Transforming the Travel Experience: A Case Study of an Innovative Travel Platform Vroom

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Abstract. *Traveling is a big part of everyone's life, yet it remains underrepresented in the digital market. Especially throughout Europe, travel quickly becomes complicated as crossing borders necessitates a convoluted search for information about motorway infrastructure, rules, and pay conditions as well as bringing issues with different languages.*

This paper explores how the platform Vroom is transforming the travel experience in the European Union by making it possible to manage tolls, vignettes, and road fines of all member states in one centralized application. In addition, it aims to show how such an application can offer emergency road services by interfacing with service providers in the area, thus lessening the impact of language barriers when suffering a breakdown abroad. In this way, the envisioned platform introduces innovative features and functionalities inspired by the need for unification of existing road applications and services on the national level, enhancing and expanding upon them to meet a multiplicity of user needs.

This case study shows in what ways a centralized travel platform can help users to plan and realize trips easily from home, how it can improve travel experience, make it more secure, and optimize costs while also offering benefits to the EU as a whole. Moreover, we will present a viable business model for providing these services by providing key artefacts pertaining to various aspects of the project generated through the use of various tools and techniques. These include design prototypes using Figma, architectural frameworks made with Archi, and proposed project timelines visualized through Gantt charts. Additionally, we will employ business modelling techniques such as business model and value proposition canvases, use case diagrams, and customer personas and journey maps to provide a comprehensive overview.

Keywords. Travel, Artificial intelligence, Tolls, Vignette, European Union, Centralized platform

1 Introduction

The increasing complexity of road travel across European borders presents significant challenges for both frequent and occasional travellers. Navigating a landscape of diverse toll systems, vignette requirements, and road regulations can be daunting, often exacerbated by language barriers and a lack of centralized information. According to the European Commission, road charging systems vary widely across EU member states (Directorate-General for Mobility and Transport, n.d.), leading to confusion and inefficiencies that can impact the overall travel experience. This fragmented landscape not only inconveniences travellers but also complicates the enforcement and compliance of road use regulations.

As empirical data indicates, the Digital Economy and Society Index (DESI) for public digital services in EU countries has been increasing annually (Directorate-General for Communications Networks, Content and Technology, n.d.), including enhanced accessibility to online payments for road taxes, vignettes, parking fines, and other governmental services. Despite these advancements, there remains a significant gap in the availability of a unified platform that offers centralized services for such functionalities for multiple European countries for ordinary citizens. This absence poses substantial challenges, as preparing for travel through several countries can become extremely time-consuming and risky. Moreover, the lack of a centralized system may lead to complications such as the necessity to

pay taxes at national borders, potential issues of double-taxation, or discriminatory practices, thereby undermining the efficiency and fairness of cross-border travel within the EU (Directorate-General for Taxation and Customs Union, n.d.).

The goal of the paper is to introduce Vroom, a platform that aims to address these issues by providing a unified digital solution that simplifies the management of tolls, vignettes, and road fines across all EU member states. Users can calculate and compare travel costs, view and purchase necessary travel permits, pay road fines, thereby reducing the stress and complexity associated with cross-border travel. Vroom assists travellers in finding the best cross-border insurance options before embarking on their journey, ensuring comprehensive coverage and peace of mind (Bruegel AISBL, 2016). Furthermore, the platform offers 24/7 multilingual support, providing real-time assistance and guidance to users navigating different countries and languages. This service is crucial for addressing emergencies and resolving issues promptly, thereby enhancing the safety and convenience of cross-border travel.

2 Methodology

The primary research question examines how the Vroom platform can enhance travel within the EU by centralizing toll management, vignettes, and road fines. Our methodology leverages quantitative data from existing sources and qualitative feedback from a targeted user group to address this question.

