories and filters (for example, by type of craft, region, price); 3) goods need to be provided with high-quality photos from different angles, detailed product descriptions, including information on materials, manufacturing

techniques, history and significance of items, with the ability to connect a geographic map with unique crafts of the regions of Ukraine, and it is also necessary to take into account omnichannel and multilingual customer support. Social media, blogs, and e-newsletters can be used to promote products and provide product reviews; and secure electronic payment systems and user data protection must be in place in accordance with national laws and international standards. When setting up an e-commerce store for handicrafts, it is important to focus on not just selling goods, but telling the story behind each item, emphasizing its uniqueness and cultural value.

Analysis of software and hardware solutions for the creation of the e-shop Various software and technological tools are used in the process of developing e-commerce websites. A comparative analysis of these tools is a necessary step to determine the optimal solution, taking into account specific needs and requirements.

There are a large number of tool solutions for creating e-commerce websites. In particular, this is a monolithic approach, the use of client-server three-tier, two-tier architectures, microservice architecture, and the aforementioned SOA.

Various technological solutions help to create a powerful and functional e-shop that is able to work efficiently and meet the needs of customers in the trade of handicrafts.

When building an e-commerce online store for handicrafts, it is advisable to use a number of software and technological solutions that ensure efficient and reliable operation of the e-commerce store.

It is worth noting that untrained developers with little IT experience can use specialized platforms for e-commerce systems, such as Shopify, WooCommerce, Magento, OpenCart, PrestaShop. These platforms have ready-made functionality for creating an e-shop, order processing, e-payment, inventory management, etc., i.e. developers use constructors.

Available content management systems (CMS), such as WordPress, Joomla, Drupal, can also be used to create an e-commerce store using application applications or extensions specifically designed for e-commerce systems.

The use of customer relationship management systems (CRM systems), such as Salesforce, HubSpot, Zoho CRM, can help the developer to effectively interact with customers, keep track of orders, analyze data, and improve sales strategies. In all of the above cases, it is important to use data analysis tools such as Google Analytics, Adobe Analytics, specially created recommendation systems to track and analyze user behavior, conversions, traffic, and other metrics that can help improve digital marketing and sales strategies. The use of SSL encryption, two-factor (three-, four-, or three-factor) authentication, protection against DDoS attacks, and other security measures to protect users' personal data and financial transactions is important. It is necessary to provide payment options in various ways, such as credit cards, e-wallets, digital money, QR codes, bitcoins, bank transfers, EPS such as Apple Pay, Google Pay, PayPal, etc. It

is also necessary to take into account the connection of mobile devices with fast web page loading, etc.

Each of these methods has its advantages and disadvantages. The aforementioned monolithic architecture has all functions, components, and modules deployed simultaneously in a single process or server, usually centralized.

Direct interaction is achieved through function calls or other types of data exchange, and a common database or data store for the entire application is another feature.

Development, implementation, and testing are simplified by following a monolithic approach due to the centralization of all elements. In addition, choosing this method can lead to improved system performance, as components do not have to go through communication processes in networks or other protocols. Small applications with this architecture are easier to deploy because of the simplicity of the high-level architecture. Despite the tightly coupled logic, monolithic applications can be easier to test and debug because they are simpler, with fewer individual components to consider.

A monolithic architecture is a traditional solution that provides a centralized software structure. While this approach simplifies development and deployment, it can make it difficult to change and scale the project later.

The *client-server two-tier architecture* includes the client and server tiers (Tanenbaum & van Steen, 2016). The client layer is responsible for the user interface and data presentation, while the server layer is responsible for managing data storage and business logic functions. The communication between the two layers is usually carried out using proto-circuits or direct connections.

The *client-server three-tier architecture* has three tiers, namely the client tier, which is responsible for the user interface. The business logic domain tier is responsible for processing the application logic, in particular, this tier interacts with both the client (presentation) and data tiers. Its basic functions cover operations for processing orders, payments, events, price calculation, inventory management, access rights, data verification, data validation, transaction management, calculation algorithms, service publishing, data security and integrity, and integration with other software systems and web services. The business logic tier can be scaled independently of other tiers, which allows you to optimize resources and application performance. The data tier, also known as the data storage tier or database tier, is the lowest tier in the three-tier architecture. Its primary responsibility is to efficiently store, retrieve, and manage the data required by the application. The data tier is responsible for ensuring data consistency, storing and managing the database (storage) containing information about products, customers, orders, transactions, etc. The data tier provides the ability to perform data operations, such as adding, modifying, deleting, or searching for records in the database. It also provides efficient access to data for other layers of the architecture, ensuring fast and efficient information exchange between the client and server layers. The data layer is responsible for protecting data from

