GoToUni: A Mobile Application Suggestion for Carpooling

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Abstract

This study aims to develop a mobile application for university students to make their transportation easier by carpooling. This application is designed especially for students who may not be able to come or leave the university of their opportunity. GoToUni application allows students to see the live location and schedule of the drivers on the Google Map and send a carpooling request. Drivers can respond to requests as well. Communication between the passengers and drivers will be provided. University members can only use the GoToUni application to prevent security concerns. This application is developed with Android Studio to be used on Android devices. Our goal is to bring together drivers and passengers commuting to universities simultaneously and route.

Keywords: Carpooling, Mobile Application, Android Application.

GoToUni: Araba Paylaşımı İçin Mobil Uygulama

Öz

Bu çalışma, üniversite öğrencilerinin araç paylaşımı yaparak ulaşımlarını kolaylaştıracak bir mobil uygulama geliştirmeyi amaçlamaktadır. Bu uygulama özellikle kendi imkanlarıyla üniversiteye gelemeyecek veya üniversiteden ayrılamayacak öğrenciler için tasarlanmıştır. GoToUni uygulaması, öğrencilerin Google Harita üzerinde sürücülerin canlı konumlarını görmelerini, geliş/gidiş programlarını görmelerini ve araç paylaşımı talebi göndermelerini sağlar. Sürücüler de istekleri kabul edebilir/reddedebilir. Üniversiteye ulaşmak isteyen yolcular ile arabası olan üyeler arasındaki iletişim sağlanacaktır. Diğer araba paylaşım uygulamalarının güvenlik sorunları vardır, bu nedenle GoToUni uygulaması güvenlik endişelerini önlemek için yalnızca Üniversite üyeleri tarafından kullanılabilir. Bu uygulama Android cihazlarda kullanılmak üzere Android Studio ile geliştirilmiştir. Amacımız sürücü ve yolcuyu üniversiteye giderken ya da çıkarken aynı anda ve rotada buluşturmaktır.

Anahtar Kelimeler: Araba paylaşımı, Mobil Uygulama, Android Uygulama.

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1. Introduction

Nowadays, traveling by car is popular. Transportation is difficult for people who do not have a car. Drivers are willing to pick people up on the road who go the same route. This study aims to introduce these two groups to each other and enhance collaboration.

Some students live within walking distance of the school, but some are not lucky enough to get to university without driving or using public transport. Students face different problems while going to university. For example, students who use public transportation can miss the bus or metro on their way to school. In addition, these students get wet and cold in bad weather conditions while waiting for public vehicles.

The second major problem is the vast number of vehicles accessing the university campus. Limited parking spaces make it difficult for students and staff to find a parking area (Kamaruddin ve Rozlis, 2019). Students can use carpooling to solve these problems, a term often used when people share a vehicle to get to a joint place of arrival (Kamaruddin ve Rozlis, 2019). Carpooling is a student-friendly and eco-friendly system at the same time. It minimizes the number of cars on the roads, reducing problems such as pollution, traffic jams, and parking shortages (Binu & Viswaraj, 2016).

One of the essential criteria in an application is that it can be used on Android OS devices. Many large and small enterprises and organizations use this framework because it is free to develop. Therefore, the Android Studio platform is used to develop the application.

2. Existing Systems for Carpooling

A literature review has been conducted to see if there are similar applications to the application that will be developed. The similarities and differences between the GoToUni applications with other mobile applications mentioned in the studies have been investigated.

In this study by Kamaruddin and Rozlis, information about the mobile application called "UiTM Share Ride," which uses the ride-sharing approach to reduce the parking problem at the university, is given its technical details are explained. When the data about the technical part of the application in this study is examined, it is examined that three-tier architecture consisting of a presentation layer, application layer, and data layer is used as application architecture. First, XML (Extensible Markup Language) displays information in the presentation layer. Secondly, Java Programming language is used in the application layer. Finally, Firebase, a real-time and NoSQL database type, stores and retrieves data in the data layer. In addition, this application is developed using Android Studio and Google Maps API for passenger pickup and destination locations (Kamaruddin ve Rozlis, 2019).

In another study (Čović & Babić, 2014), the location is defined using the Google Maps API, and data synchronization is done with JSON (JavaScript Object Notation).

