



CS491 Senior Design Project - Fall 2024 Project Specification Document

YOLLA-T2418

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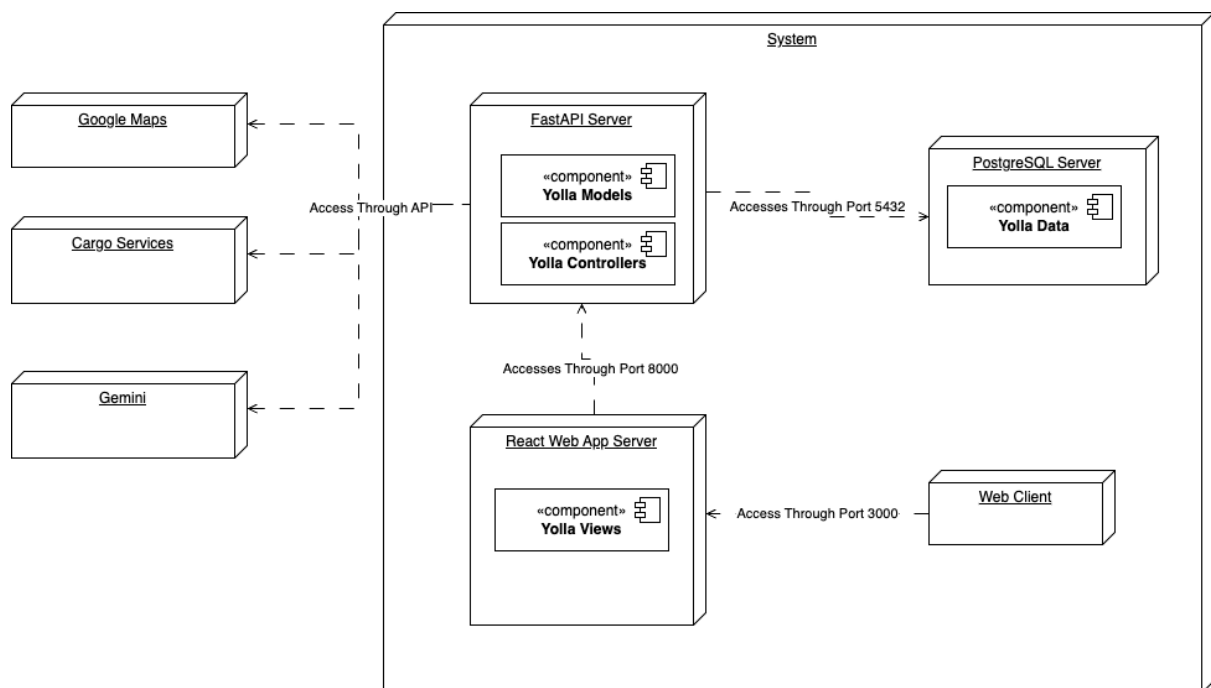
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1. Introduction

1.1. Description

Yolla is a mobile and web-based cargo marketplace designed to simplify the process of finding, comparing, and booking cargo services in Türkiye. Users can easily search for cargo options based on location, size, weight, and delivery time while comparing prices and services from multiple providers. The platform offers comprehensive service provider comparisons using various filters, real-time package tracking, and notifications, ensuring a smooth and user-friendly experience. With its responsive design, Yolla targets individual customers and SMEs by offering transparency, convenience, and efficiency in cargo delivery. Yolla aims to make cargo logistics accessible to everyone at the best price.

1.2. High Level System Architecture & Components of Proposed Solution



1.3. Constraints

1.3.1. Implementation Constraints

- Git and GitHub will be used for managing code, collaboration, and tracking changes in the project.
- Jira will be used for tracking tasks and managing project progress.
- React will be used to build the web application interface.
- React Native will be used for building the mobile application interface.

- FastAPI will be used for handling the backend of the project.
- PostgreSQL will be used as the database for managing and storing data.
- Automated testing and CI/CD will be used to have faster and more reliable development and deployment processes.
- Cloud hosting and infrastructure will be used to deploy and scale the application.
- LangChain and FAISS will be utilized to enable a Retrieval-Augmented Generation (RAG)-based chatbot service, integrated with the Gemini API.

1.3.2. Economic Constraints

Yolla will be a SaaS project with various types of costs such as maintenance, license, and marketing costs.

