



CS 492 Senior Design Project II

Final Report

Project short-name: Pigeon's Map

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pigeon-s-map.github.io

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1. Introduction

Shipping and postal services are essential in order to maintain the current system ongoing in today's world. To deliver the goods every day and in a determining period of time, needs to be planned in an optimal way to utilize the time of the personnel and the fuel of the vehicles. For any postal worker, planning an optimal path to delivering the goods is not easy and individually sustainable. Because of its quality, a route chosen by an AI only in terms of distance may not be the optimum one despite being the shortest.

Pigeon's map is a mobile application that works on smartphones and provides users with the optimum route by not only calculating the distances but also users' road ratings. Users need to register with any email addresses, and they also can sign in via gmail accounts to use the application. They can rate the roads and also comment on them.

2. Requirements Details

2.1 Functional Requirements

- Users are able to create an account.
- Users are able to log in with their existing accounts.
- Users are able to enter multiple addresses.
- There is a function to set priority for each address.
- There is a street voting system.
- Users are able to change/remove their grades on the street.
- Users are able to create notes to warn others.
- Users are able to delete their notes.
- Users are able to report any abusive content.

2.2 Nonfunctional requirements

- The software is a mobile application.
- The software works on Android devices.
- The software is open source.
- The software is easy to use.
- The software is user-friendly.
- The software works fast.

- The software is efficient.
- The software is secure from outside attacks.
- Some functions require an internet connection.

2.3 Pseudo Requirements

- Java is used as a programming language.
- Calculations are operated on the client's device.
- The application is ad-free
- The interface language is English only in the release.
- Android Studio environment is used for development.

3. Final Architecture and Design Details

At the end of the implementation process, we could reach consistent results for some features. We could not implement some features we mentioned in previous reports. Until our demo, we will try to make some of them in working condition as well.

4. Development/Implementation Details

In the implementation, we used different API's. We used Google Places API in order to get the locations of the route. Also, we used Google Distance Matrix API in order to compute the duration between every two locations. Later, we used our algorithm to compute the best route.

We used firebase as a database for user-specific data.

We were planning to use Google OR Tools API in order to calculate a route, but we could not do it due to technical problems. This API was not available for Android. Also, it was not compatible with priority features. Instead, we calculated best k routes in terms of duration, and found the route that is more compatible with priorities. This way, even if a location has low priority, if it is close to a high priority location, it will be visited in a short time. In short, we implemented a balance between duration and priority this way.

Lastly, we used Google Maps SDK in order to display the calculated route to the user.

5. Testing Details

We tested the program for different numbers of locations and various locations from different countries. The program works for many cases. But when the number of locations increases, the calculation time of the program increases too. Also, we conducted tests for circular and non-circular driving and walking routes. Lastly, we tried with different priorities. We tried multiple combinations of all these variations as well.

6. Maintenance Plan and Details

People may abuse the warning and the rating system with false or misleading information. We will check those sections regularly.

User interface will be improved. It will be more user-friendly.

Libraries we used may not be up to date in the future. All of the libraries will be checked regularly.

7. Other Project Elements

7.1. Consideration of Various Factors in Engineering Design

We considered the economic factors of the general users and postal workers. Since they are not even able to find the places to deliver. Our application can help them to improve their fuel consumption efficiencies. Thus, we considered the economy as an important factor in our design.

With the Covid-19 outbreak, public health has become one of the biggest concerns in the world. By decreasing the time spent outside our application can have an effect on improving public health. Therefore, we considered public health as an important factor in our design.

We considered that our application must be global. You could use it anywhere in the globe. Therefore, this application must be working outside Turkey too. Thus, we considered universality as an important factor in our design.

Since Climate Change is on the rise, we thought that it is important to make something for the environment. By choosing shorter routes, our application can help to reduce pollution, the carbon dioxide released by vehicles. Therefore, we consider the environment as an important factor in our design.

7.2.Ethics and Professional Responsibilities

One of the ethical issues is plagiarism. We have the responsibility to do the project on our own and give references when we use outside sources. We have not plagiarised since the start of the project. We did everything on our own and gave references for the external sources we use in our reports.

Another ethical issue is privacy. Since we ask for users' emails and they can enter private locations, like their home, we must protect their data. Besides, we must not use their data outside the range of the application as well.

7.3.Judgements and Impacts to Various Contexts

As mentioned above, economy and efficiency are important. In our application, we decided to find, not the shortest, a short enough route. The impact of economic context is 8.