In the study by (Antao, Correia, and Gonsalves, 2015), they mentioned the importance of Carpooling as a highly effective way to minimize pollution and traffic congestion. They thought that carpooling also gives one the chance to meet new individuals. The main reason for designing the carpooling application was to reduce the cost of travel for traveling people. The application will allow the user to select his/her role, i.e., driver or passenger. This app is being developed for ANDROID versions 3.0 and up. With the help of PHP, the program is connected to a MySQL database. When the application is installed, the route is determined by the driver.

The study of Amasyalı and Gül is about adding VoIP features for calls to the ride-sharing application TAG, working on Android and IOS mobile applications. As stated in the study, some users were concerned about phone number privacy. Therefore, VoIP has ensured that drivers and passengers can make voice calls. Thus, the phone number of the users remains confidential. Twilio framework uses cloud technology for VoIP calls on mobile applications. In addition, in this study, it is mentioned that while the driver and passenger once matched, a trust can be created by taking into account the Facebook friends of the users, their mobile phone connections, their colleagues, and similar features. In the conclusion part of the study, it is reported that the VoIP-based communication system has been successfully added to the TAG application (Amasyalı & Gül, 2017).

It is seen that the Google Maps service is used in many applications. An example of this can be given in the "Yol Arkadasi" application. In the study conducted by Ilhan and Mutlu in 2014, the carpooling application developed for the Android OS named "Yol Arkadasi" was introduced. This application can work on Android 2.3.3 and newer Android versions. This study uses Google Maps API v2 for map services in the "Yol Arkadasi" application. In addition, MsSQL was used as the database system in this application, and the application was developed with the Java programming language. Another important point mentioned in this study is that there were no results for Turkish queries in mobile application markets for "carpooling" and "car-sharing" (İlhan & Mutlu, 2014).

In the light of the literature, it was decided to use Google Maps API for map services in this study. Also, the Firebase platform is used to perform database operations of the application in real-time.

3. Material and Method

3.1 Requirements

A software requirements specification was accomplished to determine the study's user and system requirements. This specification explains how the project will fully meet the user's needs and serves as a roadmap for the study's development.

3.1.1. Product Perspective

GoToUni offers ease of transportation. It is possible to access the application from different platforms, including Android and IOS. The technologies and platforms used in GoToUni enable all developers to reach their target audiences easily. The application has several interactions with passengers, drivers, and administrators. They have data transmission between themselves too. Interactions are given in Figure 1.
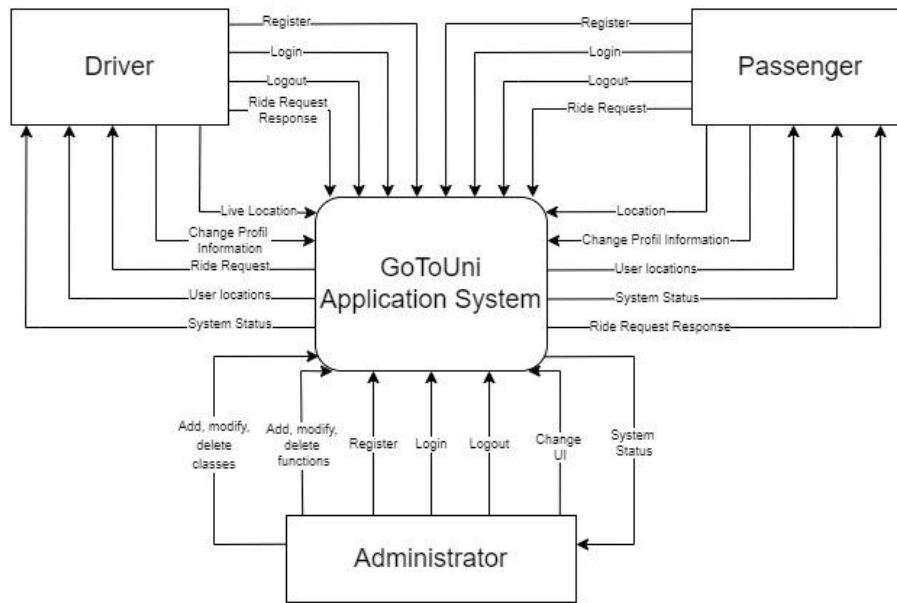
Figure 1 Overall System Context Diagram

Passengers are one of the primary two users of the application. The application serves them by finding suitable routes and drivers on time they entered. Passengers must verify their accounts with a mail sent to their university email addresses. They can register to the system, log in, log out, and change their profile information, address description, and course hours. They can see drivers on the road route and share their location with the app. They can view the instant live location of drivers. They can send requests to drivers whose time and route are suitable for the route they will go and chat with them.

