**Computer Science Department**

**Final Report: Team 14**

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| **Title of the project:** | "Easy Car" Car hire & sharing marketplace |
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**Executive Summary**

To tackle the problem of underused personal vehicles in cities all over the world, we developed the Car Hire & Sharing Marketplace. So many cars sit parked and unused, which is not only a waste of money but also bad for the environment. Our goal was to make these idle cars useful again, helping car owners earn money and giving renters a cheaper and convenient way to get around.

We created a peer-to-peer car-sharing platform using the latest web technologies that allows car owners and renters to connect directly. This platform is good for the environment because it could mean fewer cars are needed overall, making better use of the cars we already have. We got the idea as we noticed more people were interested in sharing rather than owning things, and there was a clear need to make better use of vehicles.

We spent two semesters planning and developing this marketplace. Our work involved a lot of market research, studying how users interact with apps, and developing the software in cycles, following Agile methods to keep adapting to new ideas and feedback. We used Django for a solid backend and React for a responsive frontend, creating a secure user-friendly web application. We included features like user registration, vehicle listings, advanced search

options, secure payments, and all functionality needed to manage booking-renting cars (like trips history, approvement of host and etc.).

During this project, we faced challenges like making different parts of the system work together and keeping user data safe during payments.

## Introduction

In Kazakhstan, there's a big problem with how much vehicles are used—or rather, how much they aren't. Even though the number of vehicles has been increasing, with about 4.5 million registered by the end of 2023, they spend most of their time parked, not being used for over 90% of their lifetime. This is not only a waste of resources but also harmful to the environment. For example, the Ministry of Ecology, Geology, and Natural Resources of Kazakhstan reports that nearly half of the air pollution in big cities like Almaty and Astana comes from transport. Moreover, traffic jams in these cities are costing the economy billions every year in lost productivity, according to a study by the National Academy of Sciences of Kazakhstan.

Seeing these problems, "Easy Car" is stepping in with a solution that fits into the worldwide trend of using resources more sustainably. Our idea is to create a digital marketplace where car owners can rent out their vehicles when they're not using them. This could help car owners make some extra money and offer people cheaper and more convenient transportation options. Our aim is to reduce the total number of vehicles needed in urban areas, which could help ease traffic congestion, cut down on carbon emissions, and make better use of the cars we already have.

The development of "Easy Car" is particularly important in cities like Astana, Almaty and Shymkent, where the rapid growth of the cities has outstripped the development of public transport. Our platform could be a key tool in improving how people get around in cities, encouraging people to move away from owning personal vehicles to sharing them instead. This could support environmental sustainability by reducing the need for producing new vehicles and improve economic efficiency by making better use of each vehicle and reducing the space needed for parking.

Additionally, "Easy Car" aims to tackle the growing issue of managing urban space effectively, making cities more livable, efficient, and less congested. With a cutting-edge approach to vehicle sharing and strong technology like Django for secure and scalable backend operations and React for a smooth user interface, our project is poised to lead the way toward a more sustainable and economically sensible model of vehicle usage in Kazakhstan.

## Background and Related Work

Car sharing has gained popularity worldwide as a sustainable solution to urban mobility challenges. Websites like Turo.com in the U.S.and European countries show how well peer-to-peer car rental models can work. Turo lets car owners rent out their vehicles when they're not using them, turning parked cars into money-makers. This system is especially useful in crowded places where the high costs of maintaining and parking a car can discourage people from owning one. Turo states that hosts can manage their car expenses by renting out their vehicles for just nine days a month, which really shows the financial perks. In addition to that, by boosting how much existing cars are used, Turo helps cut down on the need to build new cars, which is great for the planet.

However, in Kazakhstan, the car rental scene is still growing and mainly concentrates on big cities like Astana and Almaty. Local companies like ASTAVTO and RentaCar focus on short-term rentals for tourists and business folk and haven't gotten into the peer-to-peer sharing functionalities. These services tend to be pricey and don't let car owners earn from their idle vehicles. They also haven't really tackled the problem of cars sitting unused or the traffic jams in cities. The issue is even more noticeable in Kazakhstan's smaller cities, which barely have any car sharing options. This lack makes the problem of unused cars even worse, since many people have vehicles that just sit there most of the time. These areas also lack other transport options, which really shows there's a market gap. "Easy Car" wants to fill this gap by starting a peer-to-peer platform that everyone in the country can use and benefit from.

The "Easy Car" website is designed to adopt the successful aspects of “Turo” car sharing marketplace and adapt them to fit Kazakhstan's unique cultural and economic setting. By letting car owners in both urban and rural places rent out their rides, this plan could help reduce the number of seldom-used vehicles and cut down on the need for parking, easing city traffic in the process. Additionally, “Easy Car” promotes a more efficient usage of resources, which aligns with global sustainability goals by reducing the carbon footprint associated with the production and maintenance of excess vehicles.

In conclusion, while traditional car rental companies in Kazakhstan have started the basics of vehicle rentals, they haven't fully tackled the broader issues like how seldom vehicles are used or their environmental impact. "Easy Car" is taking the success case of “Turo” as an example to handle a solution that's more sustainable, economically valuable, and efficient for solving social issues, helping to overcome these ongoing challenges.

## Project Approach

Our project, "Easy Car-Kazakhstan," integrates advanced digital technologies and methodologies to create a comprehensive car-sharing platform that facilitates the peer-to-peer rental of vehicles. This approach is designed to maximize vehicle utilization, streamline the rental process, and ensure a high level of user satisfaction and security.
System Architecture and Technologies

**Software Architecture:** The core of "Easy Car-Kazakhstan" is built on a robust software architecture that leverages Django as the backend framework and React for the frontend development. Django was selected for its strong security features, scalability, and the extensive libraries that speed up the development process. React's component-based architecture enhances the user interface with dynamic updates and fast rendering, providing a seamless user experience.