unauthorized access. It ensures high availability and recovery of data through replication and regular backups. A well-designed data tier provides the software application with the benefits of increased performance, scalability, and reliability. Three-tier architectures, deployed mostly in current web applications, distinguish between the front-end (presentation tier) and the back-end (application tier). The application tier is usually developed using Python, Java, Perl, PHP, or Ruby, which communicates with the data tier through API calls. The data tier, sometimes called the database (DB) tier, is where the information processed by a web application is stored and managed, often developed using PostgreSQL, MySQL, MariaDB, Oracle, DB2, Informix, Microsoft SQL Server, MongoDB, Cassandra, etc. The client-server three-tier architecture is shown in Figure 1.

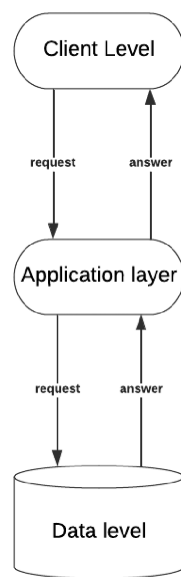


Figure 1. Client-server three-tier architecture

As for the microservice architecture, it is characterized by decentralization, since the software product is divided into independent components that communicate with each other via API. The essence of the microservice architecture of a software system for e-commerce in handicrafts is to divide the software application into small, autonomous and independent services. Each microservice is responsible for a specific aspect of the application's functionality, has its own database, and can interact with other services via API (Richardson, 2018).

Each service is responsible for performing a specific business process or function, such as order management, payment processing, product management, etc. Each microservice can be deployed and scaled independently of other services, which allows for flexibility and speed of development of the software system. Microservices can be deployed on different servers or containers, which allows you to distribute the load and ensure high availability of the system. There is a high level of automation in the processes of deployment and testing, using containers and orchestration. This allows each service to use

the optimal database scheme for its needs and reduces dependencies between services. This approach provides high flexibility and simplifies the process of updating and expanding the functionality of the program. Thus, SOA provides a high level of modularity and the ability to reuse components, which makes it optimal for the development of complex systems.

When choosing an architectural solution for the implementation of a particular e-shop, it is necessary to take into account the specifics of the product, the scale of the project, the target audience, and business needs. The use of an integrated approach that involves the analysis of available architectural models allows to optimize the development process and ensure the creation of an efficient, flexible and scalable software system (Shvets, 2018). A comparative analysis of the software and technical solutions for the creation of electronic shopping were applied, the results of the analysis are shown in the Table 1, the advantages and disadvantages of different architectural approaches to creation of e-commerce software systems are presented in this table.

Table 1. The advantages and disadvantages of architectural solutions of the creation e-commerce software systems (source: own elaboration)

Architectural approach	Advantages	Disadvantages
Mono-lithic	Simplicity of development and testing. Developers work on a shared codebase, simplifying collaboration and reducing communication overhead.	Difficulty in scaling and changes. Limited flexibility in choosing technologies, as all components within the monolith must use the same stack.
Micro-service	Independence and flexibility. Error isolation: failures in one service do not affect the entire system, increasing the overall resilience of the system.	Management complexity. Managing a large number of services can increase operational complexity and overhead.
Two-tier	Simplicity: separates the program into two levels of presentation and data, reducing complexity. Simplified testing and compatibility.	Difficult to scale horizontally due to tight coupling between presentation and data levels.
Three-tier	Separates the program into three levels – presentation, business logic, and data, promoting modularity and reuse. Provides better scalability, each subsequent layer can be scaled independently. Changes can be made in one layer without affecting others.	An additional level increases the overall complexity of the system, requiring careful design and coordination between levels. Additional levels and connections between levels can cause certain overhead costs on performance compared to a simpler architecture.

When creating an e-commerce store of folk crafts, it is extremely important to take into account the architecture of the software system to ensure scalability, ease of maintenance, productivity, etc. The choice of a high-level programming language to implement the user interface is of primary importance.