- Existing Statistics - We gathered data from authoritative sources regarding the current state of tolls, vignettes, and road fines across various EU countries. This included information on the availability and usage of online systems for managing these services (Directorate-General for Mobility and Transport, n.d.).
- Digitalization Index - We utilized digitalization indices from reliable sources to assess the readiness and current digital infrastructure of EU member states (Directorate-General for Communications Networks, Content and Technology, n.d.). This data provided a context for understanding the feasibility and potential impact of implementing the Vroom platform.
- User Feedback - We collected insights from a small group of users who frequently travel across EU borders and face challenges related to tolls and vignettes. These users provided anecdotal evidence and personal experiences that highlighted common problems and potential solutions.

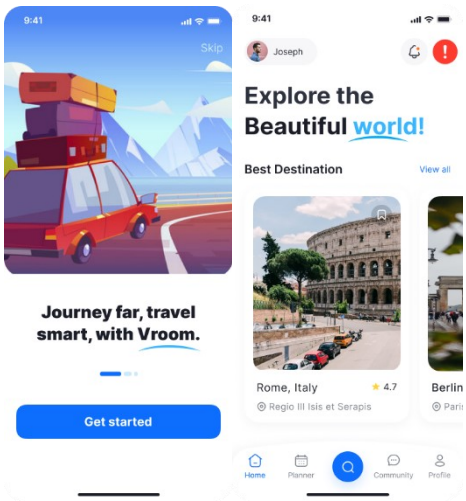
3 Results and Discussion

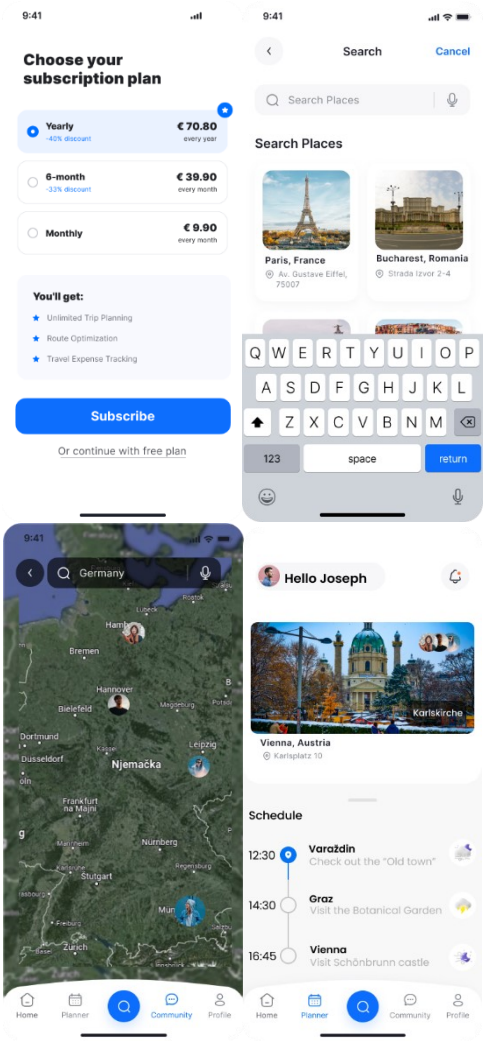
In this section, we will delve into the various facets of our findings, elaborating on how (and why) the project would be funded, different views of the structure, time estimates and marketing plans to increase market coverage.

3.1 Project view

To bring the concept of a platform to life, it is pivotal to effectively represent and visualize it. This is where the prototype becomes handy. A prototype is an excellent tool for visualizing ideas and making necessary adjustments along the way. The idea of a prototype is to assess functionalities, features and design before doing the actual product. It allows for the early identification of issues and problems and making necessary improvements before progressing to a minimum viable product (mvp) or a final product (Design2Market, 2023).

Below, there are images of the prototype showcasing various features, created using the Figma tool (Figma Inc, n.d.). The following templates were important in creating the prototype: Mobile Apps – Prototyping Kit (Renata Pôrto, n.d.), Travel App Design (Benzatine Infotech, n.d.), Travel App UI Kits (ux.alanlove, n.d.) were used. The image on the home screen was sourced from Freepik by upklyak (Freepik Company S.L., n.d.). The remaining photos were sourced from the Unsplash website. For the map display, a Google map was utilized, which will also be integrated into the platform.