- **Backend (Django):** Handles all server-side logic, database management, user authentication, and data security.
- **Frontend (React):** Manages the presentation layer, ensuring interactive and responsive design across various devices.

**Database Management:** PostgreSQL is used for database management due to its reliability and support for large-scale applications, which is essential for handling the extensive user data and transaction records involved in the platform.
Workflow and Features: Components of the Car Sharing Marketplace:

**Use Case Diagrams and User Roles**

**User Roles:**

- **Car Owner:** Lists vehicle, sets rental terms, and receives payments.
- **Renter:** Searches for available cars, books a vehicle, and makes payments.

**Use Case Diagram:**
*Structured use cases*

**Use case name:** Customer books a car

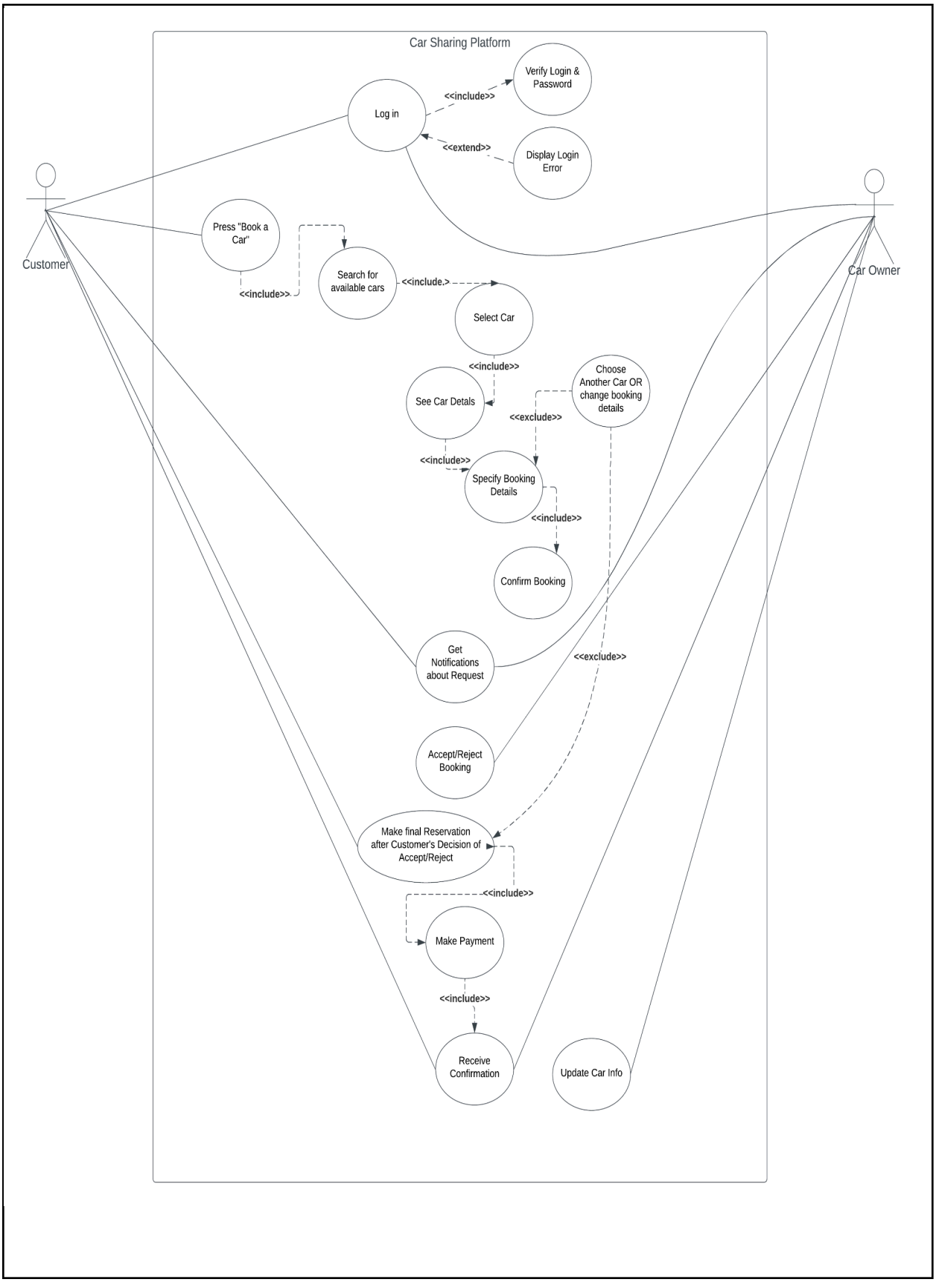
**Description:** This use case outlines the steps involved when a user books a car through the car-sharing platform.

**Actors:**

- ***Primary Actor:*** Customer booking a car
- ***Secondary Actor:*** Car Owner who owns the car available for booking
- ***System:*** Car-Sharing Platform

**Preconditions:** the customer is registered in the platform. At least one car is available for booking

**Postconditions:** the customer successfully booked a car for the specific period, and the car owner is aware of the booking.


