T.R.

GEBZE TECHNICAL UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

MOTHER-BABY MOBILE APPLICATION

MIRAY YILDIZ

SUPERVISOR
PROF. FATIH ERDOGAN SEVILGEN

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GRADUATION PROJECT
JURY APPROVAL FORM

This study has been accepted as an Undergraduate Graduation Project in the Department of Computer Engineering on 31/08/2021 by the following jury.

JURY

Member
(Supervisor) : Prof. FATIH ERDOGAN SEVILGEN

Member : Prof. Erchan Aptoula

Member : Research Asisstant Ferda Abbasoğlu

ABSTRACT

The mobile world has become a universe in which we all spend a lot of time today. The applications that are popular at the moment are those that have adapted to today's popular culture and that people can communicate comfortably. The aim of this project is to create a platform where mothers share their daily lives and consult each other.

The main and general purpose of the application is to build a clear and fast application with an easy to use interface. Using the application requires network access because it is an online sharing application. To provide these features, Flutter and Android Studio were used as development tools in the application, while Firebase was used on the backend. In addition, K-Means, a machine learning algorithm, was used in this application, which was clustered according to the diseases of infants.

After logging in, the user can perform the options of blogging, sharing photos, liking photos, commenting, using the chat feature, getting monthly information about the baby, and reaching the page that recommends users with similar immunity as their baby.

As a result, the application has become usable. Tested by test users. At the end of this process, the application has been turned into a social network where mothers can share.

Keywords: kmeans.

ÖZET

Mobil dünya, bugün hepimizin çokça vakit geçirdiği bir evren haline geldi. Şu anda popüler olan uygulamalar günümüzün popüler kültürüne uyum sağlamış ve insanların rahat iletişim kurabildiği uygulamalardır. Projenin hedefi, annelerin günlük yaşamlarını paylaşabilecekleri ve birbirlerine danışabilecekleri bir platform oluşturmaktır.

Uygulamanın temel ve genel amacı, kullanımı kolay bir arayüz ile anlaşılır ve hızlı bir uygulama oluşturmaktır. Uygulamayı kullanmak, çevrimiçi bir paylaşım uygulaması olduğu için ağ erişimi gerektirir. Bu özellikleri sağlamak için uygulamada geliştirme araçları olarak Flutter ve Android Studio, arka uçta ise Firebase kullanılmıştır. Ayrıca bebeklerin hastalıklarına göre kümelendiği ve kümelere göre arkadaş önerilen bir mekanizma geliştirilmiştir ve bu mekanizmada K-means algoritması kullanılmıştır.

Giriş işlemi yapıldıktan sonra kullanıcı blog yazma, fotoğraf paylaşma, fotoğraf beğenme, yorum yapma, chat özelliğini kullanma, bebeği hakkında aylık bilgiler alma, ve bebeğiyle benzer bağışıklığa sahip kullanıcıları öneren sayfaya ulaşma seçeneklerini yerine getirebilir.

Sonuç olarak, uygulama kullanılabilir hale gelmiştir. Test kullanıcıları tarafından test edilmiştir. Bu sürecin sonunda uygulama annelerin paylaşım yapabileceği bir sosyal ağa dönüştürülmüştür.

Anahtar Kelimeler: kmeans.

ACKNOWLEDGEMENT

I would like to thank my supervisor, Dr. Fatih Erdoğan SEVILGEN, for his constant support and help throughout the duration of the project.

Secondly, I would like to thank, Professor Erchan Aptoula, for guiding me with his good suggestions at meetings.

Also, I would like to thank, Research Assistant Ferda Abbasoğlu for patiently answering all my questions.

Finally, I would also like to thank my family, for always believing in me, my friends, for being there when I needed it the most.