Figures 1-6. Figma Prototype I-VI

Blue has been chosen as the primary colour for the platform. Blue ensures high visibility and appeal. It is associated with stability, calmness, trust which are all the qualities essential for user engagement and confidence. Furthermore, blue conveys a clean and modern look, making it suitable for a wide target audience.

The design system for the platform prototype, as shown in the image below, reflects these principles. In Figure 1 of the Figma prototype, the first screen when users enter the app is represented. Upon selecting the "Get started" button, users are directed to the homepage, which is illustrated in Figure 2 of the Figma prototype. On the homepage, the user's profile picture and username are visible. Also, an emergency red button is located in the upper right corner, providing quick access to emergency service information. The homepage also has an option to view top destination recommendations, along with their ratings given by other users of the app. At the bottom of the homepage, there is a navigation bar featuring several options: "Home" for accessing the homepage, "Planner" for making travel plans, a search button for searching places and their reviews, "Community" for viewing friends' locations and chatting with them, and "Profile" for displaying the user profile.

The app is based on a freemium model, as represented in Figure 3 of the prototype. The app offers three subscription plans: Yearly, 6-month and monthly. The plans all include features such as unlimited trip planning, route optimization and travel expense tracking, which are not available in free version of the app. The subscription options are priced differently, with discounts applied for longer-term commitments. Figure 4 presents the search option. Here, users can explore and locate places they are interested in seeing and add them to their planner.

Figure 5 illustrates the social features of the app. Here users can view approximate locations of their friends or acquaintances. If they are planning to travel to the same area or are nearby, they can tap on the individual's photo to send a message directly. Figure 6 represents the travel planner feature. Here users can see the travel plan for their entire route along with estimated arrival times. Additionally, they are shown the weather forecast for the estimated arrival in each city.