Car Sharing Platform
Verify Login & Password
Log in
<<include>>
<<extend>>
Display Login Error
Customer
Car Owner
Press "Book a Car"
<<include>>
Search for available cars
<<include.>
Select Car
<<include>>
See Car Detals
Choose Another Car OR change booking details
<<exclude>>
<<include>>
Specify Booking Details
<<include>>
Confirm Booking
Get Notifications about Request
<<exclude>>
Accept/Reject Booking
Make final Reservation after Customer's Decision of Accept/Reject
<<include>>
Make Payment
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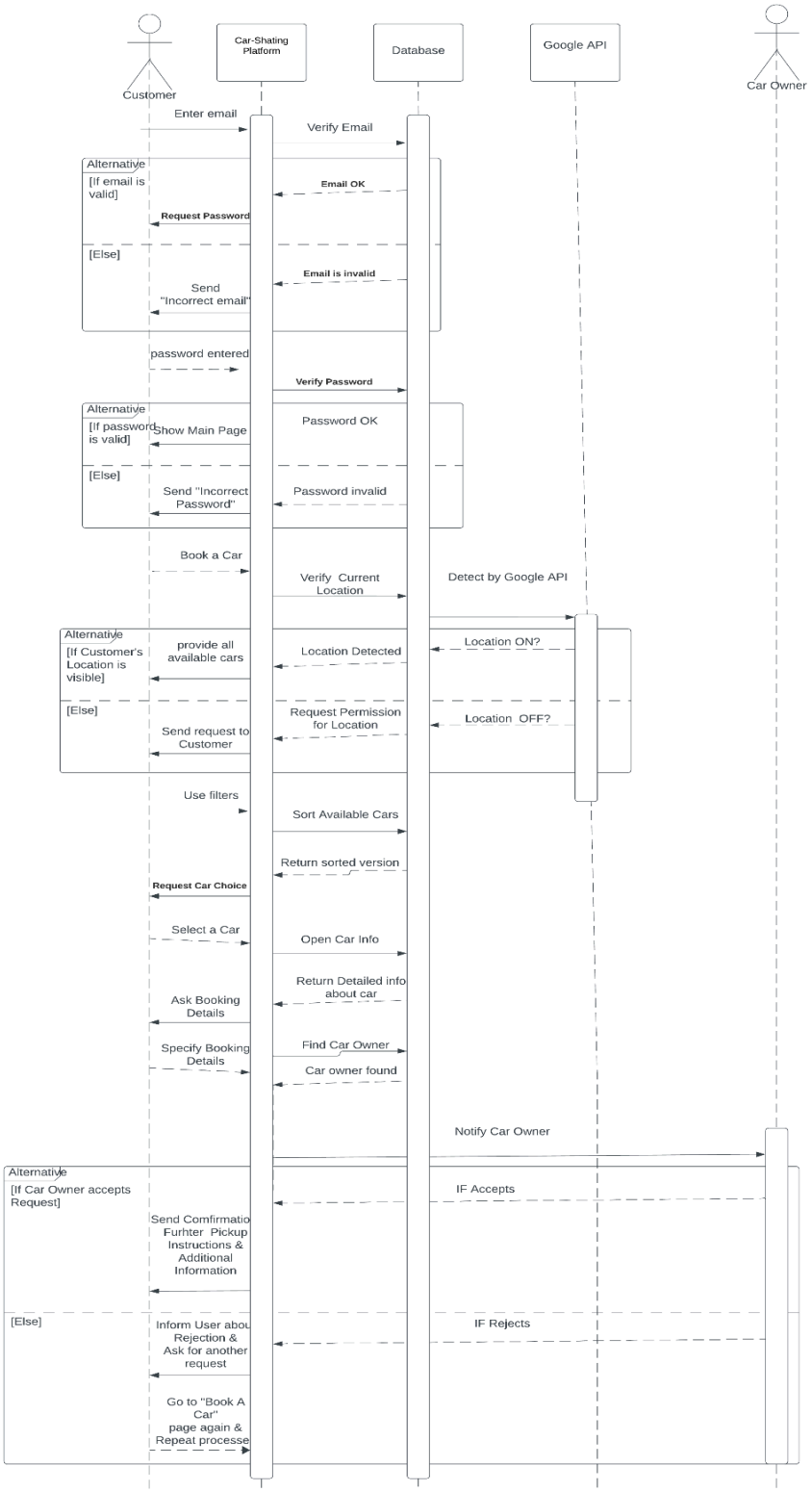
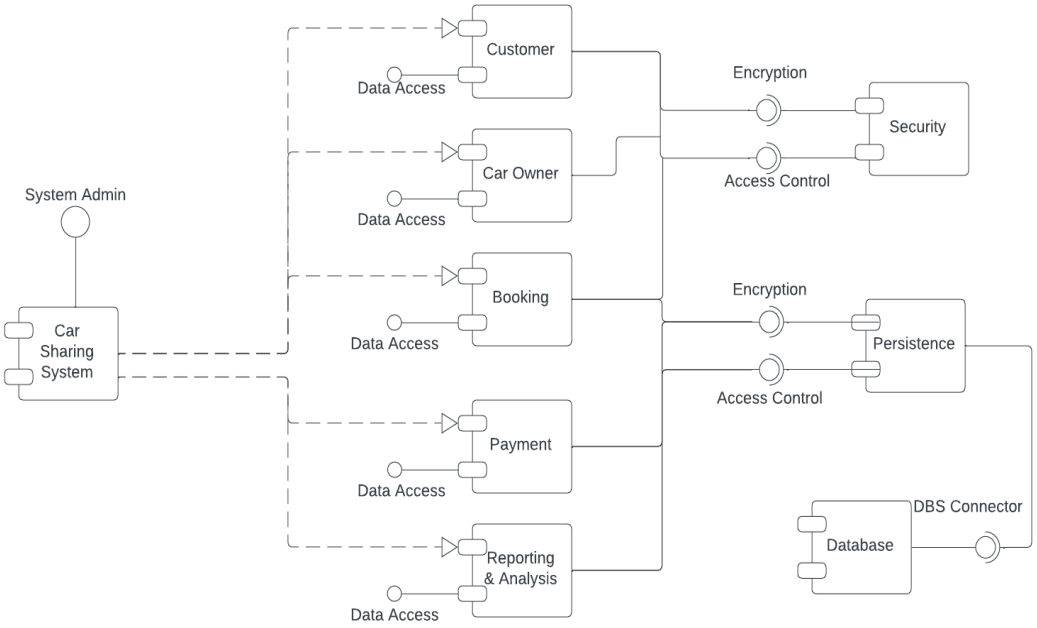
Receive Confirmation
Update Car Info