- **Campaign costs:** Yolla aims to drive a shift in customer habits, which will require investment in promotional campaigns designed to influence and reshape these behaviors.
- **Database maintenance and server costs:** Yolla will be a web-based service, therefore there will be hosting and domain costs. Growing number of users will require storing more data, which will increase our database maintenance and storage costs. We also plan to launch mobile apps, which will include App Store and Google Play Store publication costs.
- **API costs:** APIs will be utilized to establish connections with various package delivery companies, send queries to LLMs, and retrieve estimated walking times from Google Maps. While free alternatives are available, paid APIs may be required to ensure higher quality services and reliability.
- **Legal compliance:** Additional investments in security measures and legal consultations may be necessitated to ensure compliance with local regulations and to uphold data security standards.
- **Marketing:** Funds may need to be allocated for advertising, brand building, and promotional activities to effectively reach the target audience and enhance brand visibility.

Additional costs may occur during our incremental deployment with the features we add based on the user feedback.

1.3.3. Ethical Constraints

- **Contributing to Environmental Pollution by Promoting the Cargo System:** Encouraging the use of cargo services may lead to increased environmental pollution, particularly if the promoted services rely on inefficient or high-emission vehicles.
- **Contributing to Market Monopolization:** Yolla can serve to market monopolization as large cargo enterprises may give a more competitive price opposite to the small cargo enterprises.

1.4. Professional and Ethical Issues

Ensuring the compliance with the professional and ethical standards are among our main concerns in our project.

- **Data privacy and security:** We will ensure and securely store the sensitive user data. We will anonymize the user data in order to use it in our user data analytics. We will transparently state how we use the user data and respect the user consent on data usage and storage.
- **Diversity and inclusivity:** We will add an English language option for the people who do not speak Turkish. We will ensure a safe and inclusive environment in our platform by defining some terms and regulations. With suggesting the options for pick-up service from home, we will be covering the needs of the disabled.

1.5. Standards

To ensure the Yolla project aligns with industry practices, ethical principles, and user expectations, the following standards will be established:

1.5.1. Development Standards

- **Coding Practices:** Consistent coding styles will be maintained across all files in Yolla's code repository. Meaningful names will be used for variables, functions, and classes to enhance readability and maintainability.
- **Version Control:** Git will be employed for version control, with clear commit messages ensuring transparency in development progress. The repository will be hosted on GitHub, and separate branches will be utilized for code changes. Merges to the master branch will only be performed after thorough verification to prevent potential issues.
- **Documentation:** Comments and documentation will be added for all critical functions and modules to facilitate understanding and collaboration. README files will be provided to guide the project setup process.

1.5.2. Security Standards

- **Authentication:** We will use JWT tokens for user sessions to ensure security. We will implement two-factor authentication (2FA) for enhanced security.
- **Data Encryption:** We will encrypt sensitive data in transit (using HTTPS) to prevent attacks on our data. We will ensure compliance with KVKK (The law in Türkiye to protect personal data) for data privacy.

1.5.3. User Experience Standards

- **Design Consistency:** We will ensure everyone uses consistent UI features such as fonts and colors to create our branding and to make our product visually appealing.
- **Feedback:** We will provide feedback to user actions in order to prevent events with no response from the system. These feedback may be in the form of warning messages, notifications, or toasts.

- **Speed:** We will ensure that the page load times are under 3 seconds to enhance user experience. We will reduce API calls by using cache.

1.5.4. Legal and Compliance Standards

- **Data Privacy Compliance:** We will ensure full compliance with Türkiye's KVKK and other applicable laws, as explained in Section 1.4.
- **Contracts:** We will establish partnerships with cargo providers, ensuring mutual benefit.

2. Design Requirements

2.1. Functional Requirements

2.1.1. Main Features

2.1.1.1. User Registration and Authentication

- Users can create an account and log in using an email address, phone number, or third-party authentication services like Google, Microsoft, and Apple.
- Senders can save their favorite delivery addresses for future use.

2.1.1.2. Cargo Listing & Search

- Users can input the source and destination addresses either manually or by selecting them on a map.
- According to these provided addresses, cargo options will be displayed along with their delivery times and prices.
- Users can choose the best option based on their preferences.
- The users can list and search cargo services even if they are not registered.
- Users can compare the prices of different cargo options. There will be filtering and sorting options for users to list the cargo services according to their preferences.
- Users can filter the options by the estimated delivery time. Users will be able to select express, standard, or economy delivery options depending on how quickly they need the cargo to reach its destination.
- Users will be able to set a price range for the cargo service to find options that fit within their budget.
- Users can also sort the list of cargo services by delivery time, price, reviews or distance they will have to deliver the cargo to the related cargo branch.

