PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
Ministry of Higher Education and Scientific Research
Mohamed Kheider university of Biskra
Faculty of Exacts sciences and Sciences of nature and life
Computer science department

Master thesis

Presented to obtain the academic Master's in

Computer science

Speciality : Information systems, Optimization and decision (SIOD)

VIP transportation via smartphone app and IA

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Academic year 2023/2024

Dedication and Acknowledgement

We would like to dedicate this thesis to our excellent supervisor, Dr. Adel ABDELLI, for his continual advice, mentorship, and support during the thesis project process. His insightful remarks and constructive criticism were critical in helping us learn, grow, and negotiate the different hurdles of conducting research. We are really thankful for his time, tolerance, and support, which made this project possible.

We also dedicate this thesis to our loving parents. We value all of the sacrifices parents have made for our education and well-being. Their unwavering love, blessings, and trust in our skills kept us going even when things were tough. We hope this success makes them proud.

We also want to thank our siblings for their love, cheer-leading, and being our pillars of strength. Thank you for the enjoyable times and talks, as well as for always being there for us through our highs and lows.

Finally, we dedicate this thesis to all of the committed examiners and teachers in the department of Computer Science. Thank you for sharing your knowledge and motivating us to pursue this area. This work is based on the solid foundations you helped lay.

We are incredibly thrilled and humbled to have received the support of such lovely people. This accomplishment would not have been possible without each and every one of you. Thank you for joining us on this fantastic learning adventure.

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Abstract

KidTaxi is a comprehensive mobile application designed to ensure safe and reliable transportation for children. The app comprises three components: a Parent App, a Driver App, and an Administrator Website. The Parent App allows parents to manage their child's transportation by entering personal information, setting pickup and drop-off locations, and scheduling rides. The Driver App provides drivers with real-time updates and navigation to ensure timely pickups and drop-offs. The Administrator Website coordinates between parents and drivers, assigning trips and ensuring smooth operation. Additional features include customizable themes, multilingual support, location tracking, and secure login options, making KidTaxi an intuitive and essential tool for modern child transportation needs.

Keywords: Kids Transportation, Kids transportation application, Android Application

ملخص

كيد طاكسي هو تطبيق شامل مصمم لضمان نقل آمن وموثوق للأطفال. يتكون التطبيق من ثلاثة عناصر: تطبيق للوالدين، وتطبيق للسائقين، وموقع إلكتروني للمسؤولين. يتيح تطبيق الوالدين للأهل إدارة نقل أطفالهم عن طريق إدخال المعلومات الشخصية، وتحديد مواقع الالتقاط والتوصيل، وجدولة الرحلات. يوفر تطبيق السائقين تحديثات في الوقت الفعلي وملاحة لضمان عمليات التقاط وتوصيل دقيقة. يقوم الموقع الإلكتروني للمسؤولين بالتنسيق بين الأهل والسائقين، وتعيين الرحلات وضمان سير العمل بسلاسة. تشمل الميزات الإضافية إمكانية تخصيص الثيمات، ودعم متعدد اللغات، وتتبع الموقع، وخيارات تسجيل دخول آمنة، مما يجعل هذا التطبيق أداة بديهية وضرورية لتلبية احتياجات النقل الحديثة للأطفال.

الكلمات المفتاحية: نقل الاطفال، تطبيق نقل الاطفال، تطبيق أندرويد

Résumé

KidTaxi est une application mobile complète conçue pour assurer un transport sûr et fiable pour les enfants. L'application se compose de trois éléments : une application pour les parents, une application pour les conducteurs et un site web pour les administrateurs. L'application pour les parents permet aux parents de gérer le transport de leurs enfants en saisissant des informations personnelles, en définissant des lieux de ramassage et de dépôt, et en planifiant les trajets. L'application pour les conducteurs fournit aux chauffeurs des mises à jour en temps réel et une navigation pour garantir des ramassages et des dépôts ponctuels. Le site web des administrateurs coordonne entre les parents et les chauffeurs, attribuant les trajets et assurant le bon fonctionnement. Les fonctionnalités supplémentaires incluent des thèmes personnalisables, un support multilingue, le suivi de localisation et des options de connexion sécurisée, faisant de KidTaxi un outil intuitif et essentiel pour les besoins de transport des enfants modernes.
Mots Clée : Transport pour enfants, application de transport pour enfants, application Android

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Introduction

Parents often have to balance work, errands, and long lists of things to do. In the middle of all this chaos, parents worry most about getting their kids to school on time and safely. A lot of families have to deal with this every day. Every trip to school or after-school activities is stressful and hard to plan.

As we feel the weight of this shared struggle, our project shines like a beacon of hope. It's a solution that came from empathy and a deep understanding of the problems parents all over the world face. It's not enough to just make an app; you need to make a lifeline, a trusted friend on the journey of parenthood.

At the heart of our work is a simple but important goal: to make things easier for parents and safer for kids. We're motivated by hearing about busy mornings, frantic searches for carpool partners, and long waits at bus stops. Our drive is fueled by these stories, which make us want to keep going.

We're going on this adventure with a set of rules to follow. These rules are our North Star in a sea of challenges. These principles show how much we care about excellence, new ideas, and most of all, the health and happiness of the families we serve. They're the foundation of our project, grounding us in a shared vision of empowerment and security.

But beyond the technical details and logistics, our project is about people—about families coming together, about children arriving safely at their destinations, and about the collective sigh of relief that echoes through households every time our app is used. It's about making memories, forging connections, and creating moments of peace during chaos.

So, as we embark on this journey, let us remember that our project is more than lines of code or sleek interfaces—it's a testament to the power of compassion, ingenuity, and human connection. It's a reminder that even in a world driven by technology, it's the warmth of human touch that truly makes a difference.

Our application has been carefully developed using the latest technologies to ensure both functionality and a smooth user experience. For the backend, we used Laravel, a strong PHP framework, to handle data processing and secure user management. The mobile interface was created using Flutter, enabling a consistent and responsive experience across different devices. Integration with Google Maps enhances the application's functionality, providing accurate location data for trip planning and navigation. The backend infrastructure uses PHP and MySQL, providing a solid foundation for data handling and application performance.

The key features of our application include secure authentication, a user-friendly interface, an admin dashboard, notifications and alerts, driver management, and trip scheduling. Secure authentication and strong data management are ensured by Laravel and PHP, protecting sensitive information and ensuring smooth operations. The user-friendly inter-

face, developed with Flutter, is easy to navigate for both parents and drivers. The admin dashboard, accessible via a web interface, allows for efficient management and linking of drivers with children. Notifications and alerts keep parents informed about their child's pickup and drop-off status. Driver management features ensure that only professional drivers with a clean record are trusted with the transportation of children, providing parents with peace of mind. Trip scheduling allows parents to plan pickups and drop-offs, making the process even more convenient.

Overall, this project is designed to alleviate the daily challenges parents face in ensuring the safe transportation of their children, making life a little easier and a lot safer for families.

Chapter 1

State of the art of children transportation

1.1 Introduction

In today's fast-paced world, parents often struggle to balance their busy schedules with the responsibility of ensuring their children's safe and timely transportation to school and other activities. Recognizing this challenge, our thesis presents the conception and realization of an innovative application designed to serve as a reliable and secure transportation solution for children, offering peace of mind to parents. The main goal of our application is to facilitate a secure and efficient transport service for children, particularly catering to parents who are unable to drive their children due to time constraints. This service essentially functions as a personal driver, uniquely tailored for children's transportation needs, while being managed and trusted by the parents.

Safety is paramount in our application design. We will incorporate advanced safety features, such as special GPS tags to be worn by children, providing real-time location tracking. Additionally, a recording system is included either through the child's wristband or the driver's phone, ensuring transparency and accountability throughout the journey. A rigorous evaluation process is in place for all drivers, including comprehensive background checks to ensure they have no criminal record, thereby upholding the highest safety standards[14].

What makes our application unique is that we focus on children's transportation. While it draws parallels with existing mobility solutions, it is especially targeted to this population, addressing specific issues and requirements of both children and their parents. The user interface has been designed to be easy and user-friendly, allowing parents to quickly manage and track their transportation arrangements.

One of the main problems addressed in this thesis is ensuring the dual objectives of safety for children and convenience for parents are achieved without compromise. Furthermore, we look into how this tool might transform the way parents manage their time, providing them with more flexibility in their everyday routines. In summary, this thesis not only offers a novel application developed for the safe and efficient transportation of children but also looks at the broader implications and potentials of such a service in modern society. The addition of safety measures, coupled with convenience and AI-driven functionalities, marks a significant leap in the field of children's mobility options.

1.2 State of the Art in Children's Transportation Technology

The landscape of children's transportation has evolved significantly with the integration of technology, reshaping traditional methods like school buses, carpooling, and ride-sharing services. This section explores these existing solutions and the technological innovations that have been incorporated to enhance their safety, reliability, and efficiency.

1.2.1 School Buses

Traditionally, school buses have been the primary mode of transportation for children to and from educational institutions. The advent of technology has led to significant improvements in this service. Modern school buses are now often equipped with GPS tracking systems, allowing both schools and parents to monitor the vehicle's location in real-time. This ensures enhanced safety and timely communication in case of delays or emergencies. Additionally, some school buses have implemented electronic tagging systems, where children carry ID cards that register their boarding and disembarking, providing an extra layer of safety assurance to parents.

Figure 1.1: Kids' school bus

1.2.2 Carpooling Services

Carpooling has emerged as a popular alternative, especially for parents looking to coordinate with others in their community. Technological advancements have streamlined this process, with apps and platforms facilitating easier communication and scheduling among parents. These digital solutions offer features like route planning, schedule coordination, and real-time notifications, making the carpooling process more organized and reliable. Furthermore, these platforms often include rating systems, allowing parents to share feedback and build a trusted community of drivers.

Figure 1.2: Kids Carpooling Service

1.2.3 Ride-Sharing Services

Ride-sharing services have extended their offerings to cater to children's transportation, albeit with stringent safety measures. These services utilize advanced technology to ensure child safety, including thorough background checks of drivers, real-time ride tracking, and in-app communication features. Parents can book rides for their children, specify pick-up and drop-off locations, and receive notifications throughout the journey. Some ride-sharing apps have also introduced features like pre-set favorite drivers, enhancing the trust and consistency of the service.

1.3 Technological Integration in Transportation Services

1.3.1 Enhancing Safety and Security

Technology plays a crucial role in enhancing safety and security in children's transportation. Through the integration of advanced systems and innovative solutions, technology enables real-time monitoring of vehicles and passengers, facilitating immediate response to emergencies and ensuring the safety of children during transport.

1.3.2 Streamlining Scheduling and Management

In addition to safety measures, technology streamlines scheduling and management processes. Advanced scheduling platforms automate route planning and optimize transportation logistics, reducing inefficiencies and minimizing delays. By leveraging technology, transportation providers can ensure timely and efficient pickup and drop-off of children.

1.3.3 Fostering Seamless Communication

In addition, technology allows smooth communication among individuals or groups involved in the transportation of children. Mobile applications and GPS tracking technologies provide immediate updates and promote clear communication among parents, drivers, and transportation providers. This guarantees that all parties are well-informed and able to coordinate efficiently throughout the transportation procedure.

1.4 Case Study: Ridesharing Apps for Children

1.4.1 Ridesharing Platforms Designed for Children

Kids' ridesharing is one part of ridesharing that is becoming more and more common these days. Although it is common knowledge that unaccompanied kids are sometimes dropped off by regular ridesharing applications like Uber and Lyft, at least five businesses have taken the initiative to transport youngsters lawfully.

These five firms all put their drivers through extensive background checks to make sure they are safe and capable of handling driving around children. They also all have specific insurance that permits drivers to carry children. This section will examine the top five kid-friendly ridesharing applications and the experiences drivers may have working for them.

1. **Kidcaboo**

   Kidcaboo is a children's transportation solution that frees up busy parents so they can spend more time with their kids, pursue a career, and enjoy more downtime, according to the company's website.

   Kidcaboo launched in December 2019 to provide working parents with a safe means of kid transportation. Arizona, Texas, and North Carolina are the current places where it is accessible, and more states around the country are joining it soon. They carry children who don't need a five-point harness car seat, aged 5 to 17[13].

   As would be imagined, Kidcaboo drivers are referred to as Driving Childcare providers, and the employment procedure is more competitive than that of becoming an Uber driver. With a few exceptions relating to state regulations, all Driving Nannies must be at least 21 years old, have at least three years of experience providing care, have a spotless driving record, and successfully complete Kidcaboo's rigorous screening, interview, and onboarding processes[13].

Figure 1.3: Kidcaboo App

   Kidcaboo offers its drivers dual-facing dash cams, which are installed by the company. Kidcaboo's FAQs state that Driving caregivers will always get at least $15 for every ride. Additionally, Kidcaboo provides flexible scheduling, paid time off, substantial benefits, a minimum annual compensation of nearly $60,000K, and more.

2. **HopSkipDrive**

HopSkipDrive is a tech-enabled transportation service that was founded by a group of moms. Families, K–12 educational institutions, nonprofits, and child-focused businesses are among its clientele. A firm spokesman claims that more than 2.5 million kilometers of safe transportation have been made possible by the service.

HopSkipDrive has made expanding its service regions a key priority. Spokane and Seattle, Washington; Northern and Southern California, Las Vegas, Nevada, Phoenix, Arizona, the Colorado Front Range; Midland, Dallas/Ft. Worth, Austin, and Houston, Texas, Tampa, Florida, Madison and Milwaukee, Wisconsin, Philadelphia, Pennsylvania, and Virginia/D.C. are now the operating areas[13].

Figure 1.4: HopdSkipDrive Service

It's important to know that HopSkipDrive does not provide car seats for younger children, as stated on their website. The service is mostly intended for kids six years old and above, for whom booster seats are available. It is required that children under the age of six be accompanied by an adult. The adult traveling with them is in charge of bringing the required car seat and handling its installation and removal.

One booster seat is provided by HopSkipDrive during the driver onboarding procedure. However, when transporting many children who need such equipment, the corporation does not compensate for extra booster seats.

Drivers risk having their service terminated if they don't have enough booster seats on hand or try to carry several children who need them without the required gear. As such, drivers need to plan ahead and purchase several booster seats if necessary

in order to maintain compliance and ongoing service[13].

3. **Zum**

   Zūm is a kid-friendly transportation service that prioritizes reliability and security for kids five years old and above. In addition to transportation, Zūm offers several other care services. The cities of San Francisco, San Jose, Oakland, Los Angeles, Seattle, Chicago, and Dallas are among Zūm's functioning areas.

   The Zūm website states that the service takes pride in always being on time and completing all scheduled journeys. For a variety of transportation requirements, such as daily commutes to and from school, transportation to and from extracurricular activities, playdates, carpooling with friends, and party pickups and drop-offs, parents are urged to use Zūm. Zūm also provides the choice of chaperoning or childcare for the duration of the journey.

   The first booster seat must be purchased individually by drivers. Zūm provides any extra booster seats that may be required for additional children. One prominent aspect of Zūm is its carpooling function, which lets kids from different families travel together and has adaptable pick-up and drop-off locations[13].

   Zūm is open Monday through Sunday from 6 a.m. to 9 p.m., thus it is not open 24/7. Nonetheless, one may request adjustments by getting in touch with customer service via chat, email, or the Zūm website.

   Zūm's partnership with the educational institutions within its service regions is another unique feature. Through this cooperation, schools are able to pay for kids' transportation, relieving parents of some of their financial load and offering a practical substitute for conventional school bus services in situations where they are not practical. Zūm uses its large fleet of cars, SUVs, and vans to help with field trip transportation as well. With the ability to accommodate both day excursions and overnight events, the service provides transportation options for one-way or return travel.

4. **Kango**

   Kango is a specialized service offering both transportation and childcare, designed to support parents in multifaceted ways. Similar to conventional rideshare applications, Kango enables parents to schedule rides and track them in a real-time, ensuring that their children are dropped off at the designated location. The service operates within the San Francisco Bay area, Los Angeles County, and the San Fernando Valley.

Kango differentiates itself from other rideshare services such as Uber and Lyft, particularly in its capacity to transport unaccompanied minors, a service for which Uber and Lyft are not licensed. According to Kango, the service extends beyond simple curbside-to-curbside transportation, emphasizing the importance of safety and trust when handling child passengers.

Kango drivers are required to perform tasks such as signing children in or out of schools or activities and ensuring they are brought safely into their homes. The drivers undergo comprehensive background checks, fingerprinting, and TrustLine certification, which includes verification of their childcare experience[13].

Kango holds the distinction of being the only ridesharing service insured to transport unaccompanied children of any age. It offers both pre-scheduled and same-day ride requests. Additionally, Kango provides a live operations team to assist drivers with any questions or issues that may arise during a ride, ensuring a high level of support and reliability.

Figure 1.5: Kango Service

In order to guarantee the honesty and reliability of their drivers, all of these transportation apps put a high priority on security features, such as thorough background checks, fingerprinting, and Department of Motor Vehicles (DMV) tests. This strict methodology is best shown by the Kango safety checklist. Kango ensures the safety of young passengers by offering car seats and booster seats to drivers at no cost, in addition to strict safety rules. When submitting a transportation request via the app, parents must indicate whether they need car seats or booster seats.

Beyond only transportation, Kango also offers daycare, filling the void left between the conclusion of the school day and the parent's workplace. This extra service gives parents a great deal of help by offering a dependable childcare option during this crucial time.