*Sequence diagrams*



*Architectural models*

UML Component Diagram was chosen to illustrate the Architectural model.




In this component diagram:

- **Customer Component:** Handles customer-related operations.
- **Car-Owner Component:** Handles operations related to the Car Owner.
- **Booking Component:** Manages the booking of cars, including user requests and car-owner interactions.
- **Reporting Component:** Provides reporting and data analysis functionality.
- **Payment Component:** Manages payments for car bookings.
- **Database Component:** Represents the system's data storage, including user profiles, car listings, and transaction records.

Tools and Methodologies

- **Figma:** Used for UI/UX design, allowing for iterative design improvements based on user feedback.
- **GitHub:** Facilitates version control and collaboration among the development team, ensuring smooth progress across different stages of the project.
- **Agile Methodology:** Adopted to allow for flexible development, with regular sprints and feedback cycles to quickly adapt to any required changes or improvements.

The comprehensive approach adopted for "Easy Car-Kazakhstan" ensures a scalable, secure, and user-friendly platform that addresses the specific needs and challenges of the Kazakhstani market. By leveraging advanced technologies and a well-thought-out workflow, the project aims to revolutionize the car-sharing industry in Kazakhstan.

**User Interface:**

- **User Registration and Authentication**: Secure user registration and login functionality to ensure data privacy and user authentication.
- **Car Listings**: A user-friendly interface for car owners to list their vehicles, including details such as make, model, location, availability, and pricing.
- **Car Search and Booking**: Features for renters to search for available cars based on location, date, and preferences, and make bookings.
- **Payment Processing**: Integration with payment gateways to facilitate secure and seamless transactions for both car owners and renters.
- **User Profiles**: User profiles for both car owners and renters, displaying ratings, reviews, and rental history.
- **Messaging System**: An in-app messaging system to facilitate communication between car owners and renters.

**Car Management:**

- **Car Verification**: A process for car owners to verify their vehicles' condition and authenticity before listing them on the platform.
- **Availability Calendar**: Car owners can manage their vehicle's availability through an interactive calendar.
- **Booking Management**: Car owners can accept or decline booking requests and manage their rental schedule. (Fig.)

**Geolocation and Mapping:**

- Integration with mapping services to display car locations, provide directions, and calculate distances and estimated travel times.

**Rental Agreements:**

- Generation of digital rental agreements outlining terms and conditions, insurance coverage, and responsibilities of both parties.

**Payment and Fee Structure:**

- A system for calculating rental fees, insurance costs, and platform service fees.

**Rating and Review System:**

- A mechanism for renters and car owners to rate and review each other, building trust within the community.

**Notification and Alerts:**

- Notifications and alerts to inform users about booking requests, rental confirmations, and other important updates.

Below the screenshots from our project are provided, which give a visual journey through the various features and functionalities of the 'Easy Car-Kazakhstan' platform:

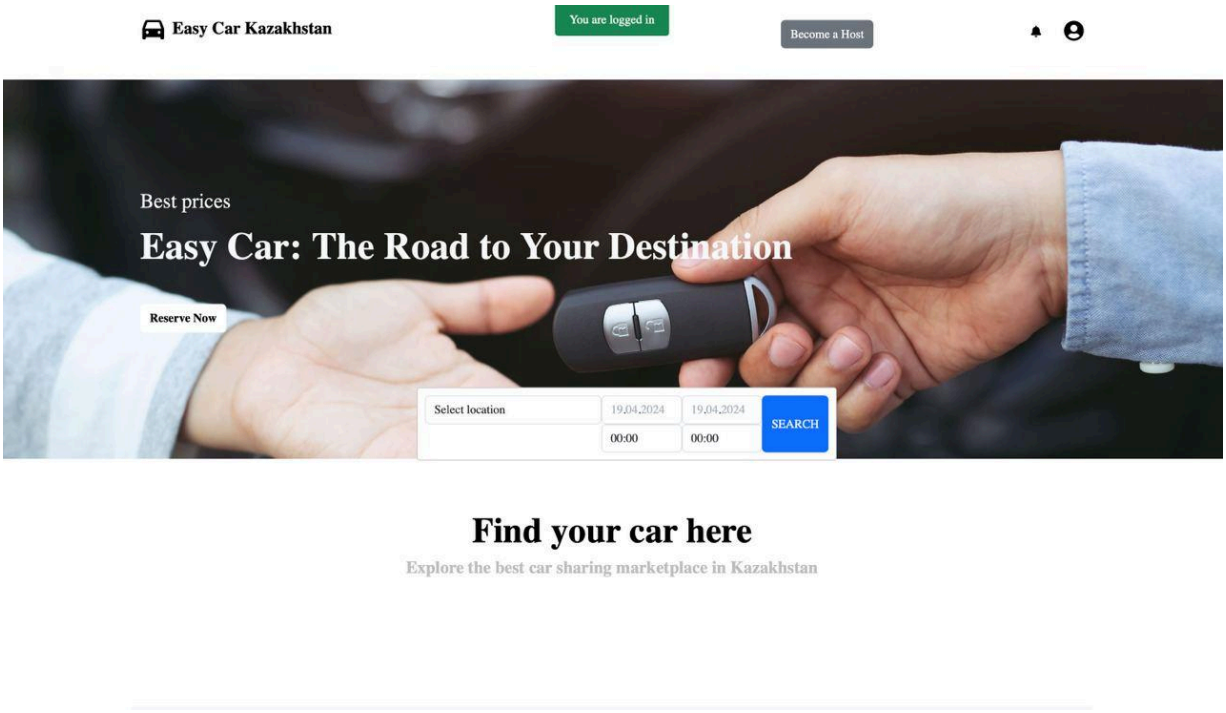



Fig. 1 - Home Page

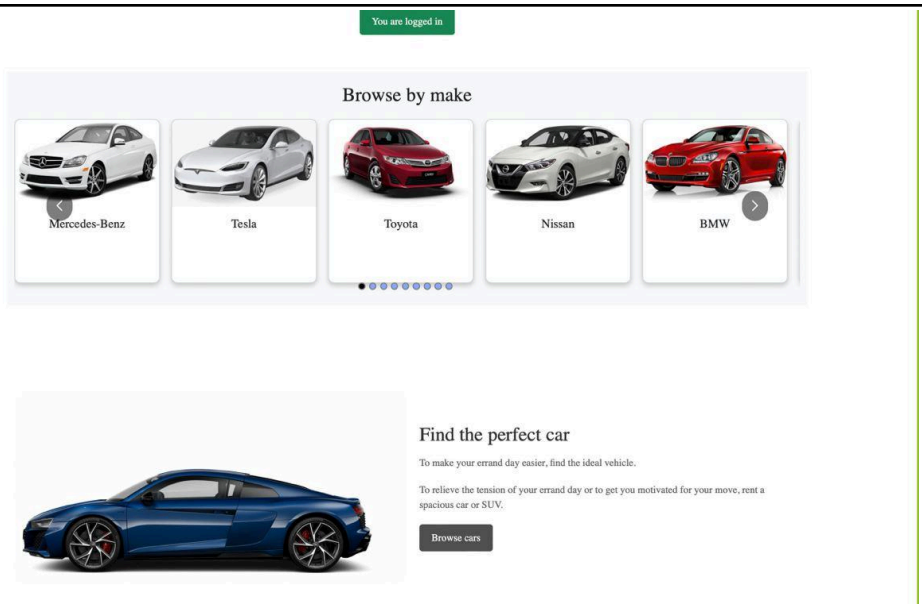



Fig. 2 - Home Page

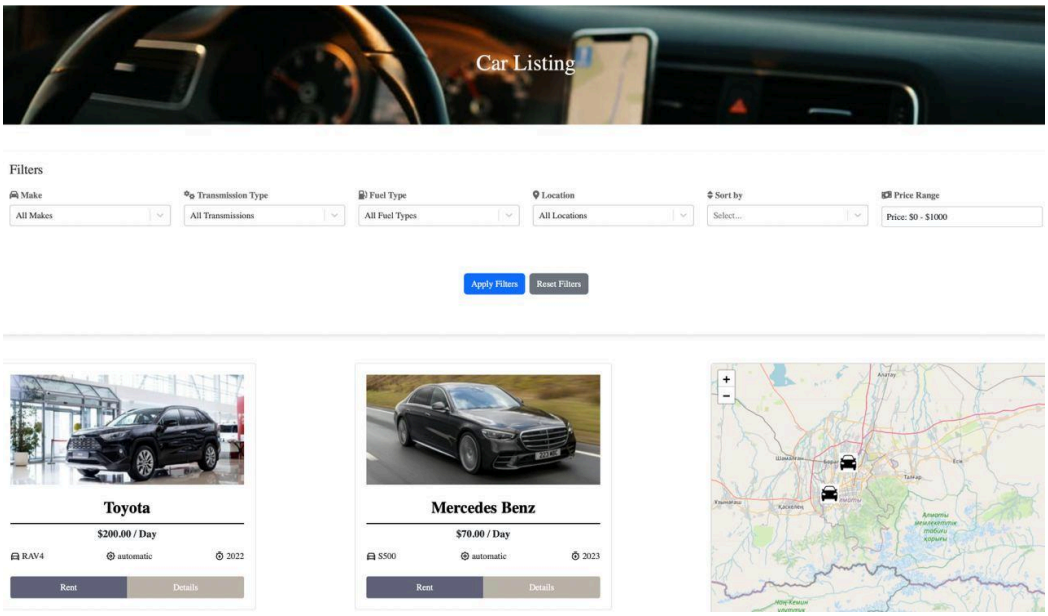



Fig. 3 - Car Listing

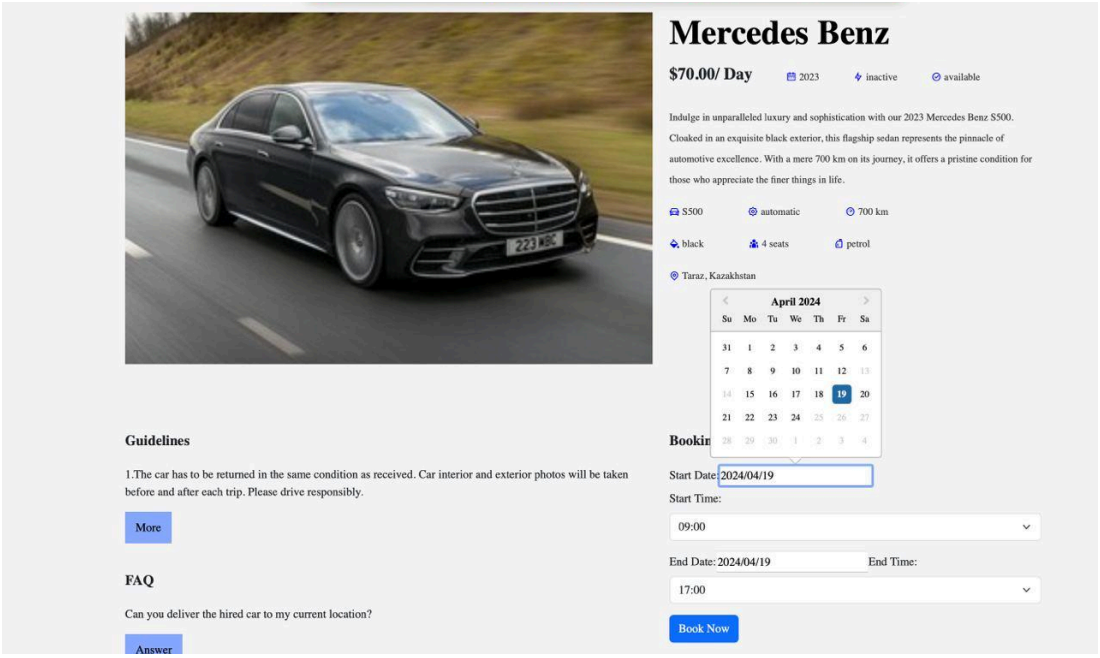



Fig. 4 - Car Details Page

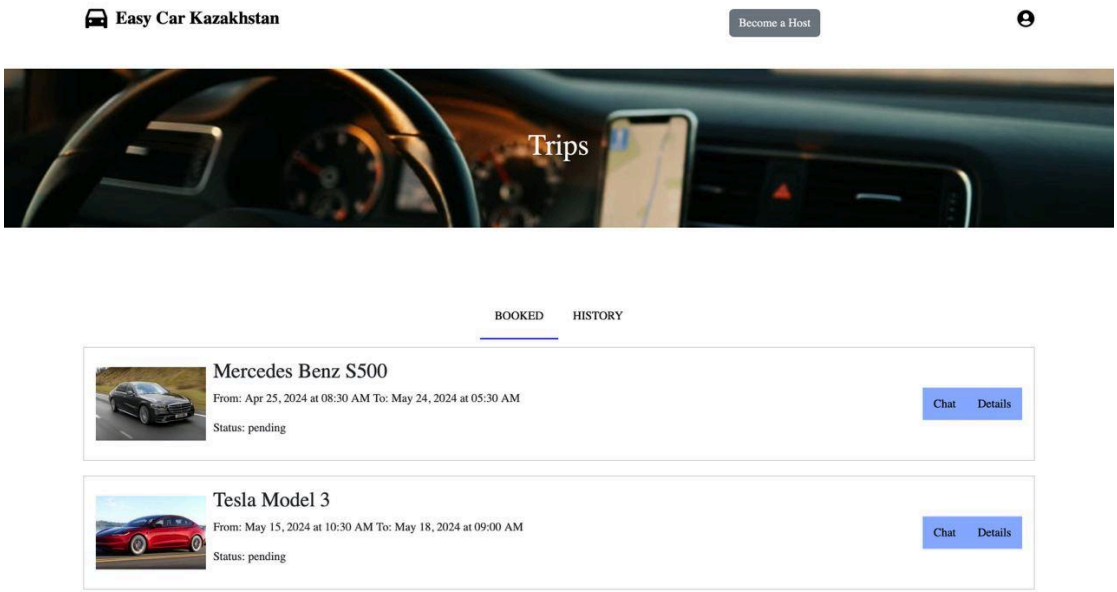



Fig. 5 - Trips Page

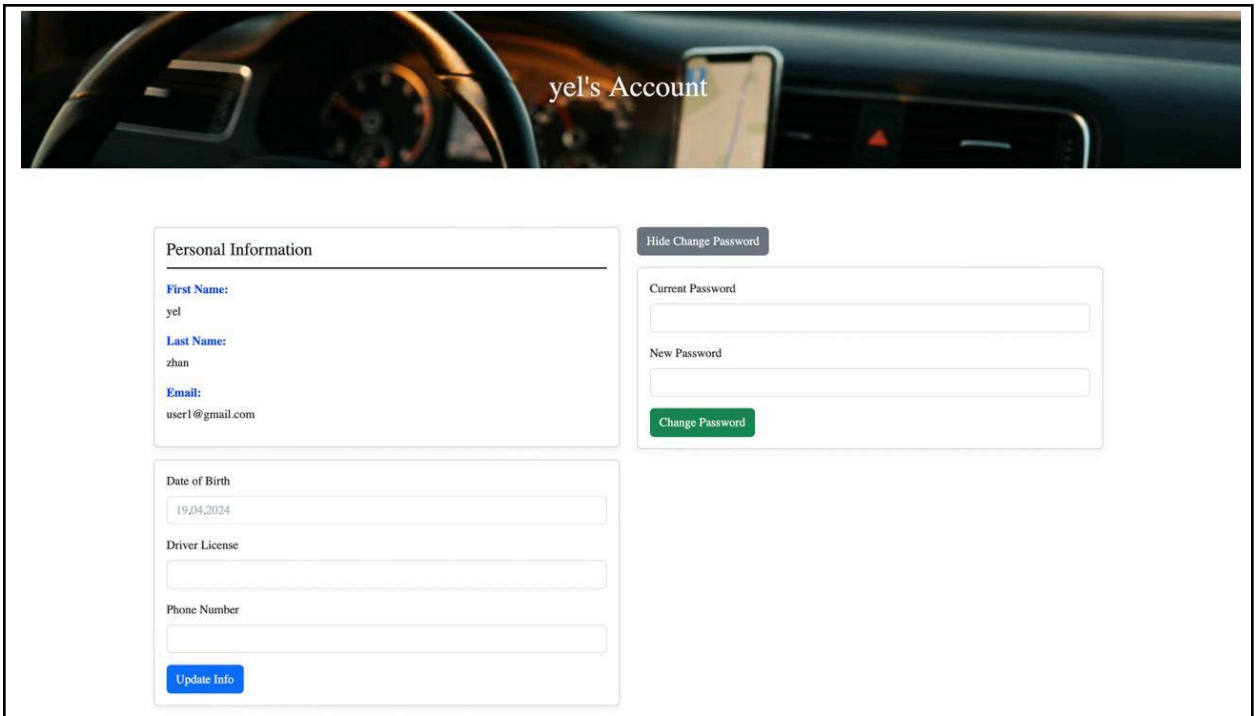



Fig 6. - User Account


Fig 7. - Booking Request Page

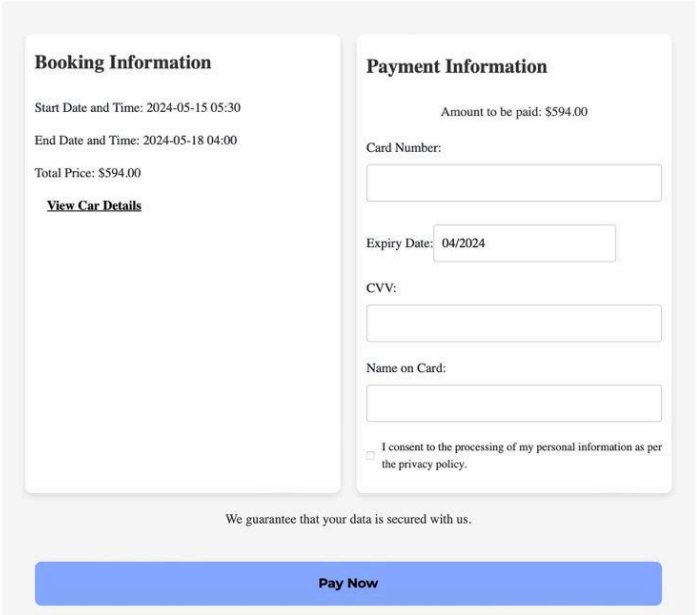


Fig.8 - Payment Page

Easy Car Kazakhstan

Become a Host

# How Easy Car works

**1. Find the perfect car**

Enter a location and date and browse thousands of cars share by local hosts.

**2. Book your trip**

Book online, choose a protection plan, and say hi to your host! Cancel for free up to 24 hours before your trip.

**3. Hit the road**

Have the car delivered or pick it up from your host. Check in with the app, grab keys, and hit the road!

## Endless options

**Browse the world's largest car sharing marketplace**

Whether it's and SUV for a family road trip, a pickup truck for some errands, or a classic sports car for a special night out, find the perfect car for all kinds of occasions and budgets on Easy Car.

Book the perfect car

Fig. 9 - “How Easy Car Works” page