2.1.1.3. Package Tracking

- Both the sender and the receiver can track their packages using a unique key provided to them. If both the sender and receiver are registered users, the code will be sent to them via SMS, and it will also be available in the app. If either party is not a registered user, only the sender will receive the code via SMS and app notification from the cargo company. The sender must be a registered user.

2.1.1.4. Receiving Payments

- The payment will be received through the payment gateway APIs such as SanalPOS and iyzico.

2.1.1.5. Notifications

- The sender and the receiver will be notified by the package's status.

2.1.1.6. Business Cargo Management

- Our platform will be a great medium for small to medium companies. They will be able track all of their sent products and can track if the products were received by the customer. The businesses can get promotions from the cargo services if they send regular cargos at a certain amount. The businesses can agree with certain companies and get promotions from the cargo companies.

2.1.1.7. Box Measurer

- Users will be able to measure their boxes using their phone's camera. By simply pointing the camera at their box, users will determine the box's dimensions. This will make it easier for them to check if their package meets the size requirements.

2.1.1.8. Chatbot Integration

- The application will provide a chatbot service so that the users can ask their questions while using our application.

2.1.2. Secondary Features

2.1.2.1. Ratings & Reviews

- The users will be able to rate and review the cargo services. They can send their commands to the relative cargo service so that other users can benefit from their feedback.

2.1.2.2. Cargo Insurance Options

- Insurance options will be provided for senders, allowing additional coverage to be added to their cargo to ensure protection during transit.

2.1.2.3. Advertisement

- Product and cargo-related advertisements will be displayed on the Yolla platform. Additionally, promotional tariffs will be offered to enhance user engagement and attract more service providers.

2.2. Non-Functional Requirements

2.2.1. Usability

Yolla prioritizes a user-friendly approach in its design across both its mobile and web platforms. The integration of a camera-based cargo box measurement service allows users to quickly determine the dimensions of their packages, eliminating the need for manual calculations. Yolla further enhances convenience by enabling users to compare different cargo service providers effortlessly, with a single click, based on price, delivery time, and other relevant criteria. Additionally, Yolla offers real-time tracking capabilities with one click from the main menu, allowing users to monitor the location and status of their sent or incoming packages with ease.

2.2.2. Reliability

Yolla aims to provide a highly reliable service with a guaranteed uptime of at least 99.9%, excluding scheduled maintenance periods. The platform will ensure data integrity by accurately processing all transactions and data exchanges, preventing data loss or corruption. Robust error-handling mechanisms will be implemented to gracefully manage any system errors, providing meaningful feedback to users without exposing sensitive system information. Regular data backups and efficient recovery procedures will be established, enabling Yolla to restore services promptly—within 15 minutes—in the event of any failures, thereby minimizing disruption to users.

2.2.3. Performance

Optimizing performance is a key priority for Yolla to ensure swift and efficient user interactions. The application will be engineered to load pages and process user requests within three seconds under normal network conditions. Yolla will be capable of handling at least 10,000 concurrent users without any degradation in service quality. Efficient algorithms and data processing methods will be utilized so that search queries and data retrieval operations return results promptly, typically within two seconds. Resource utilization on both server and client devices will be optimized to ensure smooth and efficient operation, contributing to an overall positive user experience.

2.2.4. Supportability

Yolla is designed to provide comprehensive customer support to address user needs effectively and efficiently. The platform will include a 24/7 chatbot service powered by the Gemini API, ensuring users receive immediate assistance at any time. To manage common inquiries, a detailed FAQ page will be available, offering clear answers to frequently asked questions. Additionally, a dedicated support email will be allocated, and checked regularly to ensure timely responses to user concerns. As the platform grows and reaches a substantial user base, a call center will be established to deliver personalized and real-time support, further enhancing the overall user experience. Through these support channels, Yolla aims to maintain high levels of user satisfaction and trust.

2.2.5. Scalability

Yolla is designed to scale efficiently to meet growing user demands and market expansion. The system will support horizontal scalability, allowing for the addition of more servers or resources to handle increased loads seamlessly. Elastic resource management will enable the platform to dynamically allocate computing resources based on current demand, optimizing both performance and operational costs. Yolla is prepared to accommodate a 100% increase in user base and transaction volume within the next 12 months without requiring significant redesign, ensuring continuous, reliable service as the platform grows.