When using Kango, parents may arrange recurring trips, such as daily pickups at the same time, and select certain drivers or sitters. Although Kango cannot ensure that the same sitter or driver will be available for every trip, they try their best to regularly honor these requests[13].

Kango allows parents to tip drivers and sitters via the app in exchange for their services. With the diminishing use of cash in modern culture, this in-app tipping option is beneficial for drivers and sitters as it raises the possibility of getting gratuities.

5. **JumpRydz**

   JumpRydz is a ridesharing service that serves families. Families can rely on JumpRydz drivers for dependable, economical, and safe transportation. It all began in 2011 when Margarita Clarke, who was employed at an after-school program, assisted families in need by picking up their children from school or other activities if the parents were unable to pick them up on time.

   She then used those kind gestures to launch a successful company named Titi's Kiddie Kab. The name Titi's Kiddie Kab was changed to JumpRydz in 2019, which offers rides for families and the elderly.

   Drivers may already sign up for JumpRydz in Queens, Brooklyn, the Bronx, Manhattan, and Staten Island. Nassau County, Suffolk County, Westchester County, and New Jersey will soon be served[13].

   JumpRydz says that customers and their families are welcome to meet their drivers before the trip in the FAQs section of their website. But being a driver is not necessary for this. Whether you want to do this for the passenger or family is up to you.

   In the driver's "favorite drivers" area of the app, you are immediately listed if you get a 5-star rating as a driver. In this manner, their preferred drivers will be the first to accept their trip request.

Figure 1.6: JumpRides Service

1.4.2 Technology for Safe and Convenient Rides

Technology plays a crucial role in ensuring safe and convenient transportation, encompassing various advanced solutions. Telematics solutions, combining telecommunications and information technology, facilitate real-time data transmission for effective monitoring and management of transportation systems, while tracking and localization systems are essential for dangerous freight transportation, enabling vehicle tracking, loading/unloading monitoring, and incident detection. Intelligent Transportation Systems (ITS) integrate sensors, computing, and telecommunications to collect, store, transmit, and analyze data in real-time, enabling informed decision-making for traffic management and user information. Advanced Traveler Information Systems (ATIS) leverage technology to provide real-time information to travelers, aiding in efficient and convenient travel choices through in-vehicle, pre-trip, and in-terminal/wayside systems. Emerging technologies like connected vehicles, autonomous vehicles, and 5G networks enhance ITS capabilities, enabling high-precision real-time location services, vehicle-to-vehicle communication, and centralized passenger-centric systems. Additionally, machine learning and deep learning techniques contribute to accurate arrival time prediction and ride-sharing optimization, further improving operational efficiency and promoting sustainable transportation[14, 15].

1.5 The proposed solution for Algerian kids

Figure 1.7: Algerian Kids

In the vibrant tapestry of Algerian family life, the challenges of children's transportation resonate deeply. From the bustling streets of Algiers to the serene villages of Biskra, parents across Algeria share a common concern: ensuring the safe and timely transit of their children in an ever-evolving world.

Our proposed solution emerges as a beacon of innovation and assurance—a tailored response to the unique needs and cultural nuances of Algerian families. Rooted in a deep understanding of local dynamics, our solution seeks to bridge the gap between tradition and technology, seamlessly blending modern convenience with time-honored values.

At its core, our solution offers a comprehensive platform designed to simplify and streamline the complexities of children's transportation. From intuitive scheduling tools to real-time tracking features, every aspect is meticulously crafted to cater to the specific needs of Algerian parents and children.

Moreover, our solution is underpinned by a steadfast commitment to safety—a paramount concern for families navigating the bustling streets of Algerian cities and the winding roads of rural landscapes. Through advanced technological features such as GPS tracking and stringent driver vetting protocols, we strive to instill confidence and peace of mind in every journey.

But our solution is more than just a practical tool—it's a celebration of Algerian identity and community spirit. Through localized user interfaces, culturally sensitive

design elements, and support for multiple languages, we seek to create a sense of belonging and inclusivity for families across the nation.

In essence, our proposed solution represents a convergence of innovation and empathy—a testament to our unwavering dedication to serving the unique needs of Algerian families. As we embark on this journey, we do so with humility and reverence, mindful of the rich tapestry of traditions and values that shape the Algerian experience. Together, let us pave the way for a future where children's transportation is not just a logistical challenge, but a source of joy, comfort, and connection for families across Algeria.

1.5.1 Adapting Global Solutions to Local Needs

Adapting global transportation solutions to meet the specific needs of Algerian children involves understanding the unique challenges and requirements of the local context. While ridesharing and carpooling services have proven successful in various parts of the world, implementing these solutions in Algeria requires consideration of cultural, infrastructural, and regulatory factors. In Algeria, the transportation landscape is shaped by distinct patterns of urban and rural living, varying levels of access to technology, and specific safety concerns.

To effectively adapt these global solutions, it is essential to conduct thorough research into the daily routines, transportation habits, and safety concerns of Algerian families. This includes engaging with parents, schools, and local communities to gather insights and feedback. Additionally, understanding the regulatory framework governing transportation and ensuring compliance with local laws is crucial for the successful deployment of any new service.

By tailoring global best practices to fit the local environment, KidTaxi aims to provide a customized transportation solution that addresses the specific needs of Algerian children. This involves integrating features such as multi-language support, considering local traffic conditions, and incorporating culturally relevant safety measures. Through this localized approach, KidTaxi seeks to enhance the overall transportation experience for Algerian families, ensuring safety, reliability, and convenience.

1.5.2 Implementing KidTaxi in Algeria: Challenges and Opportunities

The implementation of KidTaxi in Algeria presents a unique set of challenges and opportunities. One of the primary challenges is building trust among parents and guardians. In a country where traditional methods of transportation are deeply ingrained, introducing

a new service requires substantial efforts to demonstrate reliability and safety. This involves rigorous driver vetting processes, real-time tracking, and effective communication channels to reassure parents about their children's safety.

Another challenge lies in the technological infrastructure. While urban areas in Algeria have relatively good internet connectivity, rural areas may face limitations. Therefore, KidTaxi must develop solutions that can operate efficiently even in regions with lower connectivity. This could include offline functionalities or SMS-based communication options to ensure seamless service delivery across different areas.

On the other hand, implementing KidTaxi in Algeria also offers significant opportunities. There is a growing awareness and demand for modern, safe, and convenient transportation options. By leveraging this demand, KidTaxi can position itself as a pioneer in the child transportation sector in Algeria. Furthermore, the government and local authorities are increasingly supportive of initiatives that enhance public safety and transportation efficiency, providing a favorable environment for the introduction of innovative solutions.

By addressing these challenges and capitalizing on the opportunities, KidTaxi aims to establish a strong presence in Algeria, contributing to the overall improvement of children's transportation safety and convenience. The successful implementation of KidTaxi can set a precedent for other regions, showcasing the potential of tailored technological solutions to enhance everyday life for families.

1.6 Conclusion

In conclusion, the state of children's transportation has evolved significantly with advancements in technology and innovative solutions tailored to meet modern-day challenges. From traditional school buses and carpooling services to sophisticated ride-sharing platforms, the landscape continues to transform, prioritizing safety, efficiency, and user-friendliness. Technological integration plays a crucial role in enhancing safety measures, streamlining scheduling, and fostering seamless communication between parents and service providers.

The case study on ridesharing apps specifically designed for children highlights the potential of technology in creating safe and convenient transportation options. As we propose the implementation of KidTaxi in Algeria, it is essential to adapt global solutions to fit the local context, addressing unique cultural and infrastructural challenges while leveraging opportunities for growth and improvement.

By focusing on the specific needs of Algerian families and ensuring robust safety and

reliability standards, KidTaxi aims to provide a valuable service that brings peace of mind to parents and secure transportation for children. This chapter lays the foundation for understanding the current state of children's transportation and sets the stage for exploring innovative solutions tailored to enhance the daily lives of Algerian families.

Chapter 2

Needs analysis and Conception

2.1 Introduction

In this chapter, we start by understanding the complexities that go into creating a solution that targets parents and children and incorporates the highest degree of safety, efficiency, and user experience. We define our project requirements as a primer to all our design and analysis work. These requirements encapsulate the multi-faceted nature of our project in terms of safety protocols, technological stack, and the cultural context of Algerian families. Keeping these objectives in mind, we enumerate our design considerations in the next section. In the following chapter, we present the efforts we made to shape the proposed solution, as we illustrate a series of architectural models, user interface designs, and technological frameworks to give a better understanding of how we intend to surround our targeted users, parents, and children, with a sweat-covering and hassle-free service within the Algerian expectations and requirements. Following our initial design consideration, we proceed to provide an extensive overview of our solution through the analysis of the design aspects, discussing its sustainability, scalability, and the potential impact it might have on the transportation industry, especially the children's transportation services domain. Through meticulous evaluation and continuous refinement, we are aiming to deliver an exceptional solution that not only accommodates the needs and requirements of all our stakeholders but exceeds their expectations. As we embark on this chapter on design and analysis, we acknowledge our resolve to change the children's transportation services status quo in Algeria. With an extremely cautious and delicate approach to the Algerian parent's and children's lives and experiences, we aim to infuse the elements of innovation, inspiration, and empathy into a creative solution that goes beyond delivering kids to and from schools, providing a strong sense of security, reliability, and trust to all our client's families all over the country.

2.2 requirements analysis

The foundation of our work in the challenging process of creating our kids' transportation application is a thorough needs analysis. It's a thorough analysis of the features, functionality, and user interactions needed to realize our vision. The purpose of this study is to pinpoint the exact components needed to ensure the efficiency and seamless operation of our program.

2.2.1 User Registration

Our application should act as a gateway for parents to access all of the services offered, a robust user registration process is crucial to its functionality. It is imperative that the registration process be safe, easy to use, and straightforward so that people can create accounts with the least amount of difficulty. Important elements of the system for registering users consist of:

2.2.1.1 Account Creation

Users should be able to easily create accounts by providing essential information such as name, contact details, and password. The registration process should also include validation mechanisms to ensure the accuracy and authenticity of user-provided information.

2.2.1.2 Profile Management:

Once registered, users should have the ability to manage their profiles, including updating personal information, adding or removing children from their accounts, and setting preferences for transportation services.

2.2.2 Ride Schedule

A fundamental aspect of our application is the ability to schedule rides for children, providing parents with a convenient and reliable means of coordinating transportation. The ride-scheduling feature must be flexible, intuitive, and adaptable to the dynamic needs of users. Key components of the ride-scheduling functionality include:

2.2.2.1 Scheduling Interface:

The application should feature an intuitive scheduling interface where parents can easily specify pick-up and drop-off locations, desired times, and any special instructions or requirements for each ride.

2.2.2.2 Recurring Rides:

To accommodate regular transportation needs, users should have the option to schedule recurring rides on a daily, weekly, or custom basis. This feature enhances convenience and reduces the need for repetitive manual scheduling.

2.2.2.3 Notifications and Reminders:

The application should provide timely notifications and reminders to both parents and drivers regarding upcoming rides. These notifications serve to keep users informed and ensure timely coordination of transportation services.

2.2.2.4 Flexibility and Adaptability:

The ride-scheduling feature should be adaptable to changes in user preferences, unforeseen circumstances, and evolving transportation needs. Users should have the ability to modify or cancel scheduled rides as needed, with minimal disruption to the overall system.

2.2.3 Safety Features Implementation

Ensuring the safety and well-being of children during transportation is paramount. As such, our application must incorporate robust safety features designed to mitigate risks and provide peace of mind to parents. Key components of safety features implementation include:

2.2.3.1 Real-Time GPS Tracking:

The application should integrate real-time GPS tracking capabilities, allowing parents to monitor the precise location of their children during transportation. This feature provides transparency and reassurance, enabling parents to stay informed and intervene if necessary.

2.2.3.2 Driver Verification and Monitoring:

Drivers entrusted with transporting children must undergo thorough background checks and verification processes to ensure their reliability and trustworthiness. Additionally, the application should facilitate ongoing monitoring of driver performance and adherence to safety protocols.

2.2.3.3 Emergency Response Integration:

In the event of unforeseen emergencies or incidents during transportation, the application should provide seamless access to emergency response services. This may include features such as one-touch emergency buttons, automated alerts to authorities, and integration with local emergency services.

2.2.4 Parent-Child Communication

Facilitating effective communication between parents, children, and drivers is essential for ensuring smooth coordination and addressing any concerns or inquiries that may arise during transportation. Key components of parent-child communication include:

2.2.4.1 In-App Messaging:

The application should feature a built-in messaging system that allows parents to communicate directly with drivers regarding ride details, special instructions, or changes in plans. Similarly, drivers should be able to communicate with parents regarding pickup/drop-off status and any relevant updates.

2.2.4.2 Child Check-In/Check-Out Alerts:

Upon arrival at the destination, drivers should have the ability to confirm the safe arrival of children and trigger automated check-in/check-out alerts to parents. This feature provides reassurance to parents and helps ensure accountability throughout the transportation process.

2.2.4.3 Parental Notifications:

Parents should receive timely notifications and updates regarding the status of scheduled rides, including confirmation of pickup/drop-off, estimated arrival times, and any deviations from the planned route or schedule.

2.3 non-functional requirements

2.3.1 performance

2.3.1.1 speed

Our application boasts rapid response times, ensuring that users can access information and perform tasks without experiencing any noticeable delays. Whether parents are checking the status of their child's ride or drivers are updating their routes, the app responds swiftly to every action.

2.3.1.2 Map Refresh Time:

Real-time location tracking is a cornerstone of our application's safety features. Maps refresh seamlessly and efficiently, providing parents with accurate, up-to-the-minute in-

formation about their child's location during transportation. With minimal lag time, parents can monitor their child's journey in real time with confidence and peace of mind.

2.3.1.3 Scalability:

As our user base grows and demand for the application increases, our infrastructure scales effortlessly to meet the needs of our expanding community. Whether it's handling a larger volume of ride requests or accommodating more concurrent users, our application maintains optimal performance without missing a beat.

2.3.2 Security:

2.3.2.1 Encryption of User Data:

We prioritize the security of our users' information by encrypting all sensitive data, including passwords, using industry-standard encryption algorithms. This ensures that user data remains protected, even in the unlikely event of a breach.

2.3.2.2 Secure Authentication:

Our application implements robust authentication mechanisms, including multi-factor authentication and OAuth, to verify the identity of users and safeguard access to sensitive features and data. With secure authentication in place, users can trust that their accounts are protected from unauthorized access.

2.3.2.3 Data Protection:

From transit to storage, our application employs comprehensive data protection measures. Communication channels are encrypted using protocols like HTTPS and TLS to prevent interception, while strict access controls and permissions ensure that only authorized users can access sensitive data within the application.

2.3.2.4 Regular Security Audits:

We conduct regular security audits and vulnerability assessments to proactively identify and address any potential security vulnerabilities or weaknesses. By staying ahead of emerging threats, we ensure that our application remains resilient and maintains the trust of our users at all times.

2.4 Methodology and strategy

There's a process that needs to be followed before programming the application. The first is modeling, which involves arranging concepts, recording them, and planning the application's creation by outlining its various components and stages. In our project, we used the UML technique to build these separate pieces in the form of diagrams. Modeling helps us better understand how the application will work and plan its programming more quickly.

2.4.1 Presentation of UML

The Unified Modeling Language (UML) was created to be a common, semantically rich visual modeling language syntactically. It is meant to be used in the architecture, design, and implementation of software systems with intricate behavioral and structural patterns. The UML has uses that go beyond software development.

UML offers comprehensive coverage of the entire software life cycle, from requirement specification to development. It provides many ways to describe and represent actors, how the system is used, behavior objects, internal control flow, implementation components, their interactions, hardware structure, and object and component distribution. UML makes it possible to model without regard to how techniques are implemented, and it can be modified in accordance with project requirements.

2.4.2 The advantages of UML

• Making use of a common graphic language.
• UML makes it easier for development teams to communicate.
• User Modeling Language (UML) promotes reuse and provides abstractions and modeling layers to regulate software system complexity.
• Provides speedy error detection and helps with software system documentation.

2.4.3 Use case diagrams

A kind of diagram called a use case diagram is used in UML (Unified Modeling Language) to show how users and actors interact functionally with a system. With an emphasis on user actions and system reactions, they depict the many functionalities provided by the system from the perspective of the users.((OMG) December 2017)
There are various essential components of a use case diagram:
• Actors: The outside parties that communicate with the system are called actors. Actors

might be external components, other systems, or human users.

• Use cases: These depict the various features or operations that the system provides to its users. Every use case explains a particular exchange that takes place between an actor and the system.

• Relationships between actors and use cases are a useful way to see how they interact.

• Inclusions and extensions: When a use case is executed in a way that systematically incorporates the execution of another use case, this is referred to as an inclusion.

• System: The actors engage with the system, which is shown as a worldwide entity[5].