## Share your car confidence

All Easy Car hosts choose the protection plan that's right for them, and every host plan comes standard with $750,000* in third-party liability insurance from Travellers.

Spring for extra peace of mind, or go light for a bigger piece of the pie.

**Varying levels of vehicle protection**

Choose from five plans, each of which offers reimbursement for car repairs up to your car's actual cash value** in case of damage during a trip

**$750,000 in liability insurance**

Share confidently knowing you're covered in case of a third-party claim that may occur during a trip

**24/7 roadside assistance**

Rest assured that roadside is available for all trips****

Fig. 10 - “Customer Support” page

## Project Execution

During the execution of "Easy Car" marketplace our team transformed initial concepts into a fully operational car-sharing platform. We focused on careful planning, flexible development, ongoing testing, and solving problems strategically. Our main goal was to make sure that our technical work matched what users wanted and what the market needed.

**Design and Development Decisions**

We started the project development from a planning phase, including the platform's structure and main features. We chose to use Django for the backend and React for the frontend because of their robustness, scalability, and active community support. For the database, we used PostgreSQL due to its reliability and performance with large data, which is crucial for handling numerous user profiles and transaction data.

In the design phase, we focused on making the interface easy to use for both car owners and renters. We used a tool called Figma to develop prototypes that were iteratively refined based on feedback from potential users. This process assisted in the final design being easy to understand and working well. Also, in addressing the specific needs of our target audience in Kazakhstan.

**Challenges and Solutions**

One of the major problems we have encountered is figuring out the payment process. We could not connect third-party payment systems as Paypal or Kaspi due to the issues with the transaction security and data synchronization. To solve this problem each booking receives a unique code, accessible only to the user who created it. When receiving the car, the user hands this code to the host, who enters it into our system to confirm the booking. Approval of the booking triggers the payment authorization process. After successful authorization, the rental fees are transferred to the host's account. This ensures security and control over the payment process, guaranteeing that the host receives the funds only after confirming the booking and entering the corresponding code into the system.