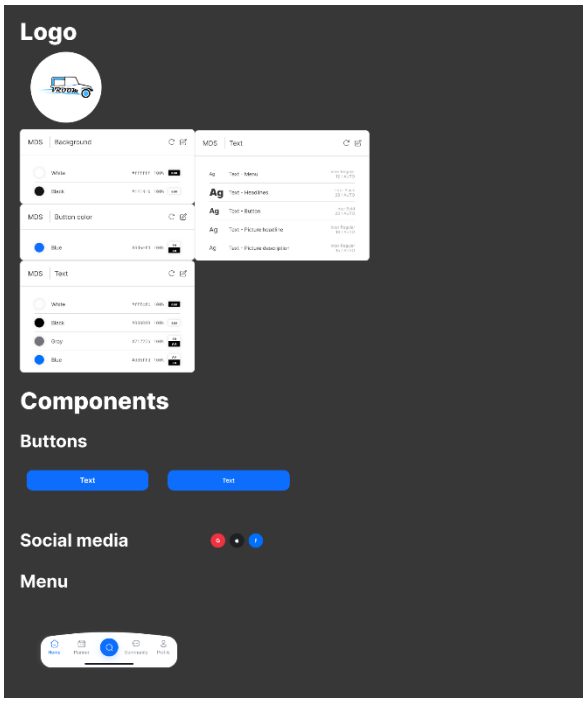


Figure 7. Prototype Components

3.2 Funding Process

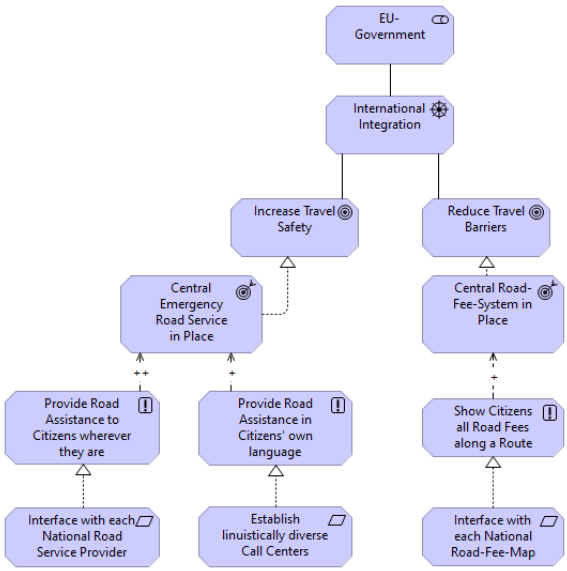


Figure 8. EU Motivation View

As the central key partner of the project, the European Union is a decisive factor for the success of the project, as it can ease cooperation with member states and provide funding for the development phase, which in turn means increased affordability and therefore more widespread usage as development costs do not have to be factored into product prices. To attain their support, two prerequisites have to be met. First, we need to ensure the project provides value to the EU and its member states and second, the project needs to go through the approval process.

Concerning the former, we believe that this project can contribute to one of the driving forces behind the EU, the free movement of people, in two ways. On one hand, increasing travel safety by centralizing access to national road services, on the other, reducing travel barriers by facilitating management of road fees of different countries along a route.

Concerning the approval process, given that there is a suitable call for proposals, the main steps are registering an organization, submitting a proposal and following up on it. While a short list, these steps each take considerable amounts of time, which will have implications for development time estimates later on.

3.3 Business model

Our business model is centered on providing significant value to customers, establishing strategic partnerships, and leveraging diverse revenue streams to ensure sustainability and growth.

At the heart of Vroom's value proposition is its all-in-one convenience, which allows users to handle route planning, toll and vignette purchases, parking ticket payments, and emergency assistance through a single, user-friendly interface. Additionally, Vroom personalizes the travel experience by providing access to the best travel deals, discovering unique destinations, and connecting travellers with a community of like-minded individuals by experience-sharing features. Vroom also promotes efficient car management by enabling users to keep track of their vehicle's history, access VIN information, and receive timely reminders for necessary maintenance. The platform provides up-to-date, accurate travel information and trusted emergency support, which enhances the security and peace of mind for users traveling across the EU.

The success of Vroom is supported by strategic partnerships that enhance its service offerings and operational efficiency. Collaborations with national toll agencies streamline toll payment processes and provide real-time toll information, making travel smoother for users. Partnerships with vignette sellers facilitate easy and quick vignette purchases directly through the platform. Vehicle and travel insurance providers play a crucial role by offering enhanced insurance options that contribute to the platform's premium services. Integration with municipal parking services allows users to pay parking tickets effortlessly, adding another layer of convenience. Roadside assistance providers ensure that users receive immediate help in case of vehicle breakdowns or emergencies, thereby enhancing user safety and trust in the platform. Secure and efficient transaction processing is enabled through robust partnerships with payment gateways, ensuring smooth financial transactions. Furthermore, collaboration with European Union bodies supports compliance with regional regulations and promotes the platform's adoption, thereby expanding its reach and impact.

Vroom employs a multifaceted revenue model to ensure financial viability and growth. The platform operates on a freemium basis, where basic services are provided for free, while premium options with enhanced features such as reduced transaction fees and better car insurance packages are available through subscriptions. This model encourages user engagement and offers additional value for those opting for premium services. Revenue is also generated through transaction fees for tolls, vignettes, and parking tickets processed via the platform. By leveraging the volume of these transactions, Vroom ensures a steady income stream. Additionally, Vroom earns commissions from travel agencies and car service providers integrated into the platform. These partnerships create a mutually beneficial ecosystem that enhances the value