Drivers are users who have a car(s) and can take passengers to their destination. Passengers who want to be a driver must have a driver's license for at least two years and one vehicle. Drivers can create an account by entering car information into the system, and they must verify their accounts with a mail sent to their university email addresses. They can view, change and delete vehicle information at any time. Drivers can determine and save their travel routes on the map while sharing their instant location with the passengers. Drivers can see the passengers looking for a vehicle on the map and access their information of the passengers. Drivers can accept or reject ride requests from passengers. If the driver accepts the incoming travel request, the driver can message the passenger who sent the request and see the passenger's information. When the driving process is completed, the driver can evaluate the passenger(s).

The administrator is also the developer of the application. He has the right to view and manage drivers' and passengers' data. Using his SQL knowledge, he can easily add, modify, delete, and view data from the application's database and limit users' access by considering their roles. The administrator should read related data effectively using their analytical skills. He has to be an expert in using at least one database management system with adequate SQL knowledge. The administrator is also responsible for creating a GoToUni application in Android Studio by using Java programming language essentially. The administrator should maintain the mobile application user interface by considering basic design concepts. He must know how a mobile application is developed and published in different stores. Regardless of his education level, he should have proficiency in at least one programming language and essential programming concepts.

3.1.2. Constraints

The following are the defined as the constraints of the application

- Only students, instructors, and staff affiliated with a specific university can use the application.
- To use the application, users must create an account by registering with the application. In addition, users are required to verify their accounts with university emails.
- Drivers must register at least one vehicle in the application.
- React Native environment should be used with the JavaScript programming language mainly.
- The car owner must add photos of his driver's license and license(permit) when registering in the application.
- The driver has to stick to his chosen path.

3.1.3. Non-Functional Requirements

Internet connection is essential for GoToUni to work properly. Minimum system requirements to meet this system requirement are as follows:

Hardware Requirements

Hardware requirements for GoToUni are a phone with operating system version 15.3.1 and later for iOS or version 11 and
later for Android.
- Processor: Minimum 1 GHz; Recommended 2GHz or more
- Ethernet connection: (LAN) OR a wireless adapter (Wi-Fi)
- Hard Drive: Minimum 32 GB; Recommended 64 GB or more
- Memory (RAM): 4 GB
- Screen Resolution: 1280x800
- Processing Power: x86

Software Requirements

A mapping platform is needed to perform map operations in the GoToUni application. For this, the Google

Maps Platform will be used. A database is needed for operations such as keeping User data and registering users in the GoToUni application. Firebase platform will be used for this.

- Operating Systems: Windows: 10
- Database: Firebase
- Integrated Development Environment (IDE): Android Studio 4.0

3.1.4. Software Methodology

The waterfall method was used in this study's software development life cycle. The main reason for using the method is that the dates of the stages in the project development process are predetermined.

The waterfall model starts with the analysis step. All software requirements are determined in the analysis step, and the analysis document is produced. Then, in the design step, the interface, database, class, etc., the software designs are made, and the design document is produced. In the next coding step, the software; is coded as specified in the analysis and design documents. Test scenarios are written for all functional and non-functional requirements and designs in the analysis and design

documents in the test step. The software is tested by executing these test scenarios.

3.1.5. Software Architecture and Interfaces

GoToUni mobile application uses a 3-layer architecture, namely Presentation Layer, Business Layer, and Data layer. In the Presentation Layer, the user can interact with the application through the application's interfaces. In this way, the user can send and receive data from the application.

The second layer is the Business Layer. In this layer, User Management and Trip Management operations are performed. User Management processes are Registration, Validation, and Modification. Trip Management operations are Scheduling trips, managing requests, and route planning by Google Map Visualization and Location Tracking. Operations in this layer were developed in Android Studio using the Java programming language.