Another significant challenge was optimizing the platform for high traffic. After launching our system, we realized that the initial server setup was not adequate to handle the system workload. To address this, we upgraded our server infrastructure and implemented load balancing techniques. They significantly improved the platform's performance and scalability.

**Adaptations and Improvements**

During the development of the project we used feedback from potential users to improve the platform. For instance, car owners expressed the need for better tools to schedule when they list their vehicles. In response, we improved the booking calendar feature, making it easier for owners to specify when their cars are available.

**Project Outcomes**

During the execution phase, we had a successful soft launch where we asked a small group of users to try out the platform. This helped us get important real-world data on how

users used the platform and how well it worked. The overall feedback we got was generally positive. Users liked how easy it was to use and the economic benefits it offered.

Overall, working on the "Easy Car" project was all about learning and adapting during the development of the platform. By being flexible and dealing with challenges as they came up, we created a platform that not only meets the needs of the Kazakhstani market right now but also has the potential to grow and change in the future.

## Evaluation

Considering that "Easy Car-Kazakhstan" still has some features that need to be completed, like the built-in payment system which lacks card processing and integration with popular local providers like PayPal and Kaspi.kz, our evaluation focused on how effective the platform was mainly as a tool for communication and sharing information. Our main goal was to see how well the platform could attract users and help car owners and renters connect, even without the ability to complete transactions directly on the platform.

To understand how engaged and satisfied users were despite these limitations, we reached out to early users who primarily used the platform to find potential renters. This group included car owners who listed their cars, as well as people looking to rent a car.

The questions were asked related to about:

- Users' satisfaction with their experience, given the platform's current features.
- Whether the car information was clear and useful.
- Users' views on the potential of the platform once full functionalities, like direct payments, are available.
- How well the platform helped users communicate with each other.

User feedback showed that while the platform is good for sharing information, the absence of a payment system was a significant drawback. Most users preferred the convenience of processing transactions directly through the platform. However, they also saw the potential of the platform and were interested in using it more once all features are in place.

Without direct payments, our analysis focused on:

- The number of new sign-ups, how often users logged in, and how much they interacted with each other.
- The number of vehicle listings and inquiries from potential renters.

The data showed strong interest in the platform, with steady increases in user sign-ups and vehicle listings throughout the evaluation period. Interaction between registered car owners and potential renters also grew, suggesting the platform was successful in fostering initial communications.

Observing how users used the platform in real-life scenarios provided insights into its practical use as a networking tool. We noticed how users managed without a payment system

by arranging payments outside the platform. This phase was crucial for spotting user-driven innovations and areas where we could improve the platform's functionality.

The evaluation showed that "Easy Car-Kazakhstan" is effective at connecting car owners with potential renters, proving its value in creating opportunities for both groups. However, the feedback made it clear that a secure and efficient payment system needs to be implemented urgently to fully unlock the platform's potential and meet user expectations.

Moving forward, our development focus will be on integrating the payment system and enhancing other key features to improve the user experience and ensure the platform functions as a comprehensive car-sharing service. The insights from this initial evaluation will guide the future development of Easy Car-Kazakhstan, making sure it evolves with user needs and market changes.

## Conclusion and Possible Work

The "Easy Car" marketplace makes a big step forward in solving the problem of inefficient car usage in Kazakhstan. We have set up a peer-to-peer car-sharing platform that offers a sustainable way to get the most out of existing vehicles, ease city traffic, and support environmental efforts. During the project, we put together a strong tech setup using Django and React, created a safe and effective payment verification by host, and brought in location services using integration of open source Map.

Our platform shows that peer-to-peer car sharing is not only possible but also beneficial in a market that previously lacked such options, especially in smaller cities of Kazakhstan. Also, the feedback from our first users has been positive, showing that there is a real demand and support for this kind of service. By making our platform user-friendly, secure, and dependable, "Easy Car" has established a strong basis to change the way transportation resources are used in both urban and rural parts of our country.

Looking forward, there are still several areas where "Easy Car" can expand and improve:

**Mobile Application Development:** Right now, we have a web platform that works pretty well, but if we could develop a dedicated mobile app, it would make things way more accessible and engaging for users. With a mobile app, everyone could handle their bookings, list vehicles, and complete transactions right from their phones, which is really what most people expect these days.

**Expansion to Commercial Fleets:** Expanding our service to include commercial fleets could significantly increase our platform's vehicle offerings. This expansion would cater not just to individual car owners but also businesses that wish to monetize their idle commercial vehicles.

**Advanced Machine Learning Algorithms:** Using machine learning could make our platform smarter at matching renters with the cars that fit their needs the best. Also, predictive analytics could help us figure out the best prices and when cars should be available, making things better for both car owners and renters.

**Integration of Electric Vehicles (EVs) and Green Technologies:** As Kazakhstan pushes for greener solutions, we could support the shift by including electric vehicles on our platform. Providing info on charging stations and promoting EV rentals could help with environmental goals and put "Easy Car" at the forefront of sustainable transportation.

**International Expansion:** After establishing a strong presence in Kazakhstan, it could be beneficial to explore opportunities to scale the service to other countries. This would mean adapting our platform to fit different regulatory environments and users' expectations.

**Enhanced Security Features:** As "Easy Car" platform grows, it'll be significantly important to enhance security measures to protect all the data and transactions. Putting in place tougher security protocols and doing regular security checks will keep our users feeling safe and keep their trust in our platform.

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