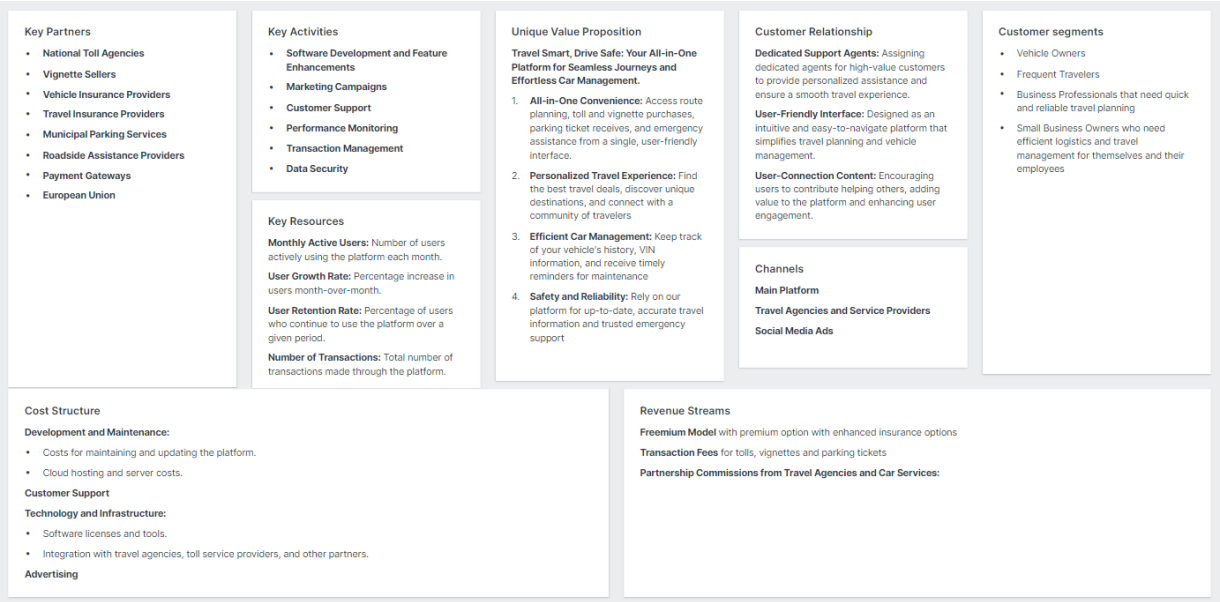


Figure 9. Business Model Canvas

provided to users while generating revenue for the platform.

3.3 Process view

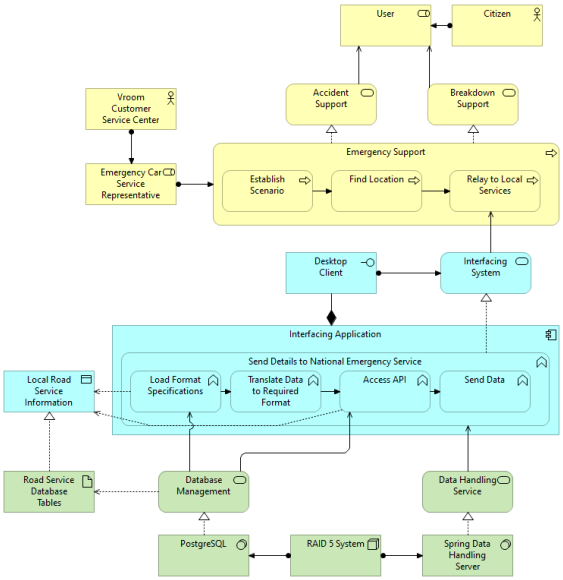


Figure 10. Emergency Road Service Architecture

To highlight the architecture of the business with its applications and the proposed tech stack, we have modeled the most important service, which is the emergency support center, using ArchiMate standard (Josey, A. et al., 2016). From the business view, this task requires a call center operative to take on the role of emergency road service representative, talk to the user to get the required information and enter it into the system. This information includes location, incident report, user contact information and type of assistance required (tow, car unlocking, etc.).

Said System is then responsible for finding the national road service provider responsible for the area the user is in, interfacing with their API and sending the data in a format their system is able to read. This way, much of the communication line can be automated and thus shortened to improve response time while also taking the burden of finding the correct road service provider off the user.