2.4.4 General Use Case Diagram

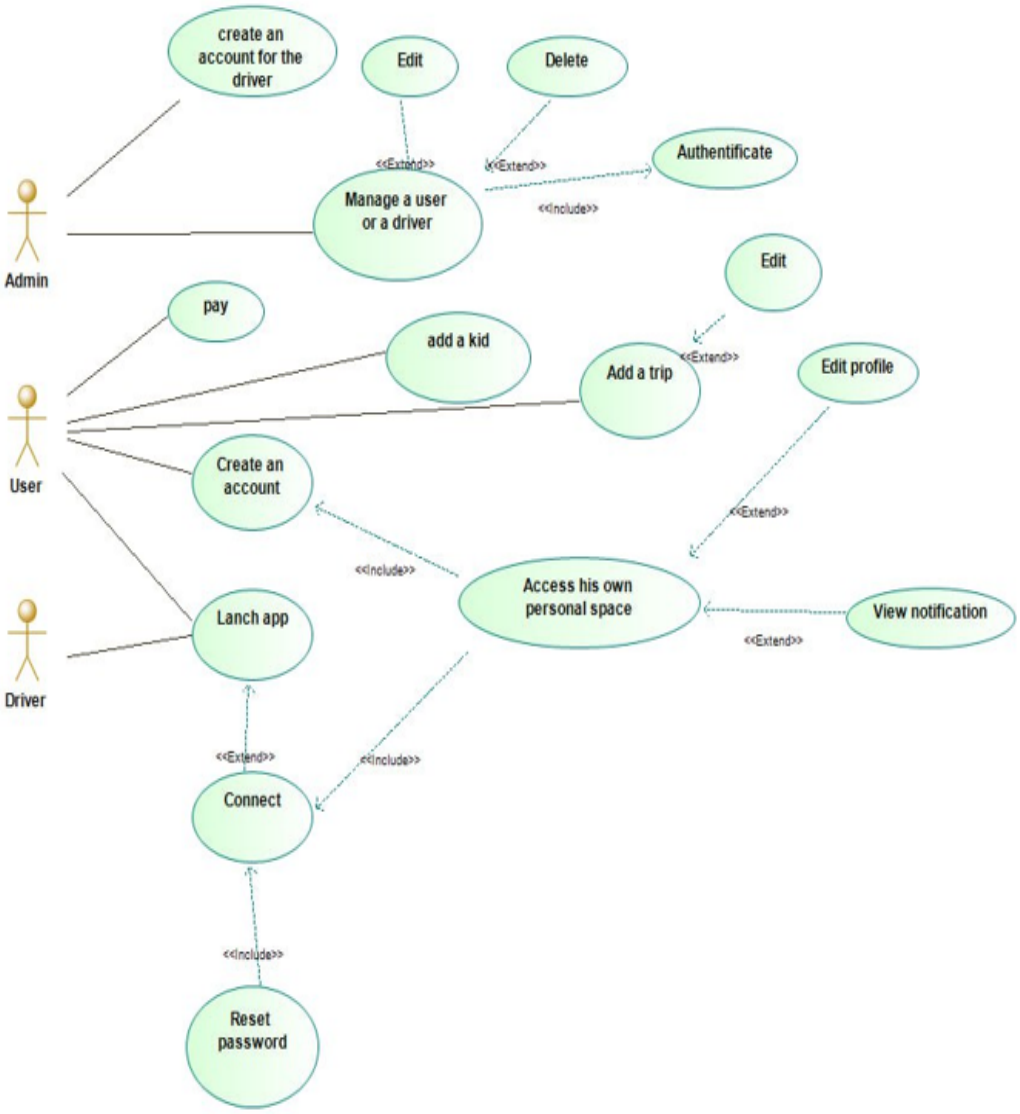


Figure 2.1: General use case diagram

2.5 System Modeling

2.5.1 Sequence Modeling

2.5.1.1 Sequence Diagram « User Authentication »

This sequence diagram outlines the user authentication process involving three primary entities: the User, the Mobile Application, and the Firebase. Here's a detailed description of the diagram:

1. **Request to Authenticate**:
    - The process begins when the User sends a request to authenticate to the Mobile Application.
2. **Display Authentication Interface**:
    - The Mobile Application responds by displaying the authentication interface to the User.
3. **User Enters Credentials**:
    - The User enters their username and password into the Mobile Application.
4. **Validation**:
    - The Mobile Application then validates the entered credentials by communicating with Firebase.
5. **Verification by Firebase**:
    - Firebase performs the verification of the provided credentials.
6. **Conditional Branches**:
    - The sequence diagram includes two conditional branches (alt boxes) to handle different scenarios based on the verification results.

First Alternative (Input Error Handling)

1. **If Input Error**:
    - If there is an input error (e.g., invalid username or password), the Mobile Application displays an error message to the User.

2. **Else (Successful Verification)**:

    - If the input is correct, the Mobile Application receives a confirmation of authentication from Firebase.

Second Alternative (Account Existence Handling)

1. **If Account Does Not Exist**:

    - If the account does not exist, Firebase returns an error.
    - The Mobile Application then displays an error message to the User.

2. **Else (Account Exists)**:

    - If the account exists, Firebase confirms this, and the User is granted access to their account.
    - If required, the account recovery process is initiated, and the Mobile Application facilitates this.

Error Handling

- If there are any errors during the process, appropriate error messages are displayed to the User to inform them of the issue.

Recurrence Loop

- The diagram indicates a loop around the input and validation process, suggesting that the User can attempt authentication multiple times if there are errors.

Overall, this sequence diagram illustrates the detailed steps involved in user authentication, including input validation, verification by Firebase, and handling different scenarios based on whether the input is correct or the account exists. The diagram emphasizes error handling and the possibility for users to retry authentication if necessary.

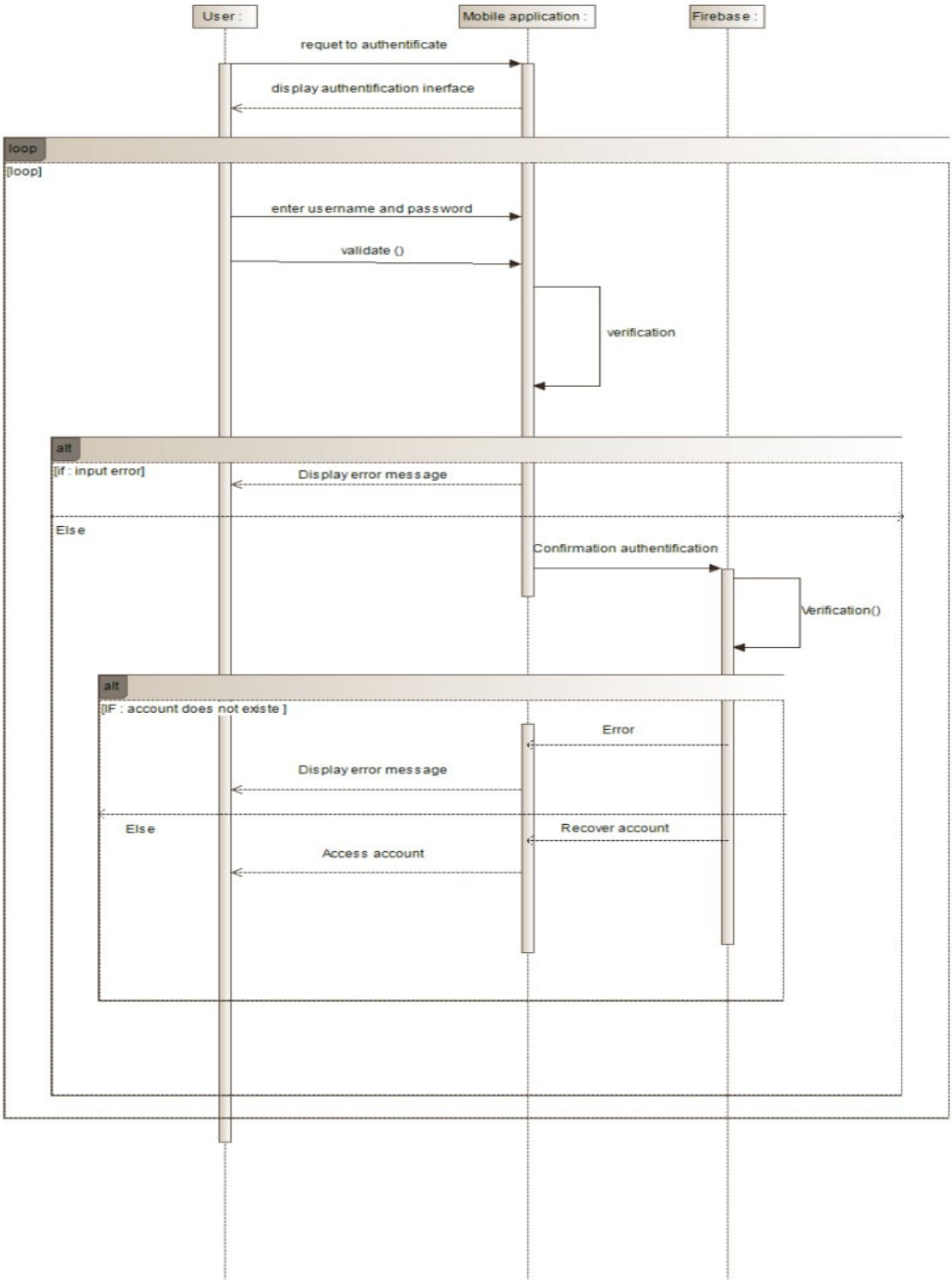


Figure 2.2: Account Creation page on the application

2.5.1.2 Sequence Diagram « Create An Account »

This sequence diagram outlines the process of creating an account, involving three primary entities: the Parent, the Mobile Application, and Firebase. Here is a detailed description of the diagram:

1. **Request to Create Account**:
    - The process starts when the Parent asks to create an account via the Mobile Application.
2. **Display Sign-Up Interface**:
    - The Mobile Application responds by displaying the sign-up interface to the Parent.
3. **Parent Enters Information**:
    - The Parent fills in their user information into the Mobile Application.
4. **Validation**:
    - The Mobile Application validates the entered information.
5. **Verification by Firebase**:
    - The Mobile Application sends the validated information to Firebase for verification.
6. **Conditional Branches**:
    - The sequence diagram includes a conditional branch (alt box) to handle different scenarios based on the verification results.
7. **Alternative (Input Error Handling)**:
    - **If Input Error**:
        - If there is an input error (e.g., invalid or incomplete information), the Mobile Application displays an error message to the Parent.
    - **Else (Successful Verification)**:
        - If the input is correct, the Mobile Application proceeds to create the account.

8. **Account Creation Process**:

   - **Create Account**:
     - The Mobile Application sends a request to Firebase to create the account.
   - **Successful Creation**:
     - Upon successful creation of the account, Firebase updates its records.
   - **Send Email**:
     - The Mobile Application then sends a confirmation email to the Parent.

Overall, this sequence diagram illustrates the detailed steps involved in creating a new account, including input validation, verification by Firebase, error handling, and the final account creation and confirmation email process. The diagram emphasizes the need for accurate information entry and outlines the process for handling errors and successful account creation.

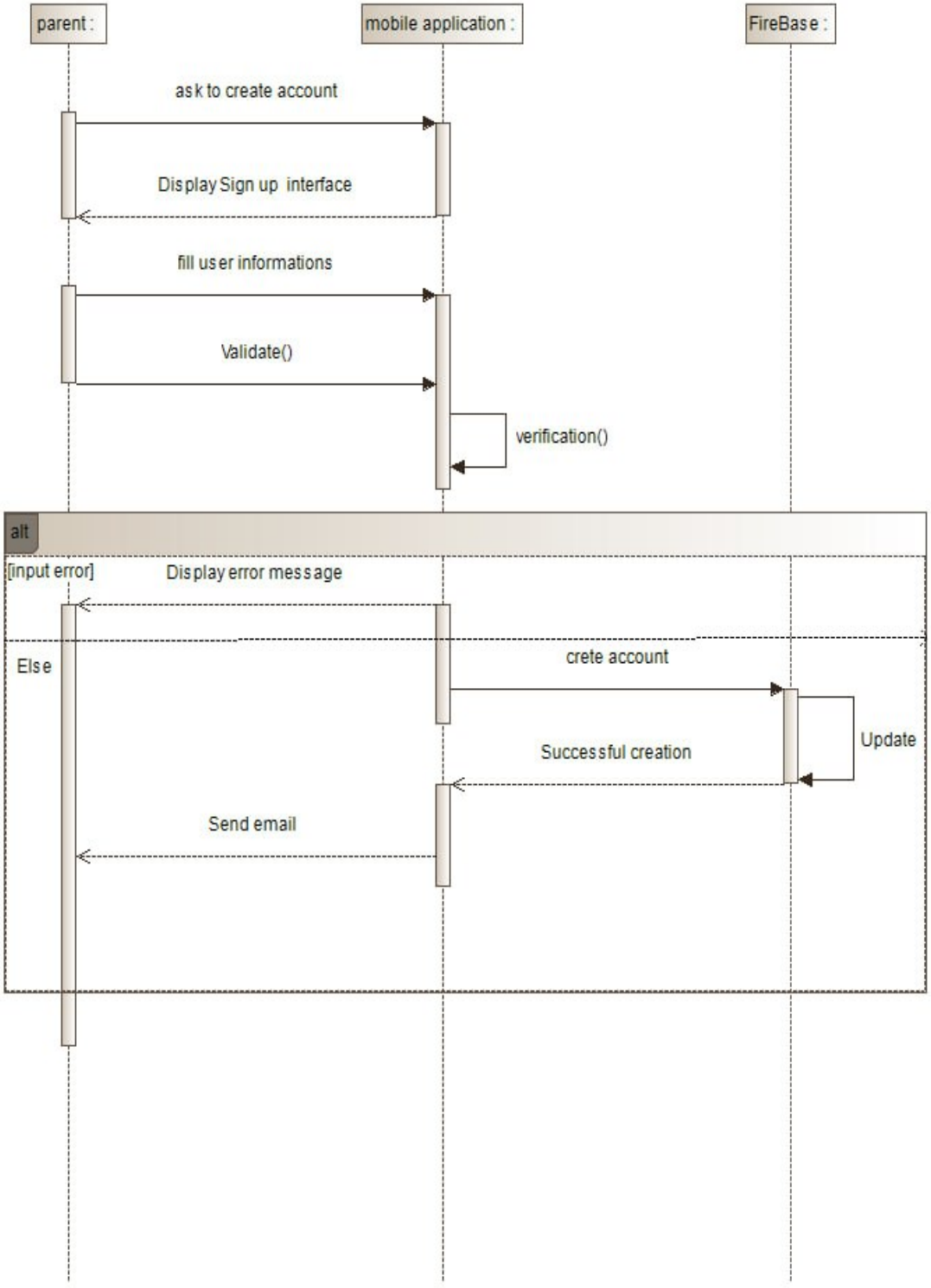


Figure 2.3: Account Creation page on the application

2.5.1.3 Sequence Diagram : Add A Child

This sequence diagram outlines the process of adding a child to a parent's account using a mobile application, with data interactions involving Firebase. Here is a detailed description of the steps involved:

1. **Add Child Information**:
    - The process begins with the Parent entering the child's information into the Mobile Application.
    - The Mobile Application sends this request data to Firebase.
    - Firebase processes the request and sends a response back to the Mobile Application.
2. **Show Interface of Pickup**:
    - The Mobile Application displays the pickup interface to the Parent based on the response from Firebase.
3. **Add Pickup Location and Destination**:
    - The Parent adds the pickup location and destination details.
    - The Mobile Application sends this request data to Firebase.
    - Firebase processes the request and sends a response back to the Mobile Application.
4. **Show Interface of Pickup Days**:
    - The Mobile Application displays the interface for selecting pickup days to the Parent based on the response from Firebase.
5. **Select Pickup Days**:
    - The Parent selects the desired pickup days.
    - The Mobile Application sends this request data to Firebase.
    - Firebase processes the request and sends a response back to the Mobile Application.
6. **Confirmation to Parent**:
    - The Mobile Application displays a confirmation message to the Parent based on the successful response from Firebase.

7. **Update Children List**:

    - The Mobile Application updates the list of children on the home screen to reflect the newly added child.

Overall, this sequence diagram illustrates the steps for adding a child to a parent's account in a mobile application, including interactions with Firebase for data verification and processing. The process includes entering child information, setting pickup details, selecting pickup days, and confirming the addition, with updates reflected in the application's home screen.