An e-commerce online store for handicrafts may have various components that help ensure its efficient operation and convenient user experience. In particular, this includes the website and the user interface, the frontend as the client part of the interface. To create the software system, we used business process modelling of the e-shop and synthesis of system components.

The three main technologies for visual accessibility include HTML, CSS, and JavaScript (Mikowski & Powell, 2013). HTML forms the basis for web pages, CSS manages their visual presentation and style, and JavaScript adds interactive and dynamic features. This is the main platform through which users can browse products, make purchases, and interact with the store, so this component includes web pages, search functions, filtering, shopping cart, ordering process, etc.

The backend contains business logic, a database (DB), an order management system (OMS), a review and rating system, an analytics and reporting system, and a content management system. The database or content management system contains information about all the products that are available for sale, it includes the product name, description, image, price, availability, etc. A OMS is a component that is responsible for processing and fulfilling user orders and includes inventory management, invoice processing, delivery tracking, and customer communication. A backend payment system is required. This component allows users to make payments for goods and services. A review and rating system allows users to leave feedback and ratings for the goods they have purchased.

The analytics and reporting component of the system is responsible for collecting, analyzing, and visualizing data on website traffic, conversion, sales, etc. It helps to understand the effectiveness of the store and make informed management decisions about its further development.

Nowadays, progressive web applications are becoming increasingly popular, as they allow developers to create powerful and user-friendly applications that work on any device and in any conditions of the information and communication network (Ater, 2017). *Progressive web applications* are web applications that combine the best aspects of websites and mobile applications to provide users with a convenient and efficient experience. They are a new generation of web applications that combine the benefits of native applications with the ease of use of the web.

3. Results

After analyzing the software and technological solutions for building an e-commerce e-shop for handicrafts, a

client-server three-tier architecture was chosen. The three-tier client-server architecture provides many advantages that contribute to the *efficiency, scalability and security* of an e-commerce online store for folk crafts.

This is primarily scalability and flexibility. The three-tier architecture allows you to divide a web application into the logical components described above (client layer, business logic layer, and data layer), which simplifies scaling and modification of the software system without affecting other components.

Each level of the architecture has its own clearly defined responsibilities, which helps to maintain and develop the system. For example, the business logic layer is responsible for processing business processes, and the data layer is responsible for managing and storing data.

Storing business logic on the server level protects sensitive data and logic processing from unauthorized access, making the system more secure.

The client layer can be implemented on different platforms (web, mobile applications), which allows for greater accessibility and convenience for users. The distribution of logic between the client and server layers allows to optimize the work of the e-shop and ensure a quick and efficient response to user requests. Thanks to the clear separation of components, the use of a three-tier architecture simplifies the maintenance and development of the software system, as changes in one layer can be made without affecting the others. The architecture must be flexible to adapt to the current and evolving web design trends and provide a high level of user interaction with the range of products representing folk crafts.

There are three main roles in a software system for e-commerce in handicrafts, including the system administrator, the user, and the guest (Figure 2).

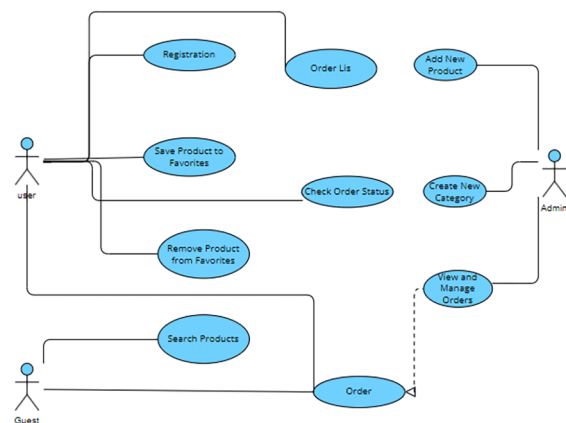


Figure 2. Diagram of roles in an e-shop of folk crafts (source: own elaboration)

The functional requirements for the system cover the following user capabilities: registration, product search, browsing, ordering, adding to the product list, and final review before placing an order. Administrators are authorized to manage the product catalog, process orders, add new products, etc.

The main processes of interaction between the user and the software system are as follows: registration, authentication, account management, product search, ordering, and transaction execution.