Finally, regarding the tech stack we propose a PostgreSQL DBMS on a RAID 5 System to prevent the loss of customer data (Kuratti, A., & Sanders, W. H., 1995). For handling the data of incoming cases and interfacing with APIs, we suggest a Spring web server (Walls, C., 2015) accessible through a lightweight frontend using Angular (Green, B. & Seshadri, S., 2013) for flexible deployment with focus on redundancy to maintain availability and ensure ongoing cases are not lost through a single point of failure.

To further elaborate on the system's architecture and user flows, we utilized a use case diagram (*see Figure 11*). This diagram captures the various ways in which users engage with the Vroom platform.

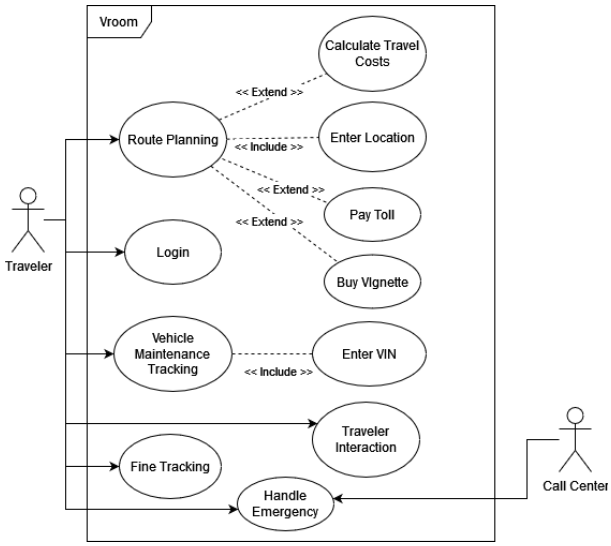


Figure 11. Use case diagram

3.4 Service view

Understanding the potential of a travel platform is as important as determining the breadth and diversity of its user audience. Consumers are a fundamental aspect of any platform or application, as they are the ones that use the platform and its features on a daily basis. Analysing the consumer base provides valuable insights into the platform's reach and usability across different age categories. Furthermore, understanding how consumers interact with the platform and visualising their entire experience can provide valuable insights for addressing the potential issues and concerns (Forbes Media LLC., 2024). This view of consumer's behaviour can enhance user satisfaction and improve overall platform performance.

To understand the consumer experience, it is essential to first create a consumer profile or persona. So, the first persona is Elena Ivanova, a Bulgarian student who works part-time as a barista. Elena enjoys going on adventures and wants a travel platform that provides all necessary travel resources in place. Her goals are to save time on travel planning and to share her travel experiences with a community of fellow travellers. Her customer journey begins with discovering that the travel platform is live and available. Following this, she considers and evaluates the platform. After an assessment, she decides to sign up and begins learning how to use the platform. Subsequently, she becomes a loyal daily user, sharing her experience with others. Below is a customer journey map for Elena Ivanova, created using a Milanote template (Milanote, n.d.). Persona picture was sourced from Unsplash.