As mentioned above, public health has become one of the biggest concerns in the world. In our case, to address the needs of public health, our application can decrease the probability of people, mostly postal workers, getting the virus. As well as minimizing the time, we decided to improve the route to select emptier streets. The idea is that the worker will have less human contact by going through empty streets resulting in less likelihood of getting the virus. The impact of public health context is 7.

As mentioned above, we want our application to be globally available. Since we can not launch our own satellite and use images from it, we decided to use globally available sources such as Google Maps. The impact of global context is 4.

As mentioned above, environmental concerns also affect our application. Since our application is merely a little software, it does not create too much pollution to the environment. In addition, we decided to make our application compute the route on the device that it is downloaded. This enables us not to use a machine that is 7/24 active and causes pollution. The impact of environmental concerns is 5.

Judgment Description:	Impact level	Impact Description
Impact in the economic context	8	finding a short path
Impact in the public health context	7	selecting empty routes
Impact in global context	4	globally available
Impact in environmental	5	local computing

Table 1: Impact levels on various factors

7.4 Teamwork Details

7.4.1) Contributing and functioning effectively on the team

Throughout the project. The work is divided between the team. The database implementation is given to Tanay and Ömer. GUI implementation is given to Berdan. The implementation of classes and interfaces is given to Ayberk and Ekin. Everyone contributed to reports as their respective contribution to implementation.

7.4.2) Helping creating a collaborative and inclusive environment

Because of the Covid-19, it was hard to create a collaborative environment. In order to solve this issue Zoom [2] meetings are arranged regularly. In order to make the implementation collaboratively, Github [3] is used. Finally, Google Docs [4] is used to write reports collaboratively.

7.4.3) Taking lead role and sharing leadership on the team

Everyone took the lead role and leadership is shared among the teammates. The work is shared among the teammates and everyone took a lead role in their areas of shared work.

7.4.4) Meeting objectives

We did meet the most important objectives we had. However, we could not meet one of our old objectives, rating the routes.

7.5 New Knowledge Acquired and Applied

Dealing with a problem similar to the Travelling Salesman Problem [5] was new for us. We learned how to find a good enough solution and add our features to it. In addition, dealing with maps and Android [6] interfaces was new for us too. Luckily, there were lots of libraries for us to use. We learned through those libraries and added our features to our application.

8. Conclusion and Future Work

The application's goal is to decrease the delivery time for postal workers to find the optimum route. Possible dangers can be detected for the users with the help of comments of other users.

We planned to add new features. Some of these are users' history, and designing a service for users to communicate with each other or determining the overall cruise speed etc.

9. Glossary

Circumstances: Infrastructure or environment of the neighborhood about a road.

Efficient path : A path close to the optimal way of saving time.

Destination: An address to stop by to deliver a package.

Optimal path : The most efficient path possible.

Point : Users can point to a road's circumstances to be considered good or bad in future.

Road material : Type of the road depending on its material.

Shortest path: A path in actual road length, without efficiency.

Traffic : Traffic density.

XML : Extensible Markup Language.