As mentioned above, the client-server three-tier architecture of a software system has three tiers, namely the client tier, business logic tier, and data tier. In accordance with the chosen end-to-end approach, an architectural solution for an e-shop of handicrafts was created (Figure 3).

Client level This level interacts with the user. To develop an effective and intuitive user interface, we decided to use the synergy of two web development technologies: Angular (Wilken, 2018) and React (Gackenheim, 2015) frameworks.

This integrated, combined solution is driven by the desire to combine the best features of these technology solutions to achieve high performance, flexibility, and convenience. This hybrid approach has never been used in the development of e-commerce websites before. The combination of Angular and React can give developers more flexibility and opportunities to create a powerful and efficient e-commerce store for handicrafts (Saks, 2019). The use of both frameworks allows the application programmer to choose the one that best suits the specific needs of the store. For example, Angular can

be used to create monolithic out-of-the-box applications, while React can be used to create flexible and dynamic web interfaces. React and Angular both support a component-based development approach, which allows developers to create components that can be reused in different parts of an application, which facilitates rapid development and maintenance of program code. Both frameworks have a wide ecosystem of tools, libraries, and additional solutions that can make it easier to maintain an e-commerce store. Using both frameworks allows you to leverage best practices and tools from both ecosystems. Using Angular for business logic and application state management, while using React to create a dynamic and interactive interface, can help to clearly distribute responsibilities between different parts of the software application. Using both frameworks can also allow you to gradually migrate some parts of the application from one to the other if necessary in the future, which allows you to maintain the existing functionality and gradually expand or improve the software system.

Business logic level The service tier uses Spring Boot (Antonov, 2015) to develop business logic. REST controllers are used for API endpoints, while Hibernate (Bauer, et al., 2015) is used for ORM (Object-Relational Mapping) (Smith, 2021). A microservice for image management was developed, implemented on Spring Boot and providing functionality for uploading, processing, and storing images.

Data access level The data access layer is used to store and organize the data used by the software system. The diagram of the interconnections of information flows and relations between different levels (presentation, business logic, data access) is shown in Figure 3 above. Arrows point to interactions between program components, for example, the connection between the interface and the server through REST API calls. It should be noted that the Spring Boot framework was used as the backend part of the e-shop. Spring Boot is a Java software development framework that provides an easy way to create self-contained and ready-to-use applications. The MVC pattern was used in the development of the e-shop (Fowler, 2012). It divides a web application into three main components: a model, a view responsible for displaying data to the user on the frontend, and a controller. The MVC pattern distributes functional responsibilities between these components, which contributes to greater modularity. Each component performs its own role and has clearly defined responsibilities. Figure 4 shows the architecture of the database of the e-shop of folk crafts, which reflects the scheme of databases with the corresponding relationships.

The database chosen was PostgreSQL (Chauhan & Kumar, 2017), an object-relational database management system that uses the SQL language to store and manage data. It is a powerful, reliable, and extensible system that supports a large number of functions. The database is utilized using the Java Persistence API. Queries to the database were implemented using JPA (Keith, et al., 2010).

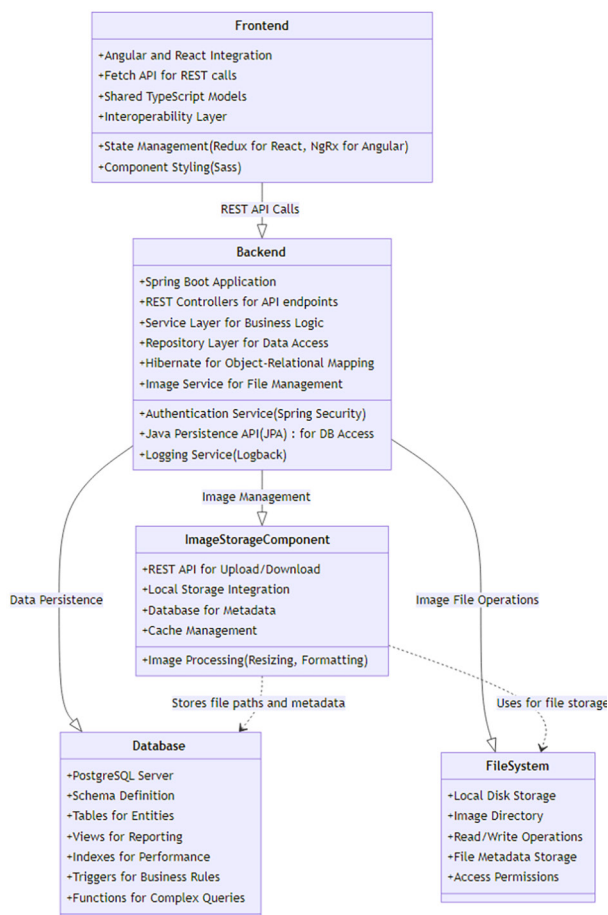


Figure 3. Architectural solution for an e-shop of handicrafts (source: own elaboration)