2.2.6. Platform Compatibility

To maximize accessibility, Yolla will be available as both a mobile application and a web application. The mobile app will support major operating systems, including Android and iOS, catering to a wide range of mobile users. The web application will be compatible with all major browsers such as Chrome, Firefox, Safari, and Edge, ensuring users can access Yolla from any device. A responsive design approach will be adopted so that the web application adjusts seamlessly to different screen sizes and resolutions, providing a consistent and optimized user experience across desktops, tablets, and smartphones.

2.2.7. Security

Security is of utmost importance for Yolla to protect user data and maintain trust. All data transmissions will utilize secure protocols (HTTPS) to ensure data integrity and confidentiality during communication. The platform will comply with all relevant data protection laws and regulations, including GDPR and KVKK if applicable, to safeguard personal information. Robust authentication and authorization mechanisms will be implemented, incorporating multi-factor authentication options to enhance account security. Sensitive user data will be encrypted both in transit and at rest using industry-standard encryption algorithms. Regular security audits and vulnerability assessments will be conducted to proactively identify and mitigate potential risks.

2.2.8. Integration

Yolla will integrate with third-party cargo service providers through well-defined APIs, enabling users to access a wide range of services within a single platform. Secure and reliable integration with multiple payment gateways will be established to facilitate smooth and secure transaction processing.

2.2.9. Efficiency

Efficiency is a core focus for Yolla, aiming to optimize resource consumption and performance. The application will be optimized to minimize CPU and memory usage, ensuring efficient operation on both server and client devices. For mobile users, the application will be designed to minimize battery consumption, enhancing usability on the go. Efficient algorithms and data processing methods will be employed to ensure fast execution of tasks, contributing to overall system efficiency. Load balancing techniques will be utilized to distribute workloads evenly across servers, preventing bottlenecks and maintaining consistent performance.

2.2.10. Flexibility

Flexibility is at the core of Yolla's design philosophy for easy adaptation to changing market conditions and user needs. The system architecture will be extensible; new features, services, and integrations with more cargo service providers should be easily added without major overhauls. Users will have the option to customize specific aspects of their experience, such as notification preferences and interface settings, which will enhance personalization and user engagement.

2.2.11. Sustainability

Yolla will serve to United Nations Sustainability goals in few aspects:

2.2.11.1. Protecting Environment

Yolla will be ranking cargo companies based on the carbon efficiency of their fleets, enabling users to make environmentally conscious choices. In addition to that, Yolla will calculate and show the amount of potential carbon emissions for every cargo option, which would introduce more transparency and raise awareness among users. To further offset this environmental impact, Yolla is working toward collaboration with NGOs committed to carbon neutrality. By means of this partnership, it will be possible for the users to make a donation of rounding up the final value and donating the difference to NGOs, therefore helping to neutralize the carbon emission that their cargo emits. Such steps reduce not only the environmental footprint of the platform but also encourage a sustainability culture within the logistics sector.

2.2.11.2. Supporting Local Economy

Yolla will contribute to the local economy by providing a platform that promotes small and medium-sized cargo businesses together with larger providers. By allowing fair visibility and ranking opportunities, Yolla enables local businesses to compete on an equal footing, promoting diversity and innovation in the logistics market. Besides, the platform nudges the user toward opting for local service providers, thus reducing transport distances and benefiting the regional economic growth of businesses. It will also give special offers to the SMEs. Yolla will grant special price packages, tailored promotions, and priority visibility for the SMEs.

3. Feasibility Discussions

Feasibility of the project will be discussed in two dimensions: Market, Competition and Academic Analysis. Market analysis is crucial to understand the economic sustainability and returns of the project. Competitive analysis will assist the project with analysis of implementation of similar ideas. Academic analysis is going to play an important role to integrate the latest technologies and apply the outcomes of relevant research to the project.

3.1. Market Analysis

Türkiye is a market with opportunities for the project. In Türkiye 86.5% of the population is using the internet. Along with the high internet penetration rate, the size of Türkiye's cargo market is over 100 billion USD by 2024 [1].

On the customer side SME dominated the market 64.5% of the total revenues in the economy is generated by SMEs [2] and the booming freelance e-commerce sector which needs cost-effective, reliable solutions for logistics. Also inflationary pressures average inflation in the last 3 years was 59.5%, expected inflation for 2025 is 35% provides an environment where customers tend to select cost-effective solutions [3].

3.2. Competitive Analysis

As the main and primary market of the project is Türkiye competitors in the Turkish market will be evaluated.