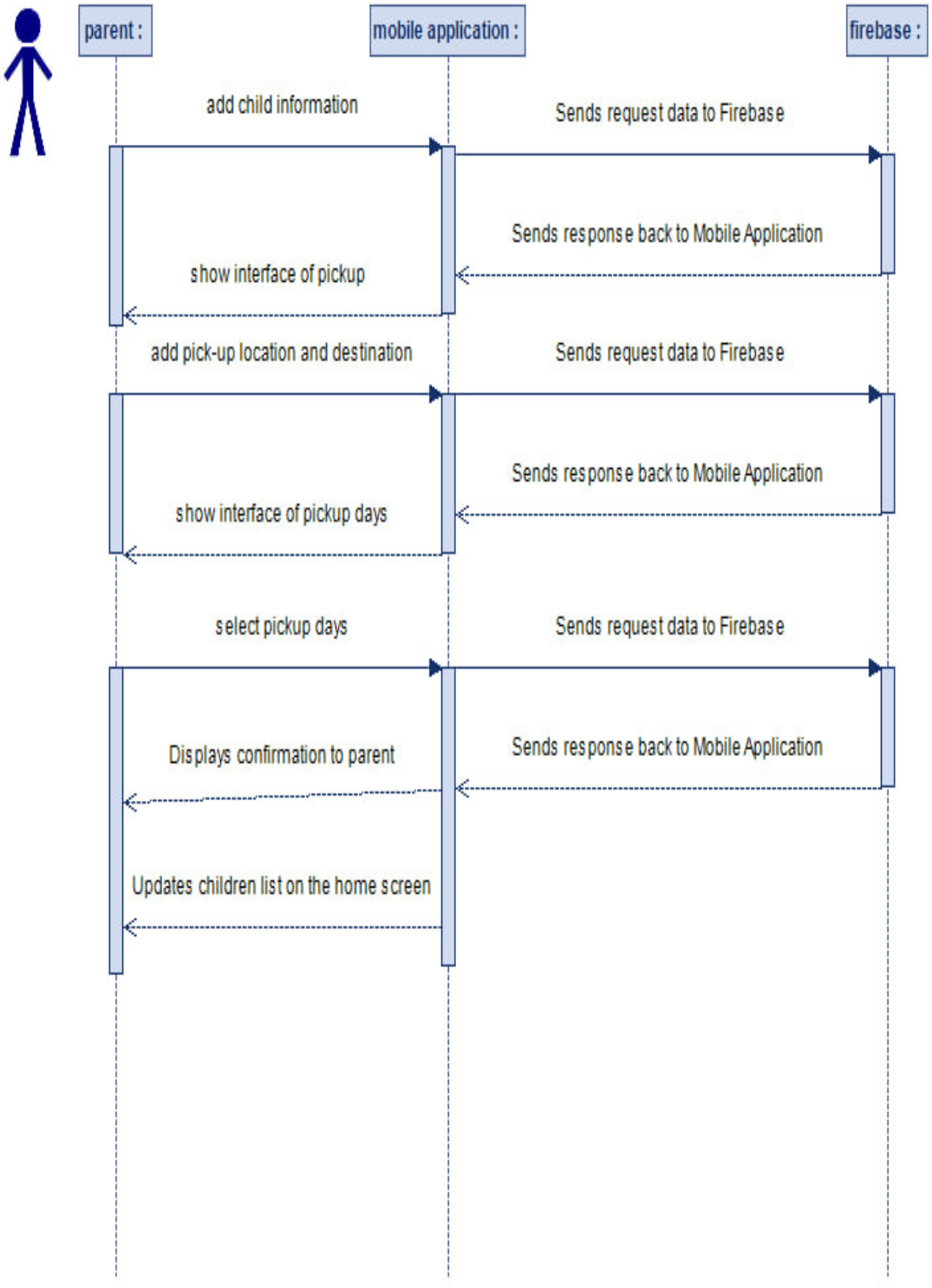


Figure 2.4: Add Child page on the application

2.6 Conclusion

Through our commitment to non-functional requirements such as performance optimization and robust security measures, we have created a children's transportation application that not only meets the functional needs of our users but also provides a seamless, secure, and reliable experience that instills confidence and peace of mind. After outlining the primary goal of the upcoming application, we addressed the requirements analysis and design stage in this chapter. We explained the stages required in planning its operation and offered a complete description of the UML language diagrams used for modeling, which include the use case diagram and sequence diagram. By employing these diagrams, we seek to simplify the application development process, which will be addressed in the coming chapter.

Chapter 3

Implementation

3.1 Introduction

This chapter starts the process of implementing and finishing our mobile application. It covers important topics, including the programming languages we utilized, the development tools we used, and a detailed summary of our progress. We'll discuss the development environment and key tools, including Android Studio, Flutter, Emulator, and Android SDK, as we get into the specifics of this implementation path. These tools have been crucial in determining the functionality of our application. We will also explore the two programming languages—Firebase and Dart—that gave birth to the app's many features and services.

By doing a thorough analysis of the KidTaxi visual brand, our goal is to create a user experience that is both smooth and visually engaging. In addition, we will present the application's architecture and a range of user interfaces, including chat interfaces, appointment booking and scheduling interfaces, parent and driver profiles, onboarding, login/register interfaces, and a number of additional feature interfaces.

This chapter provides the foundation for a full comprehension of the implementation procedure and the observable results of our hard work.

3.2 Development Environment

A development environment in software and web development is a workspace that allows developers to make changes without damaging anything in a live environment.

The development environment is typically considered as a developer's "everything-goes" workstation. When dealing with a development environment it is part of a tiered system of environments, where modifications are sent across several environments before reaching a live website. A typical environment structure contains a local, a development, a staging, and a live environment, but it might include more or fewer environments depending on the requirements and procedures of the individuals producing the website.

In certain circumstances, the word "development environment" is used to refer to an Integrated Development Environment (IDE). An integrated development environment is commonly used as a programming tool to aid the developer. It is the software suite used by developers and is meant to optimize productivity and efficiency for the developer.

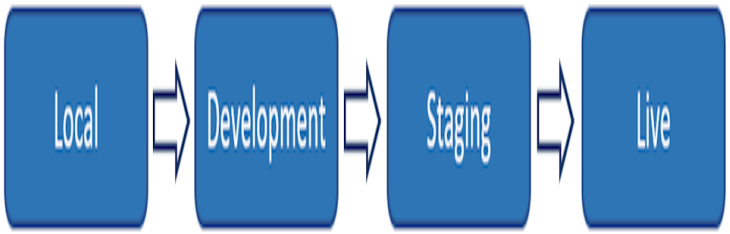


Figure 3.1: The deployment process of KidTaxi application

The objective of a development environment is to provide a location for a developer to test whatever they want without worrying about it hurting any end-users or content editors working on a live website. In most circumstances, a development environment is set up on a local workstation or server, where the website's source code is downloaded, so it is available to be edited and amended. To aid with the development process an integrated development environment (IDE) is commonly used to speed up the process and make a developer more productive[**?**].

3.2.1 Android Studio

Android Studio is an official integrated development environment (IDE) for Android application development, based on JetBrains IntelliJ IDEA software. To assist application development on the Android operating system, Android Studio employs a Gradle-based build system, emulators, code templates, and GitHub integration. Android Studio is Google's official integrated development environment (IDE) for the Android operating system, based on JetBrains IntelliJ IDEA software and optimized exclusively for Android development. The Android build system is a suite of tools used to develop, test, launch, and bundle your apps.

Android Studio is also substantially quicker than Eclipse, which, to be fair, should meet a larger variety of development requirements rather than just one, and can be operated on less powerful devices. The Gradle build system employs the more Android-specific functionality given by the Android Gradle plugin.[6].

Figure 3.2: Android Studio Logo

Android developers depend on numerous Gradle Android plugins and custom build logic to tailor the build system to your apps. Android Gradle 4.0.0 plugins feature support for Android Studio's build parser, usage of Java 8 language APIs (independent of your applications' minimum API level), and establishment of function-on-function relationships across dynamic function modules. Android Studio isn't the only option to build Android applications; Other IDEs exist, such as Eclipse and NetBeans, and it is even feasible to construct a whole application using nothing more than the text editor and a command line[6].

3.2.2 Flutter

Flutter is a cross-platform application development framework built by Google, the first version of which was published as an open-source project in late 2018. Flutter supports a large array of element libraries. Standard UI for Android and iOS.

However, it also remains ideal for the construction of typical office online applications. apps produced using Flutter take on the look of normal apps of the relevant platforms and also perform similarly.[3].

3.2.2.1 The Use of Flutter for Cross-Platform App Development

Flutter is largely used for the construction of Android and iOS apps, without necessitating the establishment of a code base particular to each of these two platforms which are so distinct from each other. In this approach, smartphone apps act, on various devices, like true native programs.

They are compiled for each platform before publishing, so they do not require a run-time module or a browser. On this shared code foundation, it is also feasible to construct browser web apps, as well as native programs for Windows, Linux, and macOS[3].

Figure 3.3: Flutter Logo

Google utilizes Flutter for various Google Assistant modules and for the Google Home Hub user interface, among others. That said, even e-commerce firms, like as eBay, Groupon, or the Alibaba Group, employ Flutter to provide their online and mobile apps with a unified appearance and functionality.

3.2.2.2 The Dart Programming Language and Its Role in the Flutter SDK

The Flutter SDK is based on the Dart programming language also created by Google. It seeks to be the contemporary successor to the old JavaScript language and, like the latter, it operates directly on browsers, in the form of a web application. Dart applications may also be executed directly on a server.

Figure 3.4: Dart logo

In the browser, they are utilized with the Dart2JS trans-compiler in JavaScript. The apps of Google's new Fuchsia platform are directly produced using Dart, whose structure is comparable to that of object-oriented programming languages such as Java or C#[2].

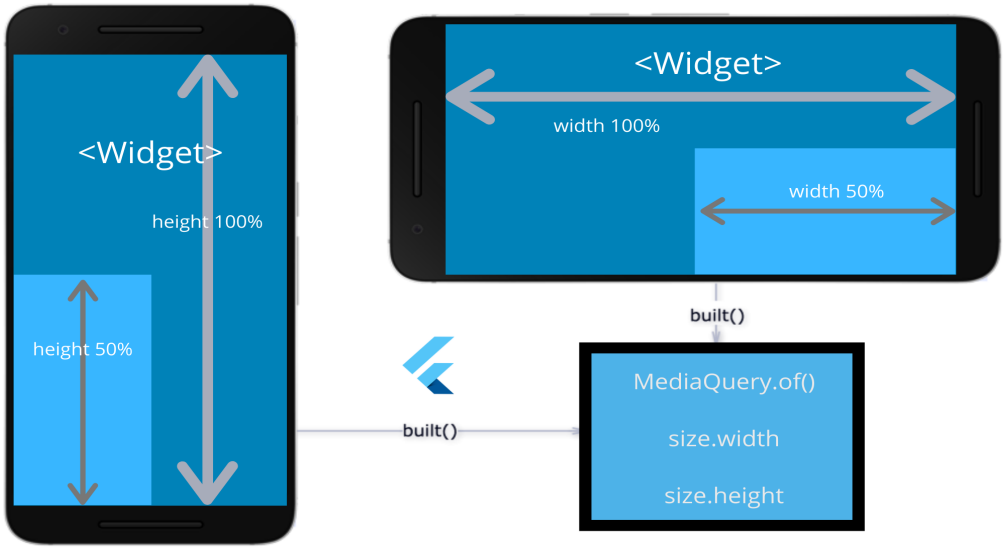


Figure 3.5: Flutter widgets

3.2.2.3 Everything is a widget: the principle of Flutter

Flutter's "Everything is a widget" technique systematically integrates object-oriented programming straight down to the user interface: a program's interface is made up of multiple widgets that may be stacked within one other. Each button and displayed text is a widget. These widgets contain different editable features. They may affect each other and respond to external state changes via integrated functionalities.

Widgets are given for all key UI components. They conform with the designs defined by Android and iOS, as well as those of standard online apps. If required, new functionalities may be added. Custom widgets may also be generated and simply coupled with existing widgets[3].

Compared to other SDK ideas, widgets provide additional flexibility. However, since they are all anchored in the program's source code, they are deeply interconnected, which may rapidly lead to confusion.

3.2.2.4 Advantages and disadvantages of Flutter

Each SDK and programming language has its perks and limitations. Generally speaking, we may state that the benefits of Flutter clearly set it apart from other comparable systems.

Advantages of Flutter:

Single code base for all main target platforms. Dart, an easy-to-learn programming language for novices. "Everything is a widget" notion presenting various options. Powerful execution of native programs on smartphones. Access to large libraries of pre-designed UI components. Easy deployment of data streams for continual user updates. Hot Reload to expedite testing throughout the development process.

Disadvantages of Flutter:
Confused programming code due to widget integration Need to update Flutter modules when upgrading designs for various OS systems. Recompiling and reinstalling modules on devices, since they are permanently embedded into the software. Recent and rare language; still tiny community[3].

3.2.3 Emulator

The Android SDK offers a virtual mobile device emulator that runs on a computer. An Android emulator is used for running, debugging, and testing Android apps. The emulator lets the developer run a sample product virtually without an actual hardware device. An emulator is identical to a real hardware mobile device with all the functions that a genuine mobile includes except that it cannot make an actual phone call. The emulator comes with preconfigured setups for many Android phones, tablets, Wear OS, and Android TV devices. Emulator is a unique Android device that may be used as a target platform to execute and test your Android application on your PC[8].

It features navigation control keys coupled with touchscreen accessibility. On a virtual device, the cursor may be used as a finger and perform all the operations such as typing, launching programs, swiping, etc. The Android Emulator operates on a complete Android system stack, down to the kernel level containing a set of preloaded apps that we can use from our applications.

Android emulator allows us to pick the API level and Android version of your choosing by setting AVDs. While running the emulator at runtime, we may use a range of commands and settings to customize its behavior. The android emulator allows dynamic binary translation of device machine code to the OS and processor architecture of our development computer[8].

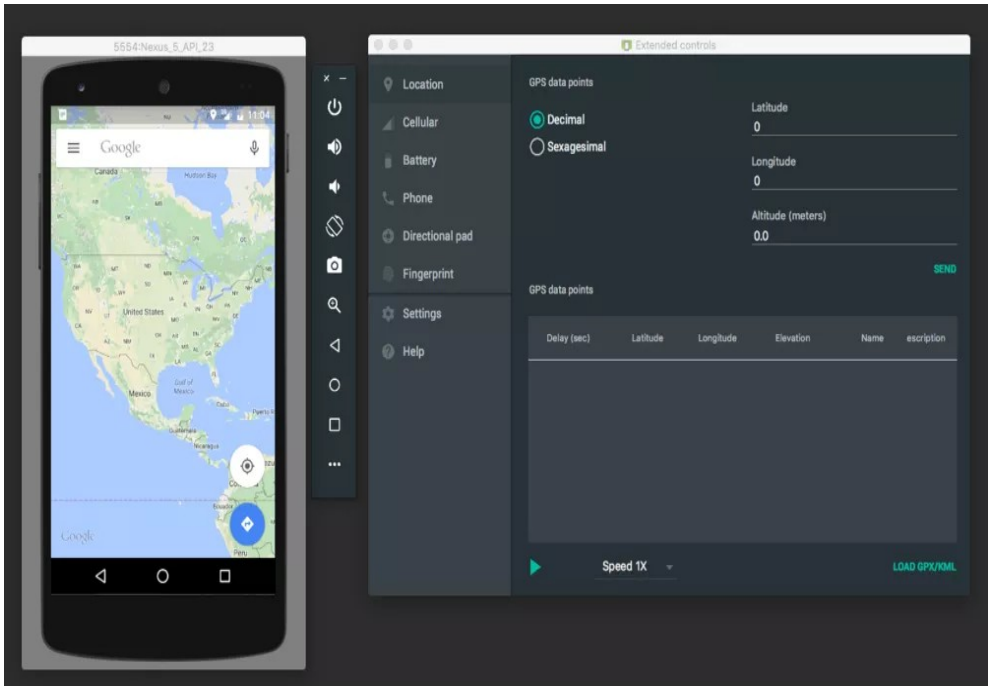


Figure 3.6: The emulator of the mobile applications

3.2.4 Android SDK

Android SDK is a set of libraries and Software Development tools that are needed for Developing Android Applications. Whenever Google publishes a new version or upgrade of Android Software, a related SDK is also released with it. In the updated or new version of SDK, certain extra features are incorporated which are not included in the previous version. Android SDK comprises certain tools that are extremely crucial for the creation of Android applications. These tools allow a seamless flow of the development process from developing to debugging. Android SDK is compatible with all operating systems such as Windows, Linux, macOS, etc[10].

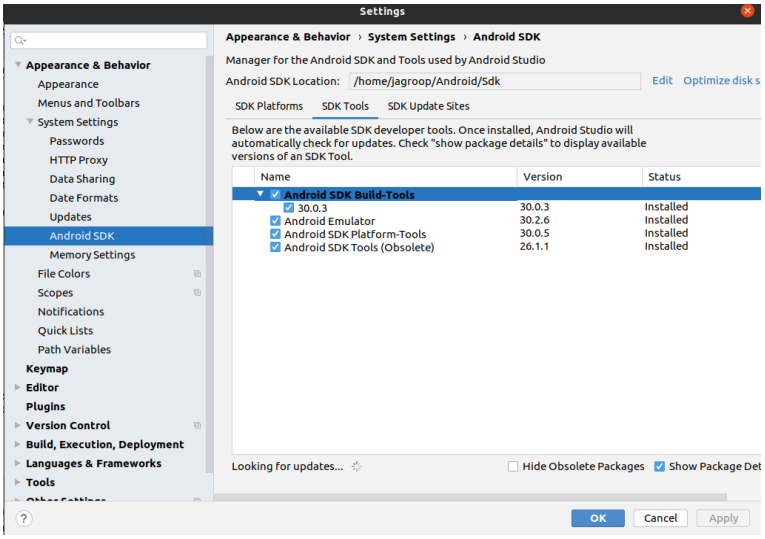


Figure 3.7: Android SDK setting

3.3 Development Languages

3.3.1 Dart

Figure 3.8: Dart logo

Dart is a client-optimized language for designing quick applications on any platform. Its purpose is to deliver the most productive programming language for multi-platform development, along with a configurable execution runtime platform for app frameworks.

Languages are characterized by their technical envelope—the decisions made during development that form the capabilities and strengths of a language. Dart is built for a technological environment that is especially suited to client development, focusing on both development (sub-second stateful hot reload) and high-quality production experiences across a broad range of compilation targets (web, mobile, and desktop).

Dart also forms the backbone of Flutter. Dart offers the language and runtimes that power Flutter applications, but Dart also supports many essential developer responsibilities including formatting, analyzing, and testing code[2].

3.3.2 MySQL

MySQL is the world's most popular open-source database. According to DB-Engines, MySQL ranks as the second-most-popular database, behind Oracle Database. MySQL powers many of the most accessed applications, including Facebook, Twitter, Netflix, Uber, Airbnb, Shopify, and Booking.com.