10. User Manual

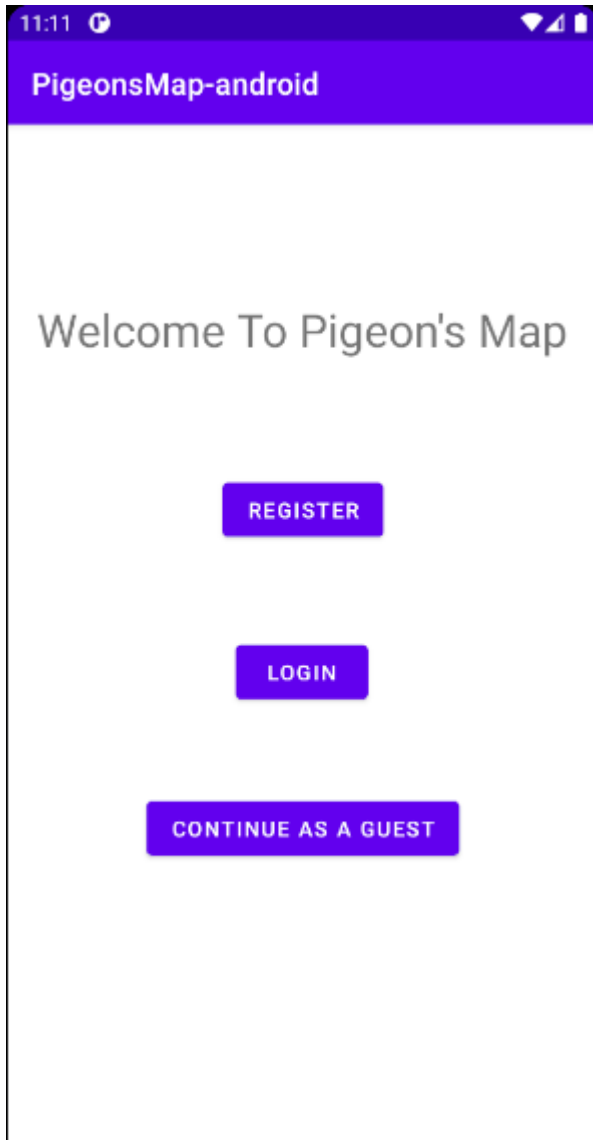


Figure 10.1

When you start the application, you will see a screen as shown in Figure 10.1. You can create a new account with the Register button or If you already have an account, you can use the login button to login. Lastly, you can use Continue As A Guest button if you don't want to login.



Figure 10.2

If you click register on the main menu, you will see the screen on Figure 10.2. After filling the required info, you can create your account. After that, you will be redirected on the screen on Figure 10.4.

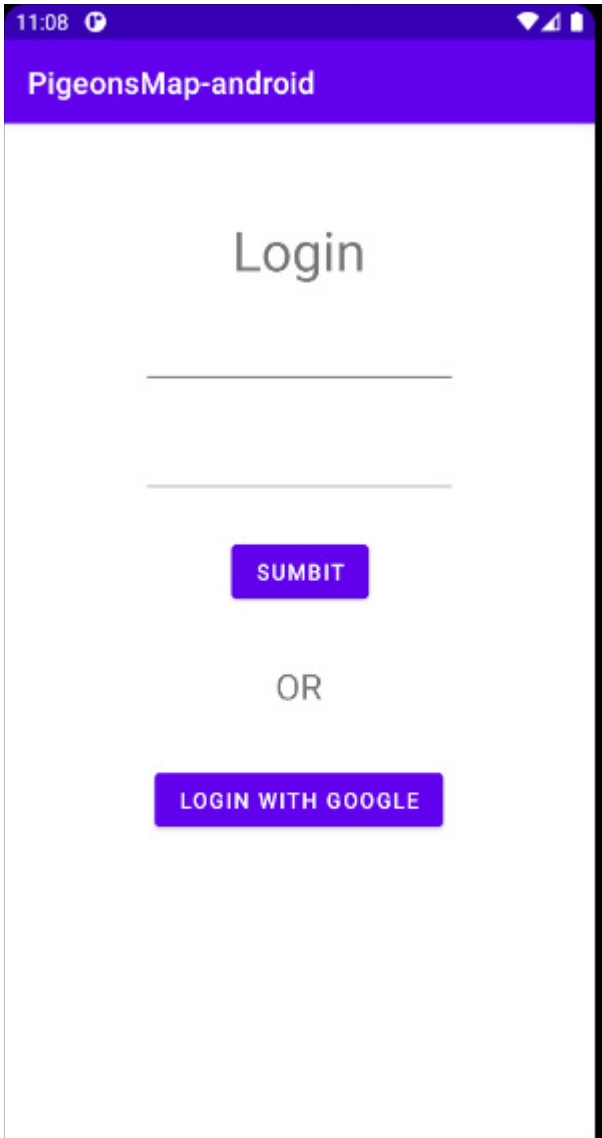


Figure 10.3

If you click the Login button, you will see a screen like in Figure 10.3. After filling the required info, you can login. After this step, you will be redirected to the menu on Figure 10.4.