3.2.1. Geliver

It is the most prominent active competitor, it offers a comprehensive platform integrating multiple cargo companies such as Aras Kargo, HepsiJet, and Yurtiçi Kargo. It stands out for features like real-time package tracking, e-commerce integrations, and end-to-end management of logistics processes. Geliver's service offerings and extensive partner network position it as the primary competitor for Yolla, presenting a significant challenge in market differentiation [4].

3.2.2. Kargonomi

Another functional cargo startup that is partnering with five major companies: Aras, HepsiJet, PTT, Sürat, and Sendeo. The platform relies on phone-based bookings and advertises economic pricing starting from 29.90 TL. It employs an AI-supported system to recommend the most cost-effective cargo options, making it a notable competitor in terms of pricing transparency and simplicity [5].

3.2.3. Grak Grak Kargo

Startup aimed at uniting senders and couriers on a single platform. It is no longer operational, likely due to low team caliber [6].

3.2.4. Kolibu

A company focused on designing to track multiple cargo services from a single interface, has ceased operations, as evidenced by its inactive LinkedIn profile and absence of updates [7].

3.2.5. KargoBul

The competitive landscape for cargo aggregation platforms indicates a market interest. However the failures of some startups highlight the challenges in sustaining operations in this sector, such as limited scalability, insufficient differentiation. Project must focus more on

the failure of the startups to enhance its work. Also active competitors like Geliver and Kargonomi have succeeded in the market by integrating real-time tracking and cost-effective solutions, but significant gaps remain in areas like comprehensive provider comparison, advanced user experience, and affordability for SMEs and freelance e-commerce users which can be utilized by the project Yolla [8].

3.3. Academic Analysis

Yolla will use a sorting algorithm to sort the available shipping options based on the cost, the location of the user and the cargo branches, and home pick-up options. The weights of these parameters will be optimized using optimization techniques such as integer programming.

3.3.1. Linear Programming Model

The methodologies outlined in the study by He et al. [8] have a great potential to further benefit the optimization of shipping options in Yolla. This paper presents a Fuzzy AHP-based ILP model that can be used to solve multi-criteria decision-making problems in transshipment logistics. The integration of quantitative factors, such as cost, with qualitative aspects, such as customer satisfaction, under uncertain environments, allows balanced optimization using the proposed approach. In a similar way, the Fuzzy AHP method can be used in Yolla for dynamic weighting of the parameters in terms of cost, proximity to cargo branches, and the availability of home pickups. These ILP-optimized weights ensure that the algorithm ranks shipping options according to an integrated assessment of user needs and service attributes. Besides ensuring more precise decision-making, this approach is also consistent with a customer-centric model, taking into consideration critical elements of service quality and flexibility, as discussed by He et al. [8]. It is likely to contribute to the better user experience and competitiveness of Yolla in the logistics marketplace.

3.3.2. Customer Retention Management

Yolla will adopt targeted campaigns to improve user retention, informed by the insights of Eva Ascarza et al [9]. This research supports an integrated approach in retention management. Yolla's strategy will focus on understanding user behavior, locating prospective customer loss, and devising appropriate motivators that increase user engagement and satisfaction.

First of all, at-risk users will be identified by the approach with the use of predictive analytics, analyzing such data as a frequency of the application usage and engagement trends. It will not focus solely on the high-risk users, who might be really unresponsive to any kind of intervention; rather, Yolla will target the ones with a medium risk of disengagement since they can respond more positively to retention efforts. With machine learning, campaigns will be personalized to create individual offers. This creates value by offering tailored incentives, such as discounts on frequently used services, or even surprise rewards.

To ensure effectiveness, Yolla will monitor and optimize campaigns by tracking response rates, improvements in retention, and overall user satisfaction. This evidence-based approach knitted the retention strategies into the larger objectives of Yolla: balance in both proactive and reactive measures that stimulate customer loyalty. In application, Yolla seeks

to utilize Ascarza et al.'s framework to achieve improved retention and increase the long-term CLV of its customers [9].

4. Glossary

- **AHP:** Analytic Hierarchy Process
- **API:** Application Programming Interface
- **CLV:** Customer Lifetime Value
- **CPU:** Central Processing Unit
- **FAISS:** Facebook AI Similarity Search
- **GDPR:** General Data Protection Regulation
- **HTTPS:** Hypertext Transfer Protocol Secure
- **ILP:** Integer Linear Programming
- **JWT:** JSON Web Token
- **KVKK:** Kişisel Verilerin Korunması Kanunu (Turkish for GDPR)
- **LLM:** Large Language Model
- **NGO:** Non-Governmental Organization
- **SaaS:** Software as a Service
- **SME:** Small and Medium-sized Enterprises

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