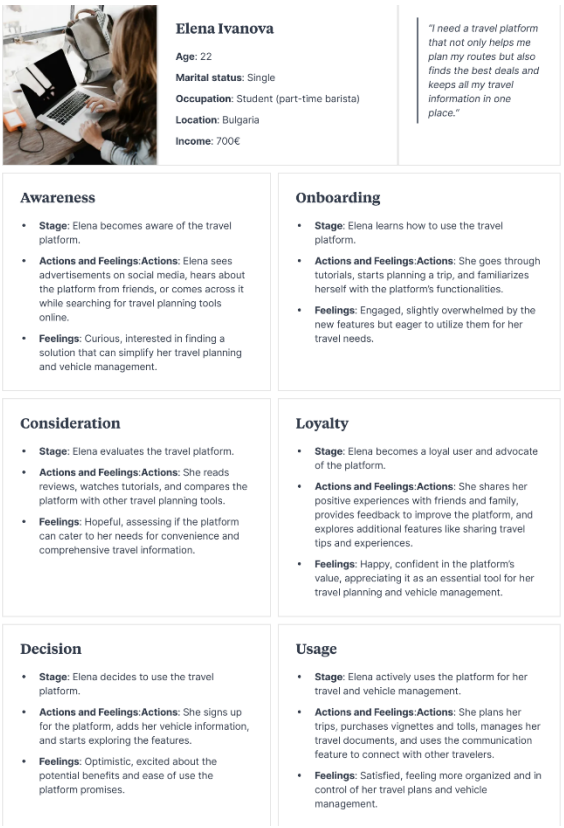


Figure 12. Persona 1, Elena Ivanova

To have a proper consumer assessment, it is important to include at least one additional persona and a corresponding customer journey map. Next persona is Maximilian Hartmann, an Austrian lawyer with a monthly income of 6000 euros. Maximilian enjoys taking his family on trips and prefers to spend as little time as possible on planning, allowing him to focus more on enjoying his time with the family on the road. His goals are to ensure the safety and comfort of his family during trips, keep all travel documents organized, and share his travel experiences with other family-oriented travellers. Maximilian's customer journey is similar to Elena's but includes one additional step which is support. In the awareness stage, Elena saw an advertisement on social media, whereas Maximilian noticed a billboard advertisement. Additionally, an extra step for Maximilian involves seeking assistance and contacting customer support for any issues encountered. Below is a customer journey map for Maximilian Hartmann, created using a Milanote template (Milanote, n.d.). Persona picture was sourced from Unsplash.

Figure 13. Persona 2, Maximilian Hartmann

Creating personas and customer journeys allow for a better understanding of audience expectations, needs, goals, and pain points. This consumer-oriented process helps identify critical touchpoints to effectively reach audience through various marketing strategies. Additionally, it enhances consumer engagement, satisfaction and loyalty (Adobe Inc., 2023).

3.6 Project Planning

While giving precise time estimates ahead of the planning phase is difficult, we collected feedback from professionals in the fields of frontend design and backend development to give our assessment of the timetable more weight. The resulting Gantt chart projects a total duration of about five years, setting the planned release date in Q4 2029 given a starting date in Q3 2024. The largest factor in the time estimate is the development phase once a viable prototype has been presented. This phase includes the time-consuming task of interfacing with APIs of both national road service providers and highway maintenance companies offering vignettes. The second largest factor, as mentioned previously, is the project approval process of the European Union, for which a proposal can only be submitted once the rest of the planning phase is completed and without which development cannot begin for lack of funding. For this reason, this process can not be parallelized with other planning or implementation tasks. However, this time frame may be used to simultaneously search for angel investors or other sources of private capital in order to finance the project in case the proposal is not approved.

3.7 Marketing plan

Marketing plays a pivotal role in the success of any app and business. There are three types of marketing: traditional, digital or both. Traditional marketing pertains to print media, while digital marketing pertains to digital media (Indeed Editorial Team, 2022).

Given there is a wide target audience it is essential to combine both traditional and digital marketing strategies. Avenues that will be utilized include billboards along roadways, profile and advertisements on social media platforms. Billboards are a great way to start advertising the platform because it is a travel platform so a lot of commuters will see the advertisement while driving. The size of billboards makes them highly visible and capable of capturing the attention of commuters. Billboards also offer the ability to operate continuously, providing 24/7 visibility. Furthermore, the biggest advantage of billboards is how cost-effective they are (DL, 2022). Complementing billboard advertising with social media profile and ads is advantageous, as it provides a diversified approach to marketing. Social media