Since MySQL is open source, it includes numerous features developed in close cooperation with users over more than 25 years. So it's very likely that your favorite application or programming language is supported by MySQL Database. MySQL is a relational database management system. The "SQL" part of "MySQL" stands for "Structured Query Language." SQL is the most common standardized language used to access databases. Depending on your programming environment, you might enter SQL directly (for example, to generate reports), embed SQL statements into code written in another language, or use a language-specific API that hides the SQL syntax. [12].

Figure 3.9: MySQL Logo

3.3.3 php

PHP is an open-source general-purpose scripting language, widely used for website development. It is developed by Rasmus Lerdorf. PHP stands for a recursive acronym PHP: Hypertext Preprocessor.

PHP is a server-side scripting language that is embedded in HTML. PHP is a cross-platform language, capable of running on all major operating system platforms and with most web server programs such as Apache, IIS, Lighttpd, and nginx[1].

Figure 3.10: PhP Logo

A large number of reusable classes and libraries are available on PEAR and Composer. PEAR (PHP Extension and Application Repository) is a distribution system for reusable PHP libraries or classes. Composer is a dependency management tool in PHP.

3.3.3.1 Advantages of Using PHP

- PHP is a multi-paradigm language that supports imperative, functional, object-oriented, and procedural programming methodologies.
- PHP is a server-side scripting language that is embedded in HTML. It is used to manage dynamic content, databases, session tracking, and even build entire e-commerce sites.
- PHP is integrated with a number of popular databases including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server[1].
- PHP is pleasingly zippy in its execution, especially when compiled as an Apache module on the Unix side. The MySQL server, once started, executes even very complex queries with huge result sets in record-setting time.
- PHP supports a number of protocols such as POP3, IMAP, and LDAP. PHP supports distributed object architectures (COM and CORBA), which makes n-tier development

possible.
- PHP is forgiving: PHP language tries to be as forgiving as possible.
- PHP has a familiar C-like syntax.

3.3.4 Laravel

Laravel is presented as "The PHP framework for web craftsmen". It was developed by Taylor Otwell, who wanted a framework with elements that CodeIgniter didn't have, such as user authentication

3.3.4.1 The advantages of Laravel

Laravel Homestead offers a streamlined initiation process into the Laravel ecosystem by providing a ready-made virtual development environment. It is an official, pre-packaged Vagrant box that delivers a comprehensive development setup without requiring the installation of PHP, a web server, or other server software on the local machine. This mitigates the risk of operating system degradation associated with direct installations.

A key feature of Laravel is its templating engine, Blade. Blade distinguishes itself from other templating engines by allowing the integration of PHP directly within its templates, thereby enhancing development flexibility and efficiency[4].

The Laravel ecosystem is further enriched by Packalyst, a repository containing over 15,000 Laravel packages available for project integration. These packages extend Laravel's functionality, enabling developers to implement a wide range of features with minimal effort.

Laravel's security framework encompasses various methods and features aimed at ensuring robust application security. These include:
- Authentification
- Authorization
- Email verification
- Encryption
- Hashing
- Password reset mechanisms

Laravel's Eloquent ORM and Fluent Query Builder utilize PDO parameter binding to safeguard against SQL injection attacks. Additionally, Cross-Site Request Forgery (CSRF) protection is enabled by default, employing hidden CSRF tokens in forms[4]

The Artisan Console, a command-line interface tool provided by Laravel, enhances

development productivity by automating repetitive tasks and facilitating the rapid generation of boilerplate code.

Performance benchmarks of PHP frameworks indicate that Laravel is among the fastest, highlighting its efficiency in handling typical web application demands.

The Laravel ecosystem also includes several auxiliary tools such as Mix, for compiling CSS and JavaScript assets, and Socialite, for OAuth authentication integration.

Laravel benefits from a vibrant community of developers akin to that of WordPress. Key community resources include:

- Laracasts: an educational platform offering tutorials, a blog, a podcast, and a forum.
- Laravel.io: a community portal with over 45,000 users.
- The Laravel subreddit: a community hub with 50,000 Laravel enthusiasts.

This extensive support network fosters continuous learning and collaboration among Laravel developers, contributing to the framework's robustness and widespread adoption[4]

3.4 Firebase

3.4.0.1 Definition

Firebase is mostly used for the development of mobile and online apps, while it may also be employed for desktop applications. Firebase is a cloud-based platform that utilizes Google Cloud Platform services to store data, handle requests, and execute other background activities for apps created with it[9]

Figure 3.11: Firebase logo

Firebase provides developers with a diverse array of functionalities, such as the Cloud Firestore database which enables real-time storage and synchronization of data across

clients, user authentication, file storage, cloud messaging, and mobile application analysis and testing.

Firebase offers a variety of features that aid developers in saving time and minimizing development expenses. One instance is the Firebase SDK, which enables the rapid development of social login functionalities such as Facebook or Google sign-in[9]

Essentially, Firebase is a cloud-based platform for mobile and web development that provides developers with a range of tools to expedite and simplify the app-building process. The platform offers a diverse array of functionalities, such as a database that updates in real-time, user verification, storage for files, messaging services over the cloud, analytics for mobile applications, and testing capabilities. Firebase is used by a vast number of developers globally and is the preferred platform for several startups and major corporations[9]

3.4.1 Firebase Services

3.4.1.1 Cloud Functions for Firebase

Fulfillment in the context of Actions on Google refers to the mechanism by which an Action's functionality and conversational elements are defined, particularly when interactions with external APIs, complex logic execution, or database operations are required. Cloud Functions for Firebase serves as the hosting platform for an Action's fulfillment, functioning as an HTTP web service for seamless deployment and maintenance. Deploying the endpoint is facilitated with minimal configuration overhead, enabling rapid integration and reducing the necessity for extensive CLI adjustments or library imports. Furthermore, Cloud Functions for Firebase offers seamless integration with other Firebase cloud services, such as Cloud Firestore, enhancing the Action's capabilities. Notably, computing resources are dynamically scaled based on the Action's usage patterns, mitigating concerns about server maintenance. Importantly, the setup of fulfillment does not necessitate the provision of credit card or billing information, streamlining the development process and reducing administrative overhead[9]

3.4.1.2 Firebase Hosting

Rich media content significantly enhances user experience within Actions, contributing to increased engagement and retention rates. Utilizing images and sound clips alongside text creates a more vibrant and memorable interaction environment. Firebase Hosting offers a straightforward solution for hosting static rich media files, simplifying the integration

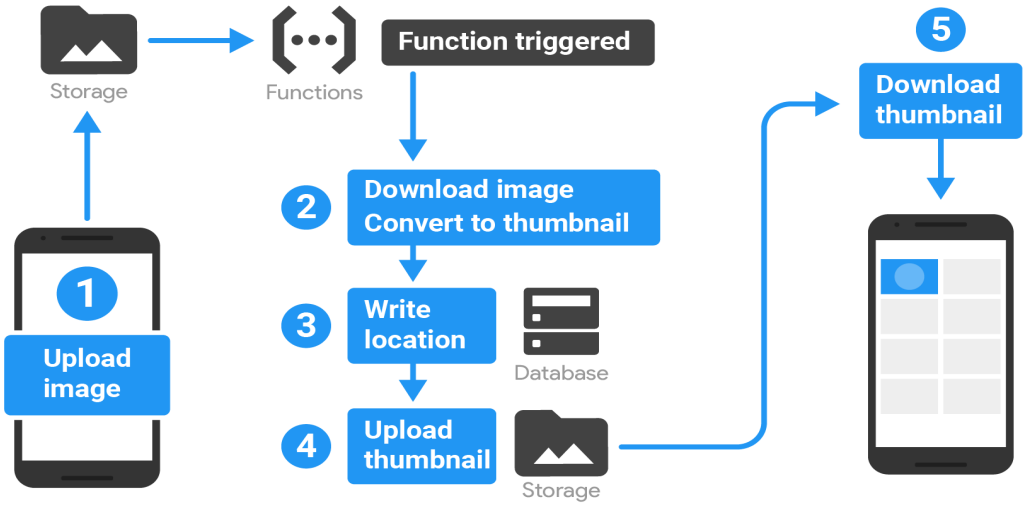


Figure 3.12: Firebase Services

of multimedia elements into Actions. Existing Firebase users can seamlessly repurpose assets already hosted for mobile or web applications. Exploring the Firebase Hosting documentation provides insights into leveraging this service to host Action files efficiently. Additionally, a provided sample demonstrates the utilization of Firebase Hosting, illustrating its potential for enhancing Action experiences[9]

3.4.1.3 Cloud Storage for Firebase

Cloud Storage for Firebase provides a robust solution for storing user-specific files generated by Actions, facilitating seamless access to content created for users across platforms. Whether it's logging Action responses in text files or storing image files, Cloud Storage enables users to retrieve their content regardless of their location or device. This cross-platform persistence ensures that data remains accessible to users across various platforms. For example, an image generated by a web app can be accessed by the same user through an Action, promoting continuity of experience. Furthermore, Cloud Storage's capabilities extend to mobile applications, where downloads may pause and resume based on connectivity, ensuring uninterrupted access to user files even in scenarios of intermittent network availability[11]

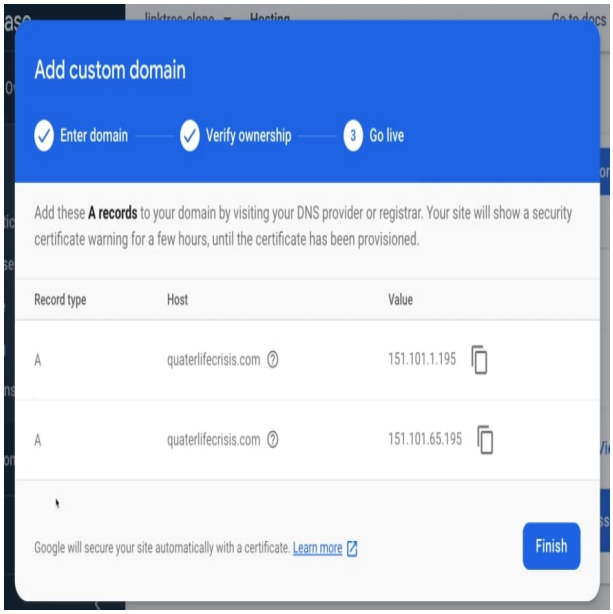


Figure 3.13: Firebase Hosting domain

3.4.1.4 Cloud Firestore

Actions on Google may require a backend to store and synchronize data, for which Cloud Firestore serves as an effective cloud-hosted solution. Cloud Firestore seamlessly integrates with other Firebase and Google Cloud Platform products, such as Cloud Functions, making it an optimal choice for enhancing the capabilities of Actions on Google. This integration ensures efficient data management and synchronization, supporting the robust functionality of these Actions[11]

3.5 Routes API Overview

The Routes API is a service that receives an HTTPS request and provides either the optimal path between two places or the distances and travel times for a matrix of routes between various origin and destination locations[7]

3.5.1 Why use the Routes API

The Routes API within Google Maps Platform offers sophisticated route and trip information, incorporating transport specifics, real-time traffic, road conditions, and user preferences. It supports diverse transport modes, provides vehicle direction, and specifies roadsides for pickups/drop-offs. The API factors in traffic and safety concerns, enabling

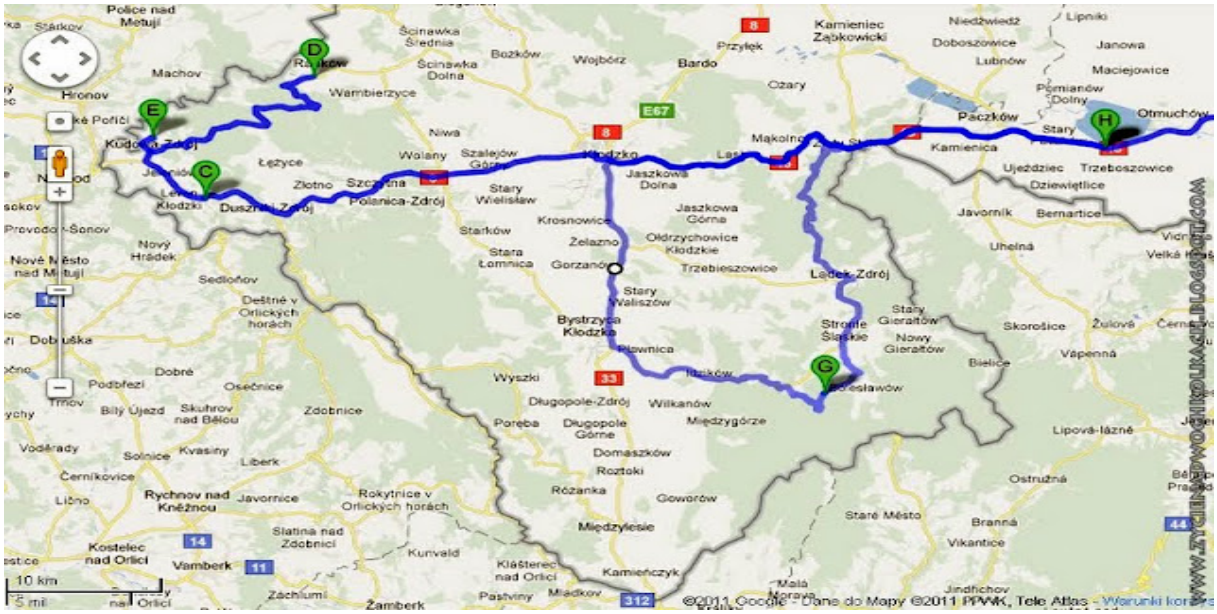


Figure 3.14: Example of a route on Google maps

avoidance of dangerous areas and identifying safe pickup spots. It balances latency, quality, and cost with features like toll considerations and trip metadata, optimizing for time, distance, and fuel efficiency. Additionally, it enhances dispatch scheduling by determining optimal routes and assignments for tasks such as package pickups and warehouse shipments[7]

3.5.2 Functions of the Routes API

The Routes API offers two primary categories of routing information. Firstly, it provides routes from a specific location to one or multiple destinations. This includes generating directions for various modes of transportation such as transit, driving, cycling, or walking, and optimizing routes based on waypoints for efficient travel sequences. Origins, destinations, and waypoints can be specified through text strings, place IDs, or latitude and longitude coordinates. Fine-tuning options include selecting eco-friendly routes, adjusting traffic calculation parameters, specifying vehicle heading, and identifying pass-through or terminal locations. Additionally, toll information, route distance, and estimated time of arrival (ETA) can be obtained, with the ability to control data retrieval for improved efficiency[7]

Secondly, the Routes API facilitates obtaining a matrix of possible routes between multiple start and end points, aiding in decision-making for optimal origins and destinations based on business requirements. This matrix includes distance and estimated arrival times for recommended routes, allowing for efficient routing of passengers, shipments, or

workers across various locations. The API supports streaming of response elements to reduce latency and enables specifying multiple origins and destinations per server-side request, catering to diverse routing scenarios.

3.5.3 the Functionality of the Routes API

The Routes API comprises two fundamental methods: ComputeRoutes and ComputeRouteMatrix. The ComputeRoutes method operates by receiving an HTTP POST request containing a JSON request body delineating the requisite details, including origin, destination, travel mode, and a field mask indicating the desired return fields. Upon submission of the request, the service proceeds to compute the designated route and furnishes the specified fields in the response. On the other hand, the ComputeRouteMatrix function entails the acceptance of an HTTP POST request with a JSON request body elucidating the necessary particulars. This includes at least one origin, two or more destinations, the desired travel mode, and a field mask outlining the pertinent return fields. Following submission, the service undertakes the computation of the route matrix as per the provided parameters and returns the specified fields in the response[7]

3.6 KIDTAXI Visual Identity

3.6.1 The Application Logo

The KidTaxi logo is creative and inviting, featuring a red car on the left to symbolize transportation. The name "KidTaxi" is cleverly integrated with child-themed designs.

The letter "i" is depicted as a girl, and the "x" is represented by a running child, adding a sense of fun and movement.

(a) Logo **(b)** APP

Figure 3.15: kidTaxi APP

Overall, the logo effectively balances the concept of reliable transportation with a friendly, child-centric design, perfectly capturing the essence of the KidTaxi service.

3.7 Unveiling The Application

In this part of the research, we are currently exploring and analyzing application interfaces to understand how they are designed and their impact on users.

3.7.1 On-Boarding Interfaces

3.7.1.1 1. Language and Theme Selection Interface

In the first boarding interface, users are prompted to select their preferred language and app theme. This ensures the app is personalized and accessible from the start.
Language Selection: list of available languages allowing users to choose their preferred language for the app's interface.
Theme Selection: Options to choose between light and dark themes, enhancing user experience based on individual preferences and comfort.