The third layer is the Data Layer. In this layer, Data Access and Data Modification operations are performed. Firebase Firestore Database, a real-time database, was used to store the data in the application. The system architecture of the GoToUni application is given in Figure 2.
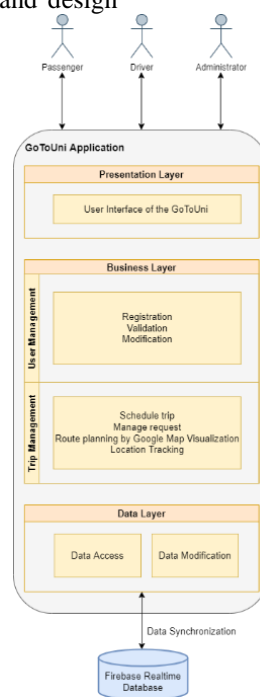

Figure 2. GoToUni Software Architecture Schematic

Some of the user interfaces are as given as follows: on the register page (Figure 3), users should enter their first name, last name, university email, password, phone number, profile photo, birthdate, and gender. If the user has a car, he/she should enter a driver's license, car model, car color, and plate number. The system should check the email extension entered (.edu), and a confirmation email will be sent to the university email. The entered user and vehicle information will be saved to the firebase database.

On the login page (Figure 4), users should enter their email and password to enter the system. Then, users' information is recorded in the database.

On the route page, drivers and passengers decide where and when to go. They can see each other's location on the map is given in Figure 5. If the passenger finds a suitable driver on her/his route, he/she will be able to go together. The selected route is shown on the page with the help of Google Maps. Google Maps recommends all the possible best routes.
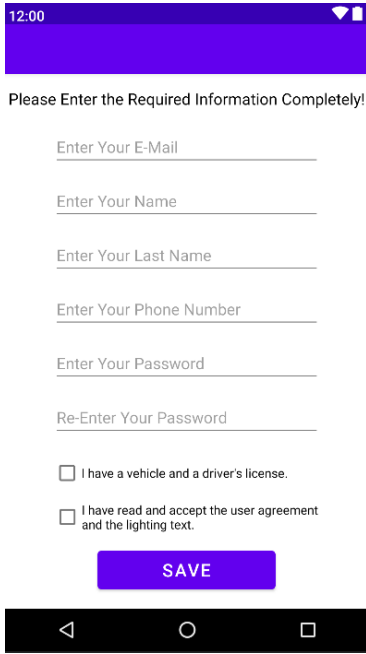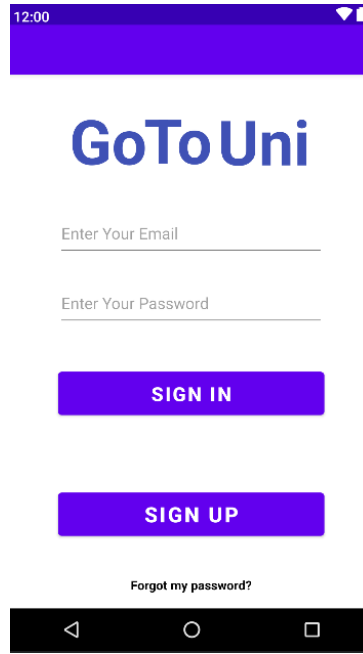
Figure 3. Register Page

Figure 4. Login Page

Figure 5. Map Page

3. Results

Thanks to GoToUni mobile application, students can register to use carpooling while transporting. If we constantly adjust the live location update, the problem may occur in the database. Therefore, we adjust the live location update every single 20 seconds. GoToUni has a register, login, schedule, admin, home, map, send request, and settings pages. Generally, students' schedules are similar. Significantly during the exam weeks, this increases the possibility of the GoToUni application being used for carpooling.

4. Conclusions

This study is developed only for carpooling between university members. The development of this project showed that there is a big market for reliable, safe, and efficient carpooling solutions. Early adaption of this application depicted that people are willing to use such solutions to overcome transportation hindrances. To amplify the benefits of the idea, we propose the following future work:

-Matching drivers with the university sticker to retrieve information for the database.

-Matching drivers and passengers by their schedule automatically beforehand.

-Application could be used between universities.

-Message system could be added.

-Barcode system for identification.

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