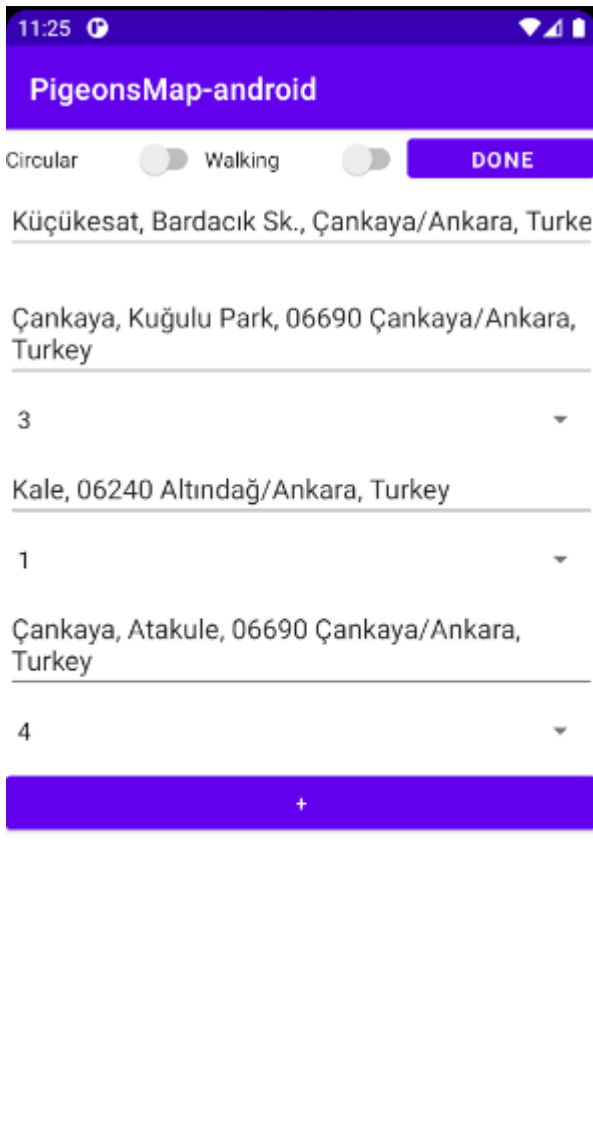


Figure 10.4

If you complete login or register, or you choose to continue without register, you will see a menu line in Figure 10.4. In this menu, you can enter addresses and choose their priorities from the menu. You can use the + button to add more addresses. You can also choose options on top as circular or non-circular and walking or driving. When everything is done, you can tap the top right button to proceed. In this case, you will be redirected to the menu on Figure 10.5.

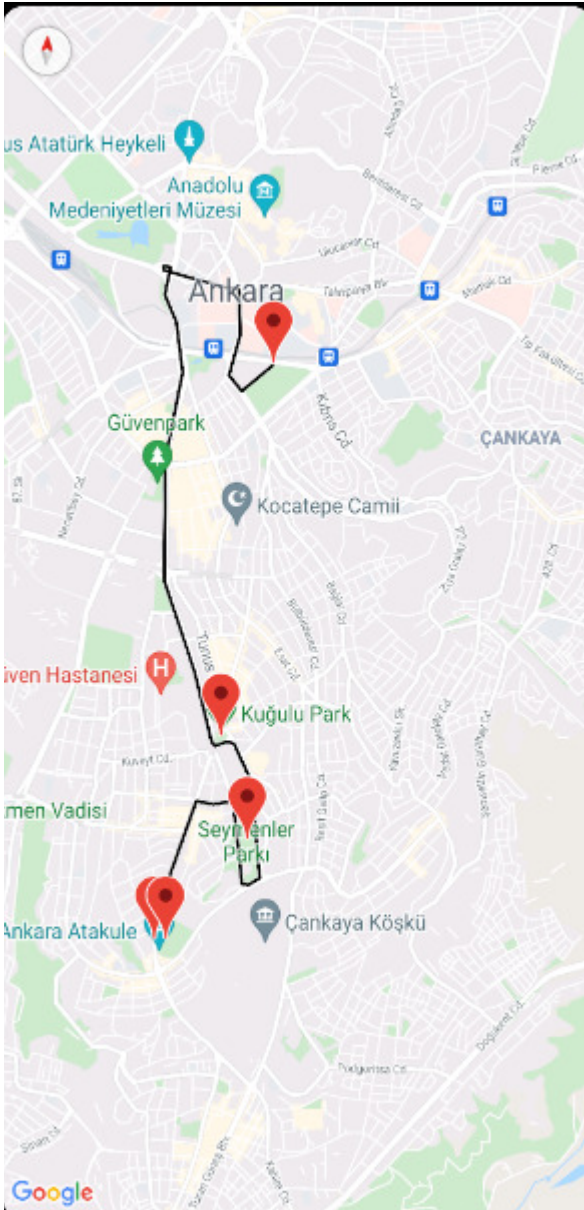


Figure 10.5

Lastly, you will see a map containing the best route considering different alignment of locations and their priorities. You can follow the route from this screen.

11. References

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