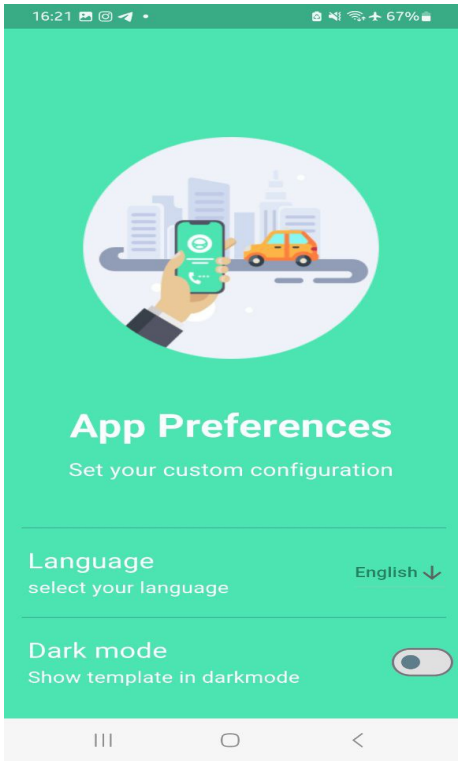
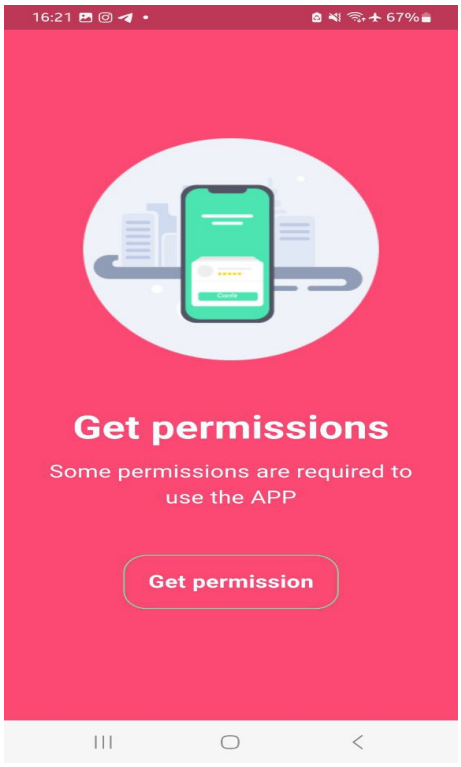


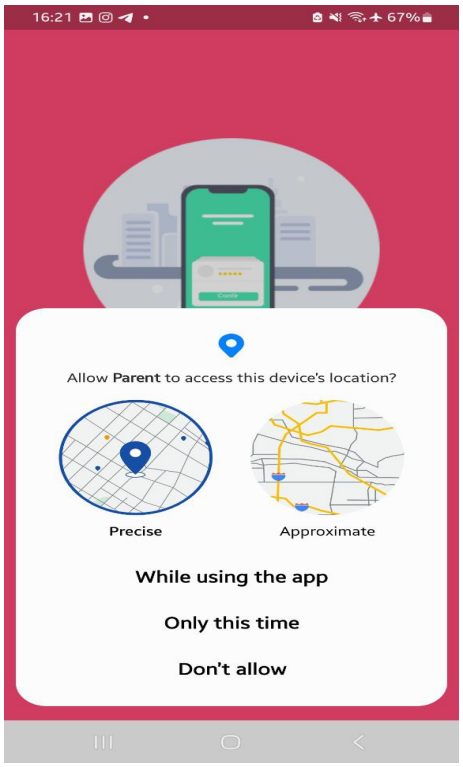
Figure 3.16: The First Boarding Interface

3.7.1.2 Location Permission Interface

The second interface requests permission to access the user's location, which is crucial for providing accurate pickup and drop-off services.



(a) The Second Boarding Interface



(b) The Third Boarding Interface

Figure 3.17: The Second and Third Boarding Interface

The final boarding interface directs users to either sign in to their existing account or sign up to create a new one, setting them up to use the app's features.

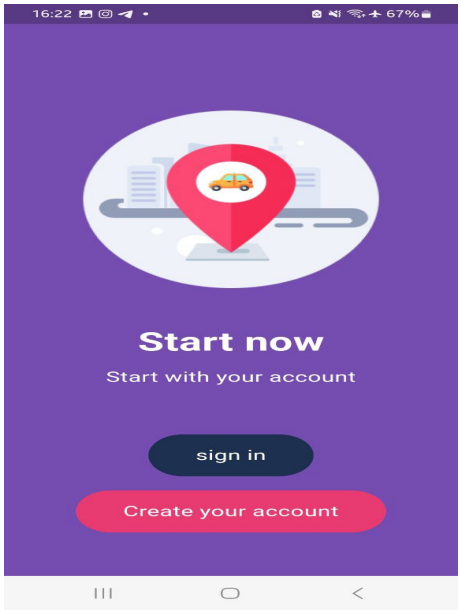
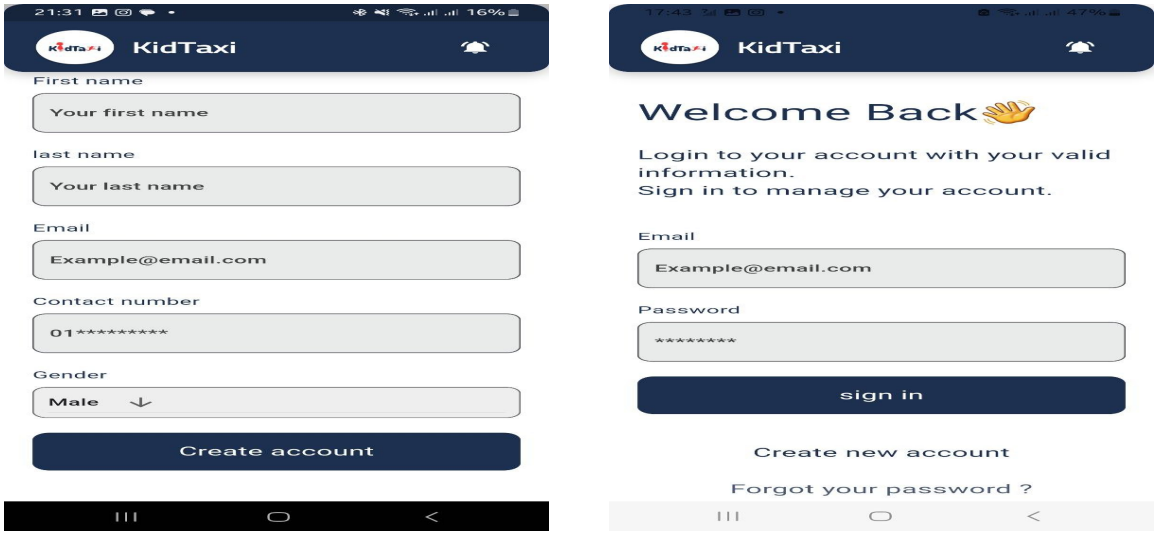


Figure 3.18: The last Boarding Interface

3.7.2 Sign in And Sign up Interfaces

Like any other application, our application has a sign-in interface where the user has to enter the email and the password. To Sign up, the user needs to enter the full name, email, phone number, and gender.

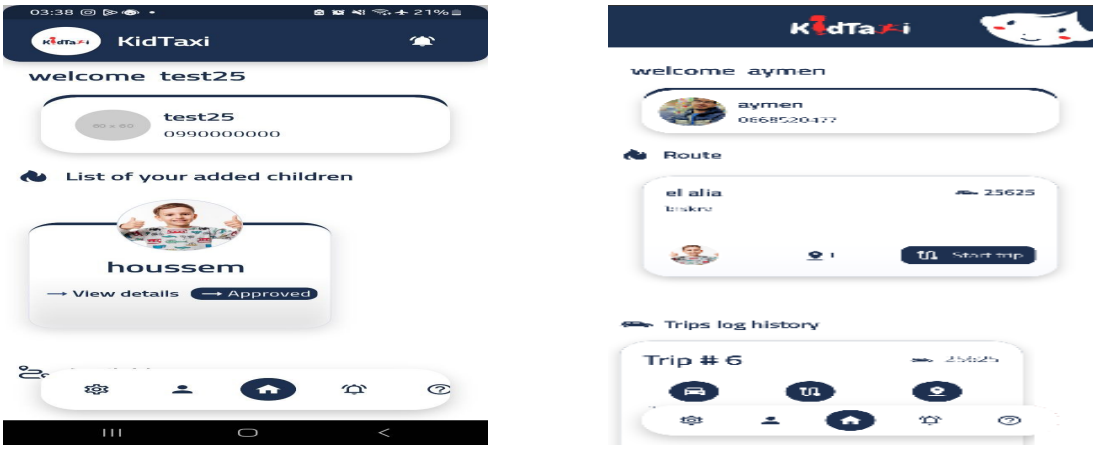


(a) Sign Up Interface **(b)** Sign In Interface

Figure 3.19: Sign in and Sign up interfaces

3.7.3 HOME

After the user (parent or a driver) will be forwarded to the home interface as we can see in figure 3.29



(a) Parent **(b)** Driver

Figure 3.20: Home

3.7.4 Parent Profile

The Parent App Profile screen for the KidTaxi application provides a user-friendly interface for parents to view and manage their personal information.

Figure 3.21: User Profile

3.7.5 Setting

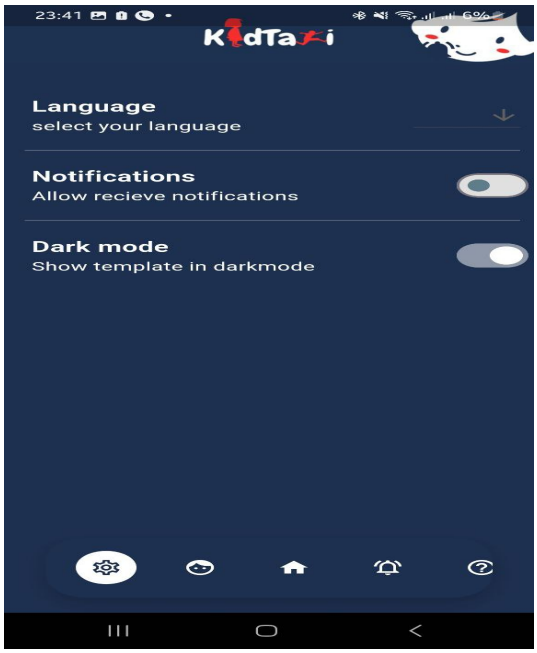


Figure 3.22: Setting page

3.7.6 Notifications

The Notifications Bar in the Parent App of KidTaxi is an essential feature that keeps parents informed about important updates and activities related to their child's transportation. This bar is designed to provide real-time alerts, ensuring that parents are always aware of changes and events that require their attention.

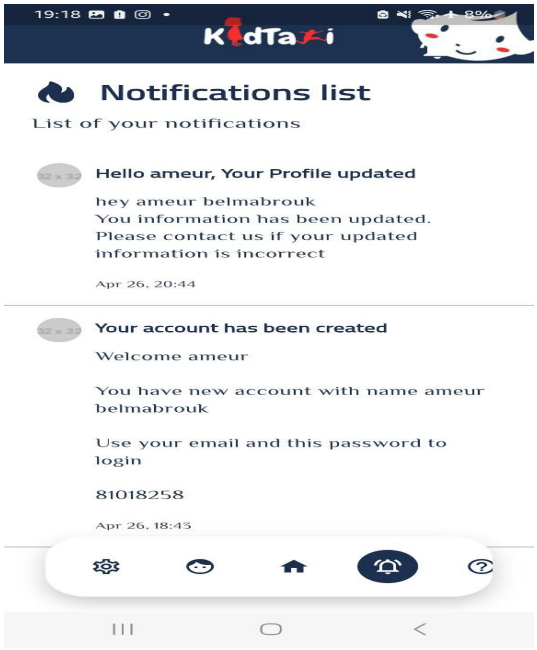
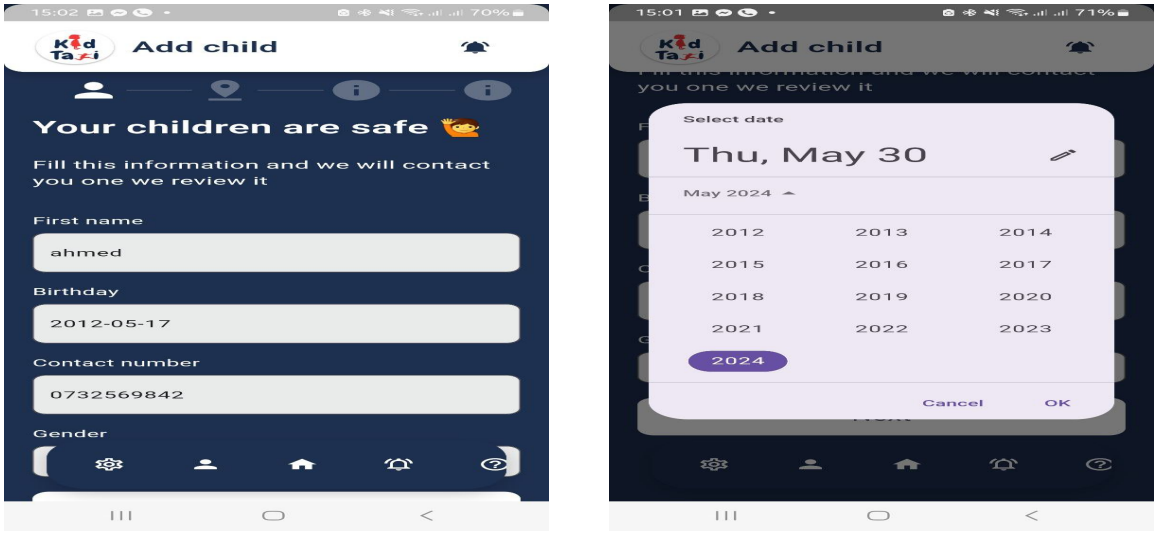


Figure 3.23: notification

3.7.7 ADD CHILD

The first step in adding a child to the parent's list in the KidTaxi app involves entering the child's personal information. This interface is designed to collect all necessary details to create a comprehensive profile for the child.



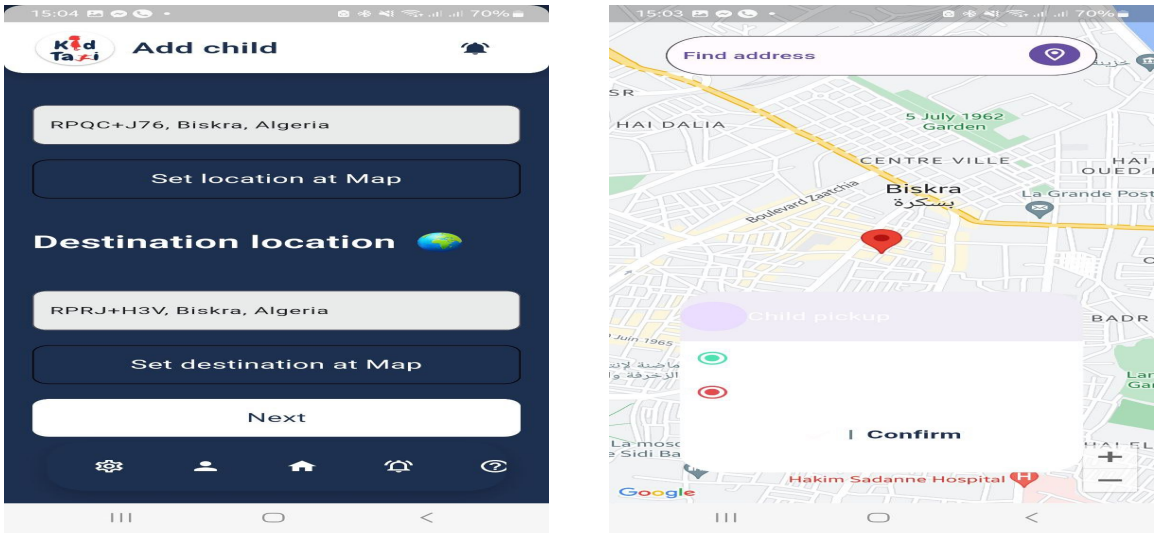
(a) Add Child's Informations **(b)** Selecting Date of Birth

Figure 3.24: add informations

3.7.7.1 Pickup and Destination Information Interface

The second interface focuses on specifying the pickup and drop-off locations for the child. This step ensures that the driver knows exactly where to collect and deliver the child.

- Pickup Location: An address input field for the parent to type in the pickup location. An interactive map where the parent can pin the exact pickup spot for precise navigation.
- Destination Location: An address input field for the destination location. The same interactive map feature to select the precise drop-off point.