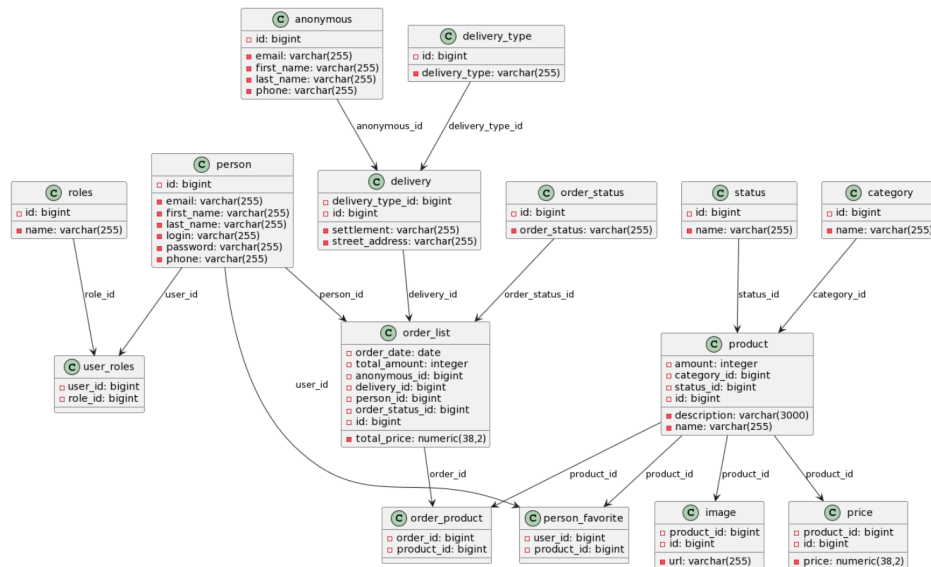


Figure 4. Diagram of the database of the software system of the handicrafts e-shop (source: own elaboration)

Table 2 shows the structure and relationships between the various entities (tables) in this database. Each table represents a specific entity (e.g., roles, users, products, orders) and contains the corresponding fields that define the characteristics of that entity. The diagram describes the keys that determine the uniqueness of records in the tables or establish relationships between the tables (The PostgreSQL Global Development Group, n.d.).

Table 2. Description of database tables (source: own elaboration)

Table name	Appointment
Anonymous	Keeps the user anonymous
Category	Saves the product category
Delivery	Stores delivery information
Delivery _type	Saves the delivery type
Image	Saves product images
Order list	Saves the list of orders
Order product	Stores products in the order
Order _status	Saves the order status
Person	Stores personal information
Person _favorite	Saves user’s favorite products
Price	Saves the price of goods
Product	Keeps the goods safe
Roles	Saves user roles
Status	Saves the status of the product
User roles	Saves user roles in the system

Figure 5 shows a UML diagram in which the store administrator adds a new product to the appropriate product category.

User authentication:

1. The user clicks the profile button.
2. The frontend checks for a token.
3. If the token has already been received, the frontend

checks its validity by sending it to the backend for verification.

4. If the token is valid, the frontend re-verifies the user’s role.
 - If the authorization token has the role of “admin”, the user is redirected to the admin page.
 - If the role is not “admin”, the user is redirected to the user page.
 - If the auto-cut token is invalid, a pop-up window opens to enter your login and password.
 - After receiving the updated token, the frontend re-verifies the user’s role and performs similar actions.

If the token is not received, the frontend opens a pop-up window for entering the login and password.

- The user enters a login and password.
- The frontend checks the entered data and sends JSON with the login and password to the backend.
- The backend searches for a user by login in the database.
- If the user is found, the backend decrypts the password and compares it with the entered password.
- If the passwords match, the backend generates a JWT token and sends it to the frontend.
- If the passwords do not match, the front end receives an authentication error.
- If the user is not found, the frontend receives an authentication error.