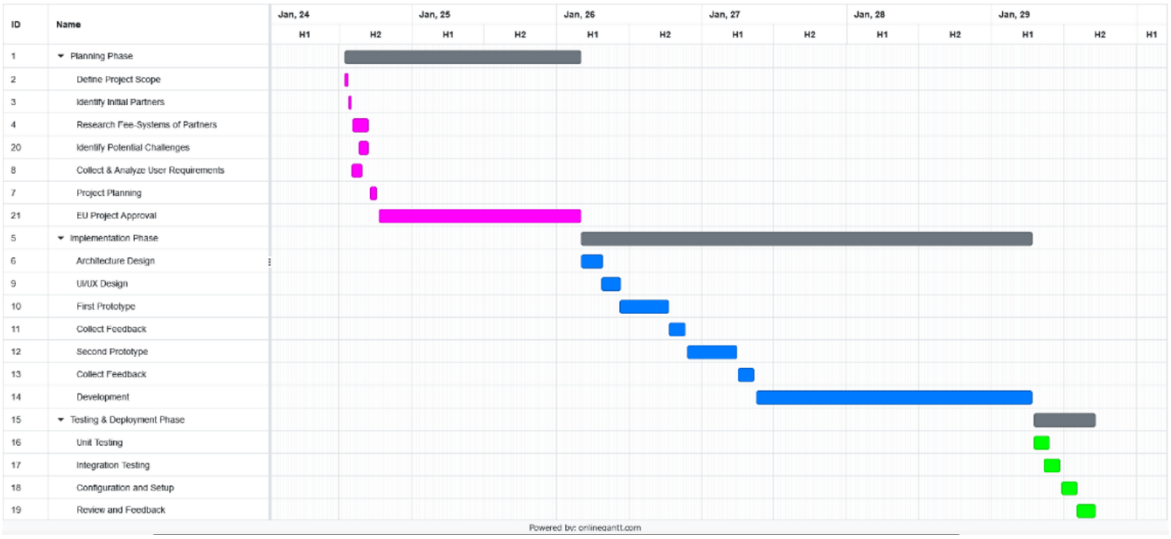


Figure 14. Timeline Projection

platforms have their own advantages when it comes to marketing. A lot of people have social media profiles, so it is likely that they are going to see the travel platform profile or ad. Social media is the easiest way to catch the attention of potential users of the platform and to be discovered anywhere in the world. (Pec, n.d.) After the platform goes online and becomes available, additional marketing campaigns will be launched, including the distribution of merchandise. The merchandise will include items such as shirts, hoodies, and bags, providing tangible promotional materials to spread the word of the brand and the travel platform. Below, there are images of some of the merchandise.

Figure 15. VROOM Hoodie

Figure 16. VROOM Bag

5 Conclusion

The Vroom platform represents a significant advancement in streamlining travel across the European Union by centralizing essential services such as toll management, vignettes, and road fines in a single application. By mitigating language barriers and providing comprehensive, multilingual support, Vroom enhances the travel experience, making it more accessible and secure for a diverse user base. The platform's innovative integration of various national systems not only simplifies the logistical aspects of travel but also offers a practical solution for cost optimization, benefiting both individual users and the broader EU community.

Future improvements to the platform could further enhance its utility and user engagement.

Integrating the platform with parking systems, including the ability to pay for parking hours and access real-time data on available spaces via parking sensors, would provide added convenience for travellers navigating urban areas. This feature could significantly reduce the time and stress associated with finding parking, thereby improving the overall travel experience.

Another promising development is the introduction of a trip-sharing feature, allowing users to share their travel plans and connect with others heading to the same destination. This social aspect could foster community engagement even more.

Vroom could also offer automated vehicle maintenance reminders and service booking, ensuring users never miss crucial check-ups like oil changes or tire rotations. Easily schedule appointments with local garages or dealerships directly through the app, maintaining your vehicle's health and safety.

As Vroom continues to evolve, these future enhancements have the potential to make it not only a tool for efficient travel management but also a platform for social connection and environmental stewardship.

Acknowledgments

This research was facilitated by the support of "Digital Platform Enterprise" (DEMO) project that was Co-funded by the Erasmus+ programme of the European Union under project ID 2021-1-RO01-KA220-HED-000027576.

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