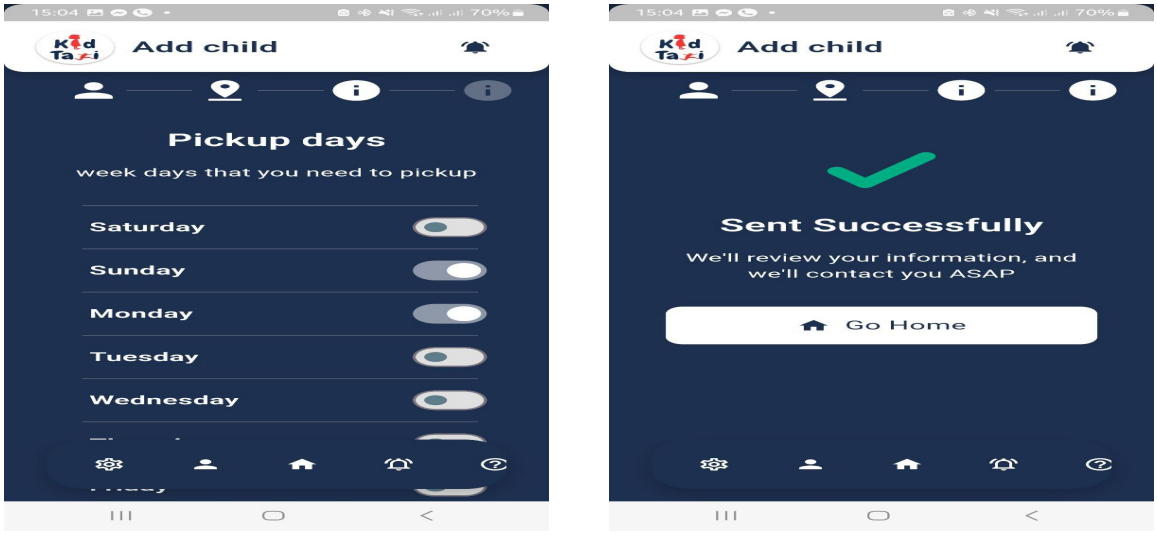
(a) Adding location and destination **(b)** Map

Figure 3.25: add informations

3.7.7.2 Pickup Days Selection Interface

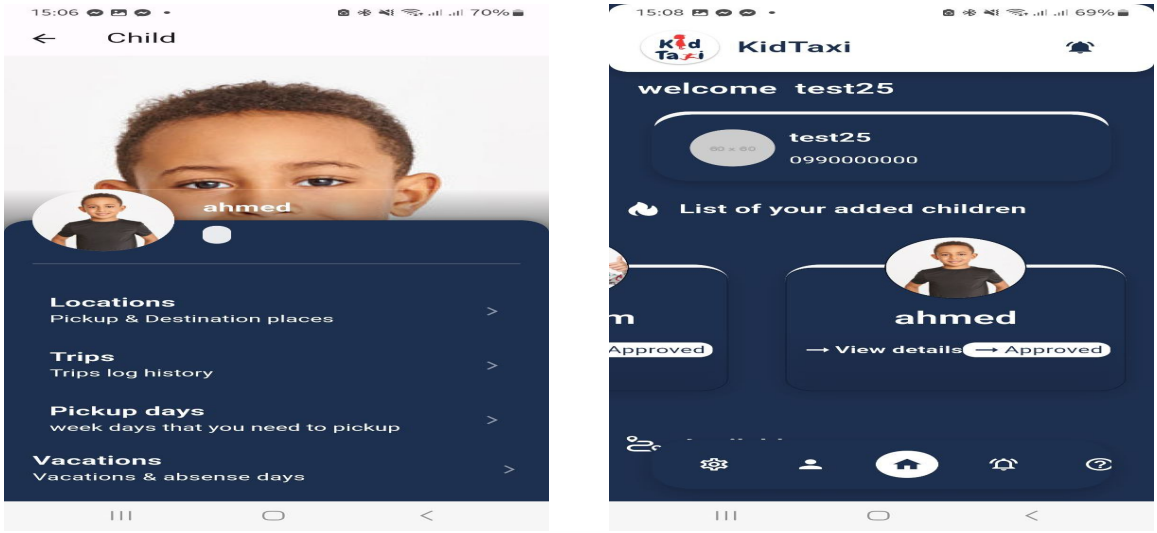
In this interface, the parent can specify the days of the week when the child needs to be picked up. This allows for scheduling flexibility and ensures regularity.

Day Selection: toggle switches for each day of the week, enabling the parent to select the days the child will be picked up.



(a) Pickup Days **(b)** Adding Child Completed

Figure 3.26: submit informations



(a) Child Profile **(b)** New Child In The List

Figure 3.27: Child added

After successful addition, the parent is directed to the child's profile page, which consolidates all the entered information into a comprehensive view. This structured process ensures that all necessary information about the child is collected accurately and efficiently, providing a seamless experience for parents. The interfaces are designed to be intuitive and user-friendly, with clear instructions and easy navigation, enhancing the overall usability of the KidTaxi app.

3.7.8 Recovering Password

Password recovery is a critical feature in modern web and mobile applications, enabling users to regain access to their accounts in the event of forgotten credentials. This paper explores the methodology and implementation of password recovery systems using the Simple Mail Transfer Protocol (SMTP) service. We discuss the technical considerations, security implications, and best practices associated with this approach. Password recovery mechanisms are essential components of user account management systems. They provide a way for users to reset their passwords and regain access to their accounts without administrative intervention. One common method involves sending a password reset link or temporary password to the user's registered email address using the Simple Mail Transfer Protocol (SMTP). This paper examines the technical aspects and security considerations of implementing such a system.

SMTP Service Overview

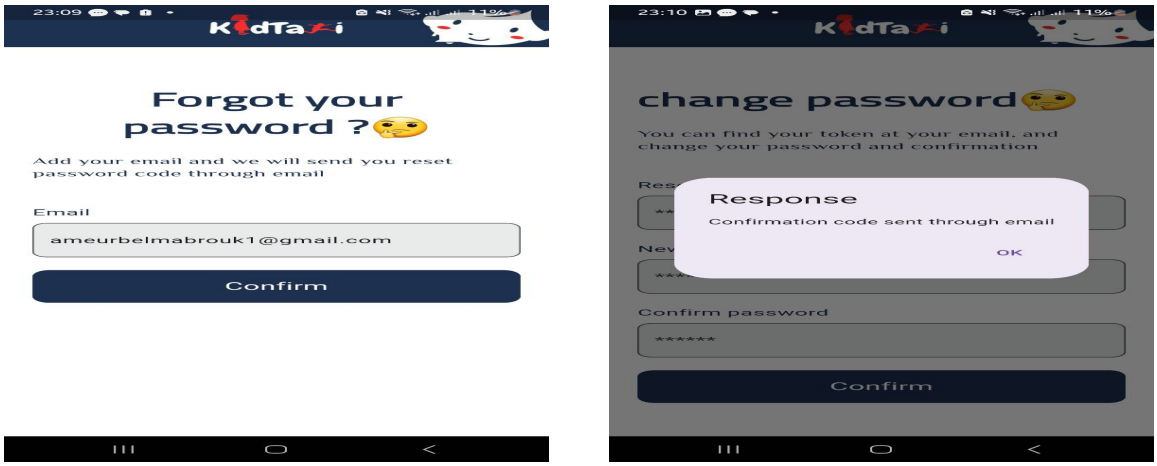
Simple Mail Transfer Protocol (SMTP) is an internet standard for email transmission. It is widely used to send messages from an email client to an email server and between email servers. SMTP operates over TCP/IP and typically uses port 25, 587, or 465. The protocol is responsible for ensuring the delivery of email messages, making it a reliable choice for sending password recovery emails.

Password Recovery Workflow

The password recovery process using SMTP typically involves the following steps:

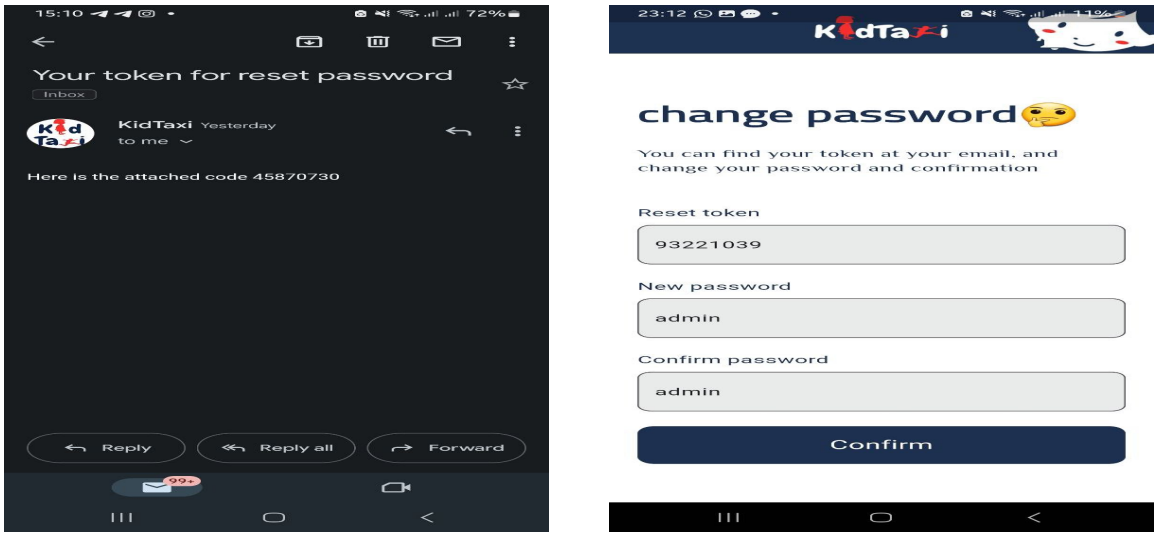
1. **User Request:** The user initiates a password recovery request by entering their email address on the application's password recovery page.
2. **Token Generation:** The server generates a unique, time-limited token associated with the user's account.
3. **Email Composition:** An email containing a token, is composed.
4. **Email Transmission:** The composed email is sent to the user's registered email address using the SMTP service.
5. **User Action:** The user receives the email, copies the token, pastes it on the previous page, and sets a new password.

6. **Verification:** The server verifies the token and saves the new password of the user if the token is true.



(a) User Request **(b)** New Child In The List

Figure 3.28: Token Generation



(a) token received **(b)** resetting password

Figure 3.29: New password

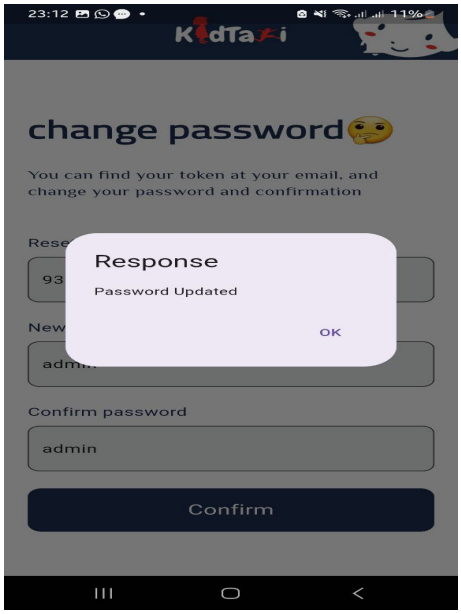


Figure 3.30: password updated

3.7.9 SUPPORT

Support Interface, this interface is really important to the user, by it the user can text the admin directly and describe his emergency. it improves safety and it is more reliable because our company provides customer services who deal with these situations.

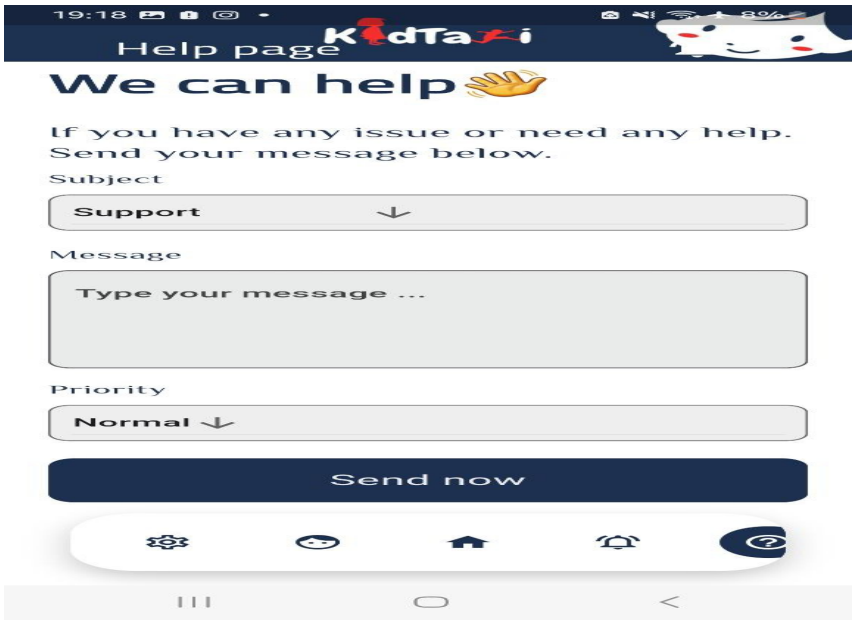


Figure 3.31: Support Image

3.7.10 Administrator Dashboard

3.7.10.1 Home

The "KidTaxi" dashboard provides a comprehensive management interface for a child transportation service. The layout and elements present in the image can be described as follows:

Top Navigation Bar

- **KidTaxi Logo**: Represents the branding for the service.
- **Language Switcher**: An icon for changing the language or accessing user settings.
- **Admin**: Indicates the current logged-in user.

Left Sidebar Navigation Menu

- **Dashboard menu**: Serves as the title of the sidebar .
- **DASHBOARD**: Main dashboard view as we can see in figure 3.32.
- **CUSTOMERS**: Section dedicated to managing customers.
- **CARS**: Section dedicated to managing cars.
- **DRIVERS**: Section dedicated to managing drivers 3.33.
- **ROUTES**: Section dedicated to managing routes3.34.
- **TRIPS**: Section dedicated to managing trips.
- **HELP MESSAGES**: Section for managing support messages.
- **EVENTS**: Section for managing events.
- **USERS**: Section for managing users.
- **MANAGEMENT**: General management section where we can see the notifications events, system settings, and roles management 3.36.