Authorizing and adding a new product:

The administrator clicks the “Add new product” button.

5. The administrator fills in the form fields.
6. The frontend sends JSON with product data and an auto-cut token to the backend.
7. The backend saves the product to the database and returns a confirmation of successful saving to the frontend.

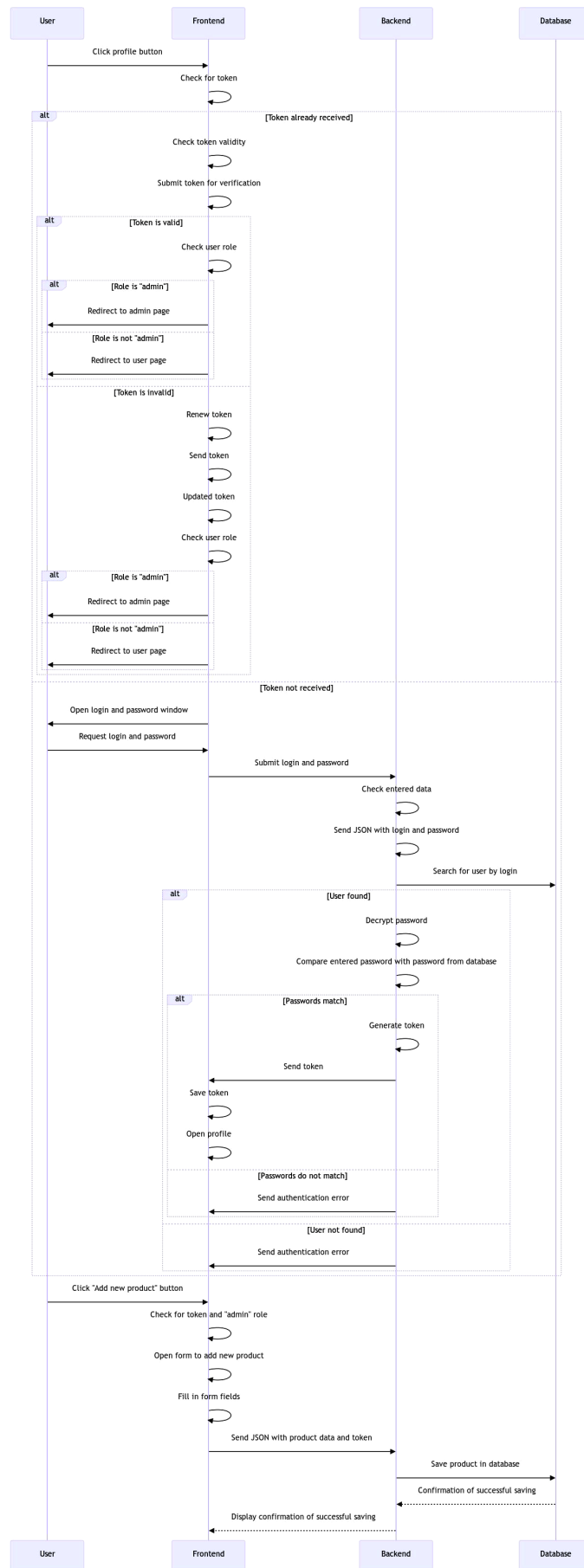


Figure 5. Diagram admin adds a new product (source: own elaboration)

It should be noted that the design of the user interface (UI) and user experience (UX) is of great importance for the further development and prospects of a software system. A powerful UI/UX design improves not only the aesthetic appeal of a software application, but also its functionality and usability, which leads to higher satisfaction and the attraction of new users. This hybrid approach effectively leverages the strengths of frameworks through the use of HTML, SASS (Syntactically Awesome Style Sheets) (Cederholm, 2013) and TypeScript to create a friendly user interface.

After entering the address of the e-shop, the user is redirected to the main page of the e-shop. The home page has a simple and user-friendly design aimed at ensuring convenient viewing. At the top of the page is a header that contains the logo, a search bar, and convenient buttons. Below the header, there is a slider that shows different images related to goods or services (discounts). The slider automatically rotates to attract attention. The main page of the e-shop is shown in Figure 6.