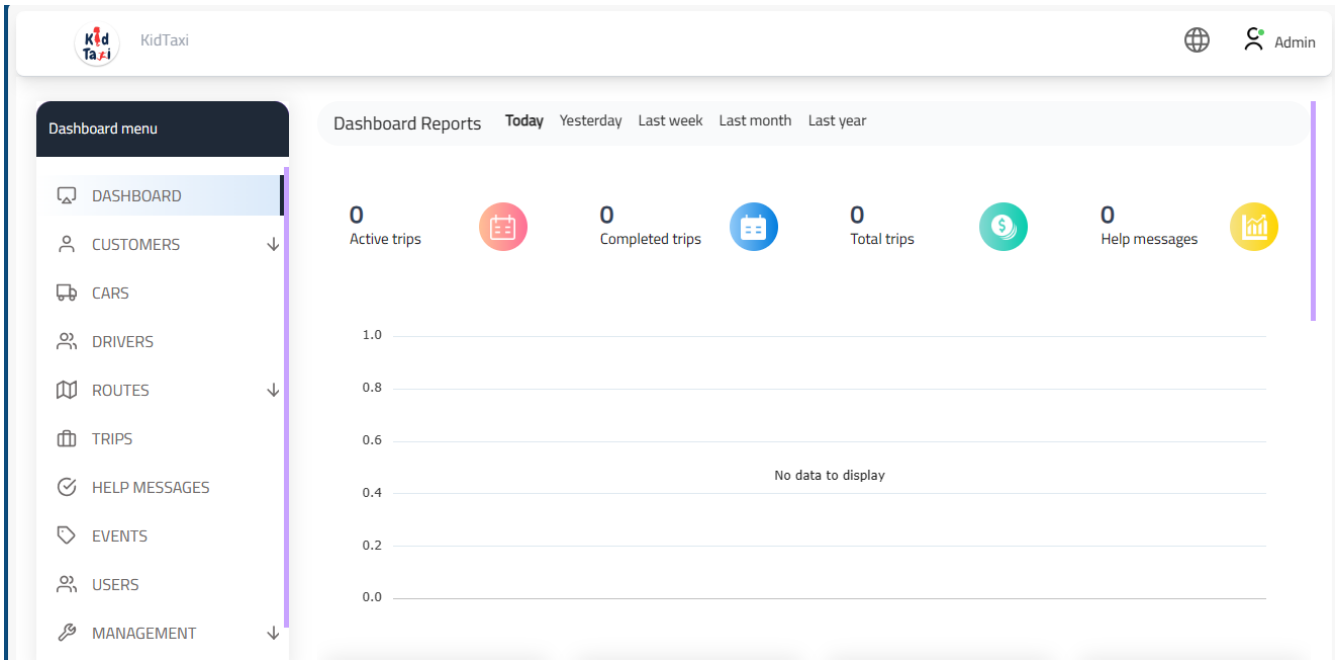


Figure 3.32: Home

3.7.10.2 Drivers

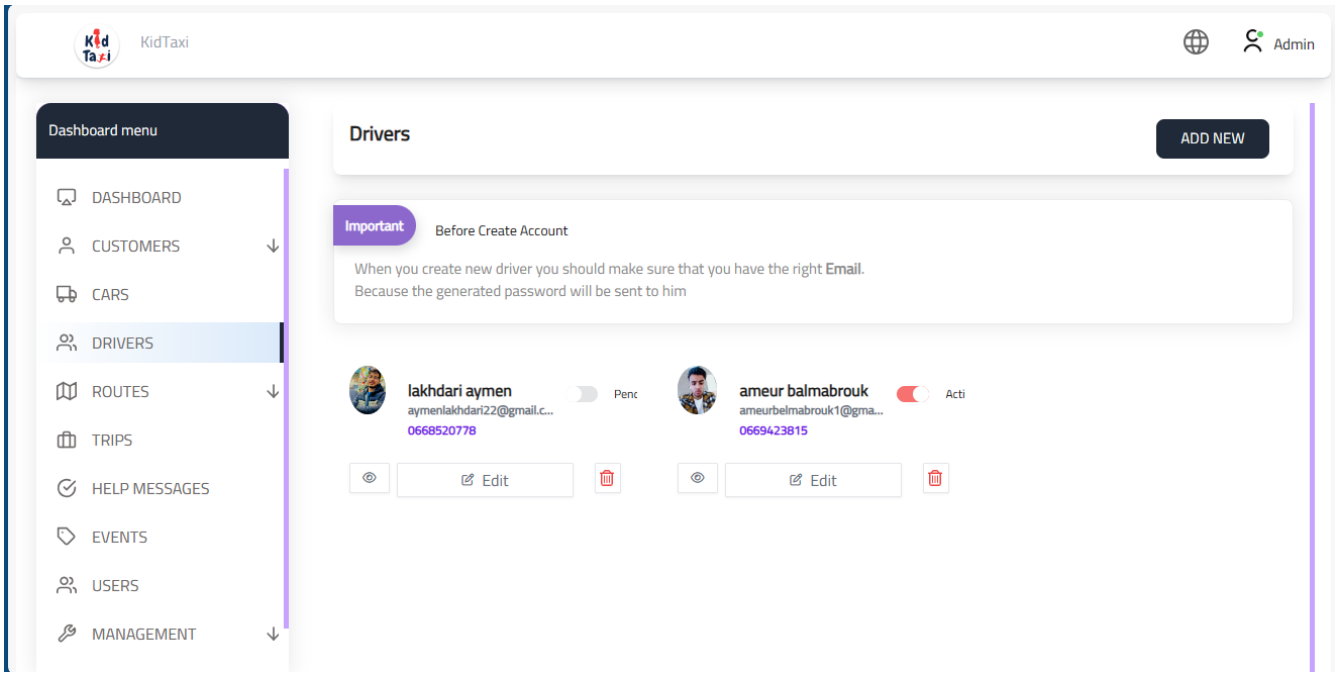


Figure 3.33: list of drivers

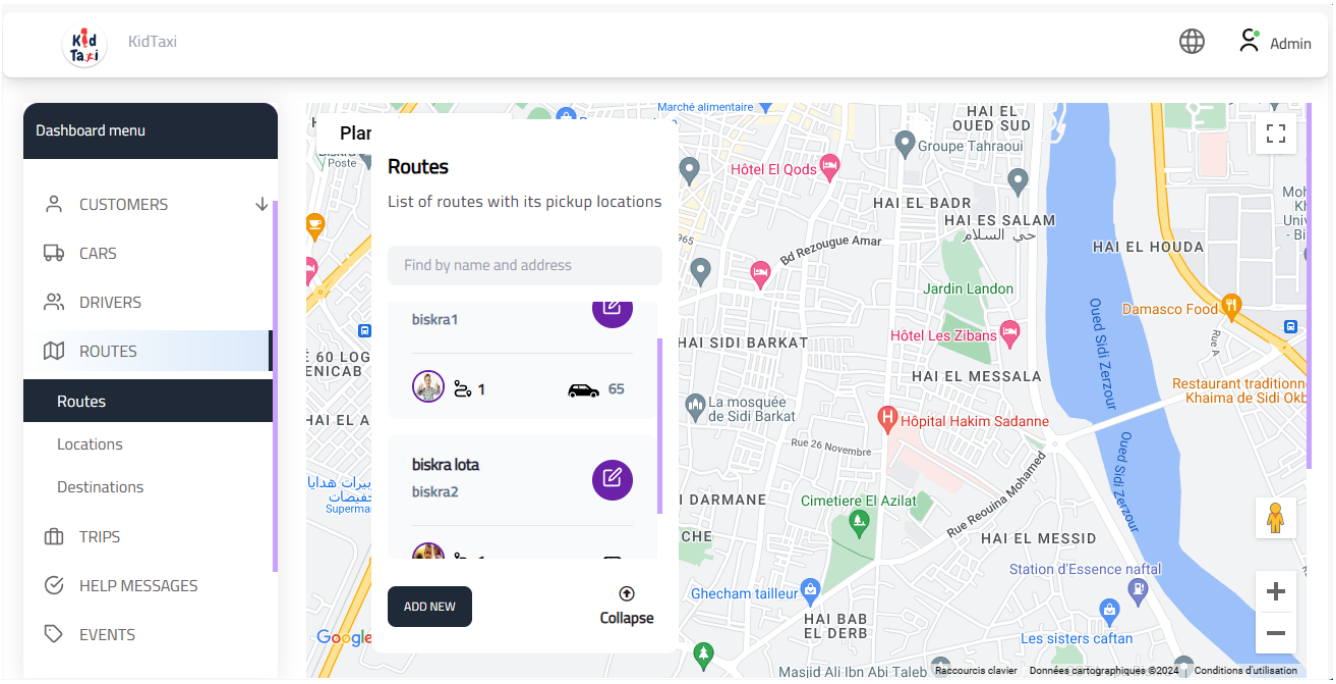


Figure 3.34: Road

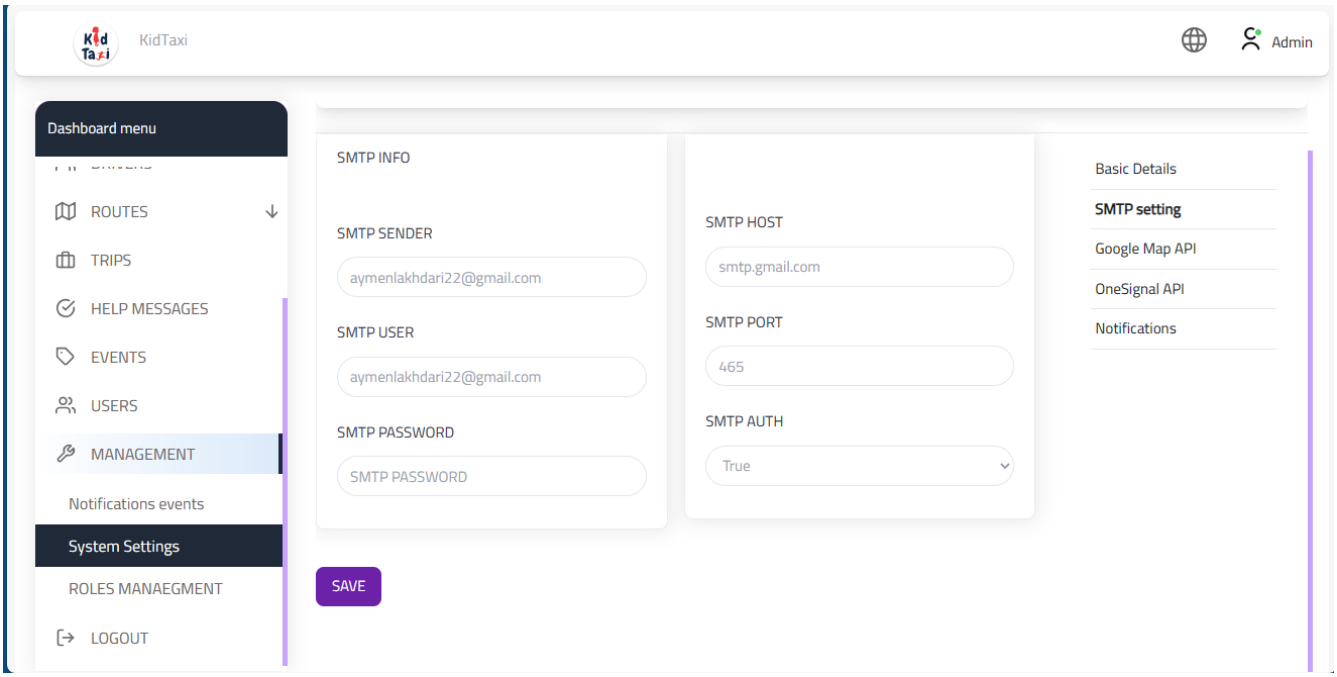


Figure 3.35: SMTP setting

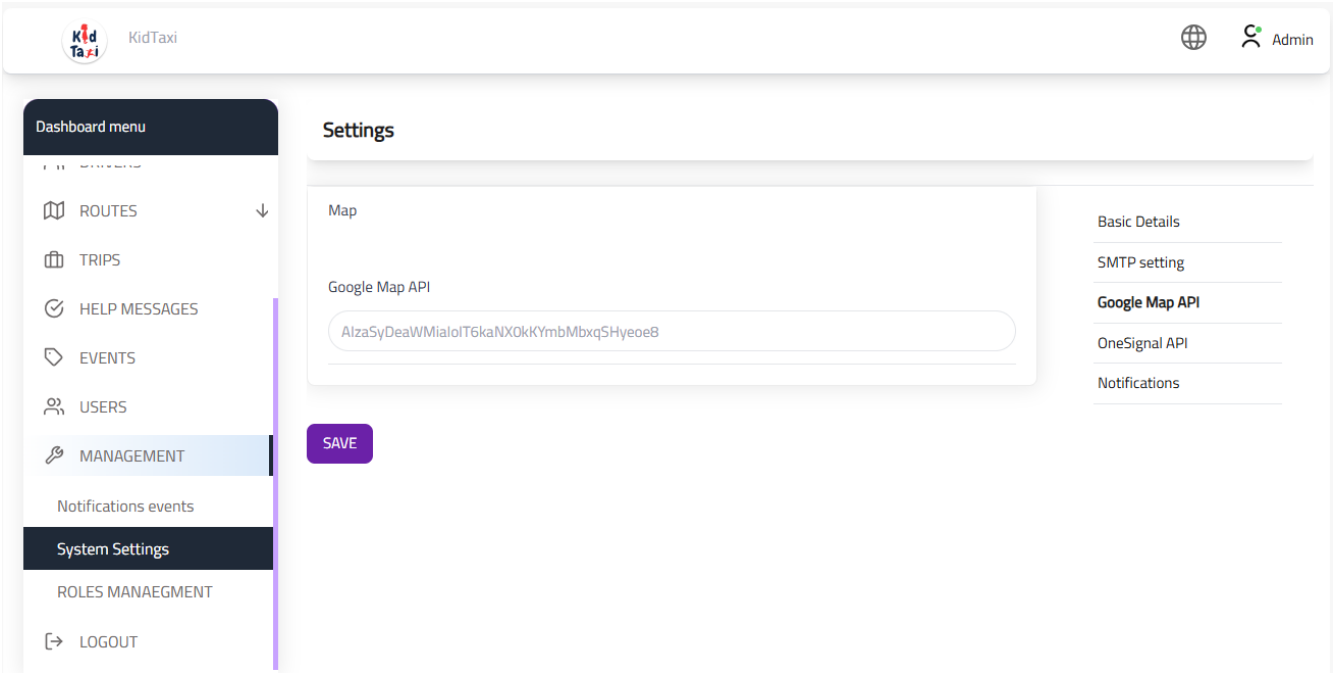


Figure 3.36: Google map API setting

Notification Events

- **New Driver created**: Notification for when a new driver is created.
- **New Ticket comment**: Notification for a new comment on a help message.
- **New parent account created**: Notification for when a new parent account is created.
- **Pickup Location updated**: Notification for when a pickup location is updated.
- **Driver info updated**: Notification for when driver information is updated.
- **New Pickup Location**: Notification for a new pickup location.
- **Pickup update alert for parent**: Notification alerting parents about a pickup update.
- **Trip started**: Notification for when a trip is started.

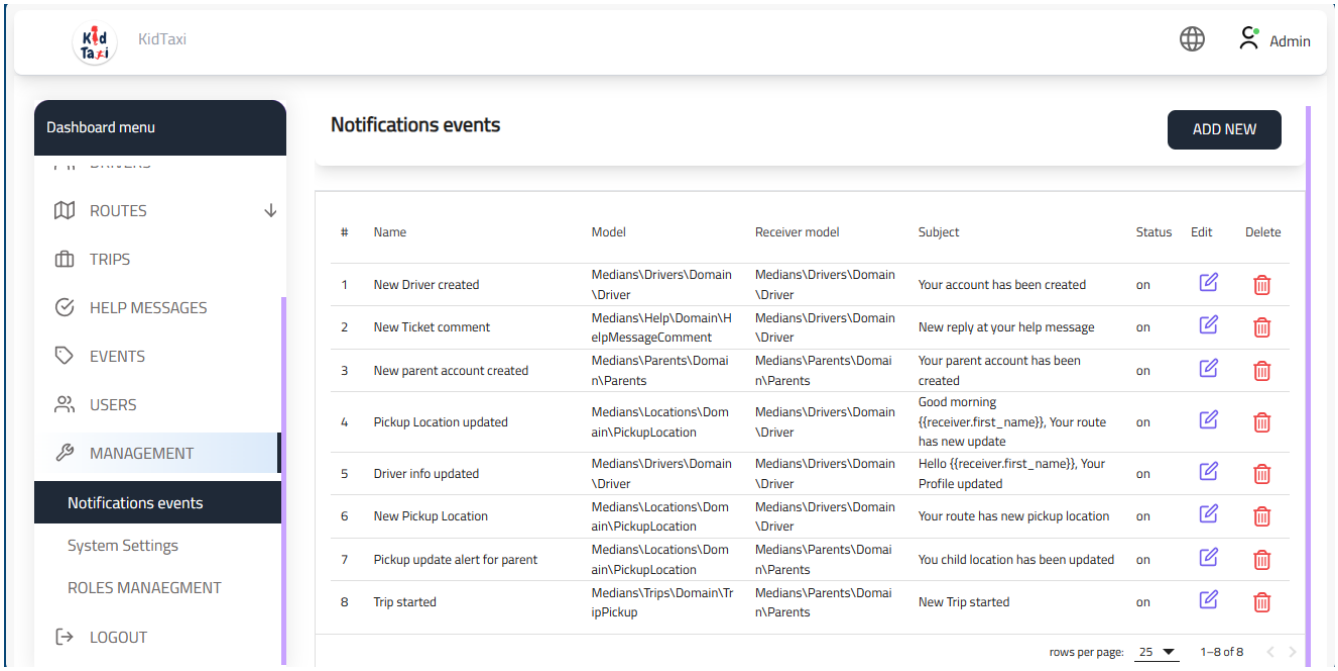


Figure 3.37: Notification Base

3.8 Conclusion

KidTaxi's implementation phase has been carefully carried out, utilizing state-of-the-art technologies and a strong development environment. The Android SDK and emulators were necessary for the smooth development of mobile applications, which was made possible by the use of Android Studio and Flutter. Our development stack was built on the foundation of Dart, MySQL, PHP, and Laravel, which allowed for effective data management and backend functions.

The Routes API simplified travel planning and navigation services, while the Firebase integration improved user authentication and notifications management. The visual identity of KidTaxi, which includes the application logo and interface designs, reflects our dedication to user-friendly aesthetics and functionality.

KidTaxi hopes to revolutionize child transportation services in Algeria. Upcoming improvements, such as Real Time Tracking, should bring even more satisfying service.

Conclusion

To sum up, the process of creating and executing the KidTaxi app has been both enjoyable and difficult. Despite the challenges faced, the project has proven to have the ability to change child transportation services and greatly enhance parents' daily lives. KidTaxi will soon be Algeria's modern solution for the kids' transportation market.

In addition to meeting our users' functional needs, our application offers a dependable, secure, and seamless experience that inspires confidence and peace of mind. This is the result of our dedication to non-functional requirements like performance optimization and strong security measures. By giving these factors top priority, we make sure that parents can rely on KidTaxi to transport their kids safely, knowing that the service is based on strict security procedures and effective operation.

KidTaxi's main objective is to lessen the everyday struggles parents encounter in making sure their kids are transported in a timely and safe manner. This project was born out of a thorough comprehension of the practical challenges and safety worries parents face. Motivated by the accounts of stressful mornings and the search for dependable carpool options, we have worked to develop a solution that offers families convenience and peace of mind.

We followed guiding principles that highlighted our dedication to quality, creativity, and the welfare of the families we serve throughout the development process. Our project is built on these rules, which also point us in the direction of a common goal of security and empowerment.

Modern technology had to be used to guarantee smooth operation and a positive user experience. For data processing and safe user management on the backend, Laravel, a powerful PHP framework, was used. The Flutter-crafted mobile interface provides a responsive and consistent experience on a range of devices. The application's functionality is improved through integration with Google Maps, which offers precise location information for navigation and trip planning. The application performance and reliable data handling are guaranteed by the backend infrastructure, which makes use of PHP and MySQL.

KidTaxi's primary features are driver management, trip scheduling, alerts and notifications, an admin dashboard, safe authentication, and an easy-to-use interface. With these features, KidTaxi is guaranteed to be not only dependable and efficient but also user-focused, catering to the individual requirements of parents and drivers. Sensitive information is protected by strong data management and secure authentication, and the admin dashboard makes managing drivers and trips easier. Parents can stay updated about their child's whereabouts via notifications and alerts, and driver management tools guarantee that children are transported by only licensed, trustworthy drivers with spotless records.

We discussed the requirements analysis, the main objective of the application, and the stages of design in this thesis. In addition to outlining the essential planning phases, we gave a thorough explanation of the UML language diagrams—use case and sequence diagrams included—that are employed in modeling. These flowcharts were essential in streamlining the application development procedure and guaranteeing an organized and unambiguous strategy for accomplishing our objectives.

Looking ahead, we envision integrating real-time tracking and artificial intelligence (AI) capabilities into KidTaxi to further enhance its functionality and user experience. Real-time tracking will allow parents to monitor their child's journey live, offering additional peace of mind and ensuring timely pick-ups and drop-offs. Implementing AI can streamline operations by automating the matching process between drivers and clients, minimizing the need for administrative intervention. This intelligent matching system can analyze various factors such as location, time, and driver availability to optimize the transportation process, making KidTaxi even more efficient and reliable.

All things considered, KidTaxi is a big advancement in addressing Algerian children's transportation needs. It serves as evidence of empathy, resourcefulness, and interpersonal relationships. This project serves as a reminder that, even in a technologically advanced world, genuine human connection and a desire to find practical solutions to problems are what really matter. We are dedicated to realizing our goal of providing children with a safer, more dependable transportation option as we develop and improve KidTaxi. This will not only make life easier for parents but also greatly improve the safety and well-being of their children.

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