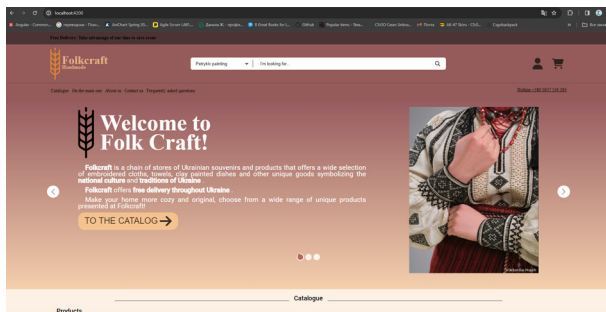


Figure 6. Home page of the e-shop of folk crafts (source: own elaboration)

The product catalog contains a list of available products with a brief description, price, and the ability to view detailed information to make a purchase.

The “About Us” section describes the e-shop of folk crafts and its principles of operation. The last section of the page is the footer, where you can find important information about the store’s opening hours and address.

When you click on the product catalog, a new page opens to redirect the user. This page contains a list of all products in a particular category.

The *administrator page*. The logo is located on the left and three buttons are located below it: “Add catalog”, “Add product” and “List of all orders”. On the right is a

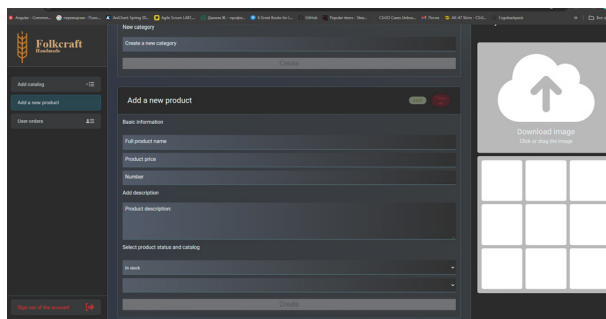


Figure 7. Store administrator page (source: own elaboration)

block for creating a new catalog. Below it is a form for creating a new product (Figure 7).

To verify that the software works properly, a number of manual tests have been written, a manual type of testing in which test cases are performed manually by a tester without the use of automated tools. Manual testing is particularly valuable for evaluating usability. To achieve full coverage of testing, a combination of the two approaches, automated and manual, is often used. This software system was generally tested. Thus, the study resulted in the design, implementation, and testing of an e-shop for the sale of handicrafts.

A ready-made e-store provides effective trade in handicrafts in the online environment.

The purpose of further research is to develop and implement a methodology for obtaining data based on the geoinformation map of folk crafts in the regions of a certain country and aggregate the information obtained on the e-shop website with the ability to generate analytical reports on specific domestic crafts in real time and provide craftsmen with a platform for selling unique goods.

4. Conclusions

In the digital era, e-commerce craft stores have great potential for success, and developing technological solutions helps to utilize this potential to the fullest.

The study solved the following tasks: investigated and described the theoretical foundations for creating an e-shop based on web technologies; analysed software, hardware and other solutions for building an e-shop; were designed, implemented and tested an e-shop of handicrafts using hybrid information technology, based on a three-tier client-server architecture. The following technology stack was used to develop the software system: Angular and React, a programming language for TypeScript development, were used on the frontend. The backend used the Spring Boot framework based on the Java programming language. The PostgreSQL database was used for data storage. The developed e-store provides efficient trade in handicrafts in the digital environment. Such an e-shop is a useful digital tool for interaction between craftsmen.

The digital space opens up the opportunity for e-commerce stores to gain global access to digital markets, not limited to geographical boundaries, which allows them to attract new customers and increase sales. In the digital age, people are increasingly using the Internet for shopping because of convenience and speed (Radu, 2023). E-shop of folk crafts allows users to make purchases from any place and at any time, which helps to increase sales. The technological solution described above automate many business processes, such as order processing, inventory management, customer interaction, etc., which increases the efficiency of e-commerce and reduces the cost of managing them. Digital solution allows to collect and analyze large amounts of data on user behavior, sales, and the effectiveness of advertising

campaigns, which helps make informed management decisions about business development and optimization. In the age of digital technologies, competition among e-commerce stores is growing significantly, so the development of effective innovative solutions allows you to create competitive advantages, such as website speed, user-friendly interface, and personalized approach to customers.

Disclosure statement

The author does not have any competing financial, professional, or personal interests from other parties. The author is no competing interests to declare.

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