Miray Yıldız

LIST OF SYMBOLS AND ABBREVIATIONS

Symbol or Abbreviation	:	**Explanation**
Baas	:	Backend-as-a-Service
JSON	:	JavaScript Object Notation
IDE	:	Integrated Development Environment

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1. INTRODUCTION

Today, social networks have become a hobby where we spend our hours during the day. Over time, a certain audience and user profile of each application began to form. As an example, we can give that the LinkedIn application has a user base in a certain age range and that the posts are business-oriented. The fact that the applications appeal to different segments led the developers to the idea of creating different applications for social groups. For example, applications where book reviews are made for book lovers, and blog applications for those who love blogging have been developed. The purpose of the MyBaby application was designed as a social network developed for mothers. The target audience was selected as women with children and an easy-to-use and enjoyable application was developed.

In this context, the best way to make an app different from the others was to examine other apps. Similar applications from the Google Play Store were reviewed. At the end of this process, an interface was created. This interface contained design information. In the first design, transitions between the pages were planned with the help of the Navigation Driver. Afterwards, it was decided to use the Bottom Navigation Bar to be more clear and functional. In this way, the pages that you want to switch to at the bottom of the screen have been added.

In this context, there are 7 icons representing 6 different pages in the bottom navigation bar. These pages are set as the timeline where the posts appear, notifications with notifications, photo sharing page, search page, user profile page and blog page and baby page. In the user profile, you can see the posts, the number of followers, the number of followings and the option to edit the profile. You can also add friends who are similar to your immune system by clicking the suggest friend icon in the timeline.

The report will continue with the explanation and aims of the designs and functional features described above, the technologies used, the algorithms and the database and device tests.

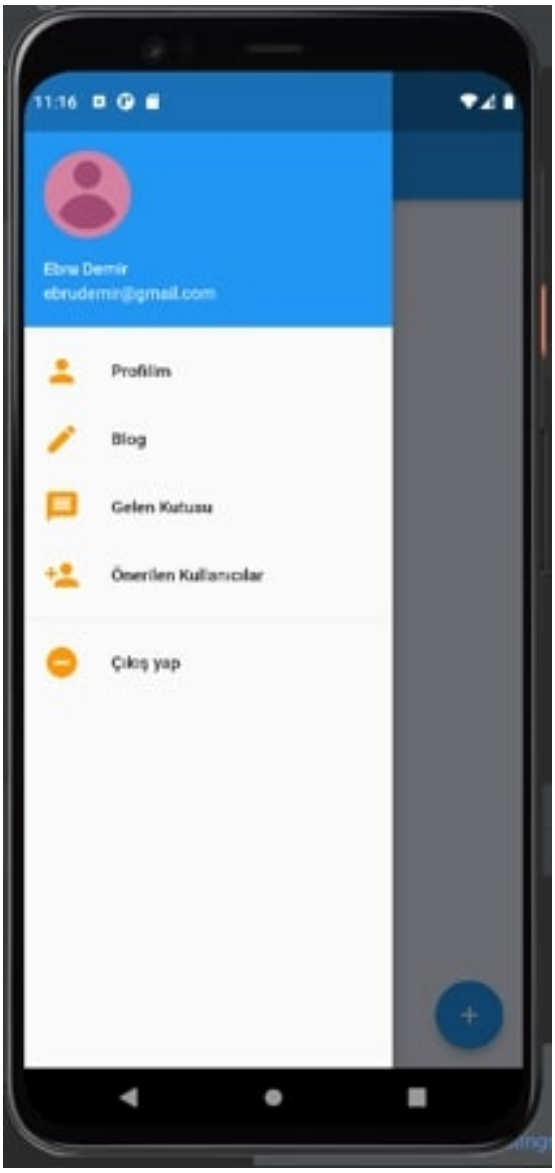

Figure 1.1: First design of Navigation.

2. DEVELOPMENT PROCESS

When starting the project, a plan was made following the "Software System Development Life Cycle" shown below [1]. The requirements of the project were determined. Necessary inferences were made by adhering to Software Engineering processes. In line with this plan, many diagrams were created. Below I will examine the diagrams and requirements in more detail.

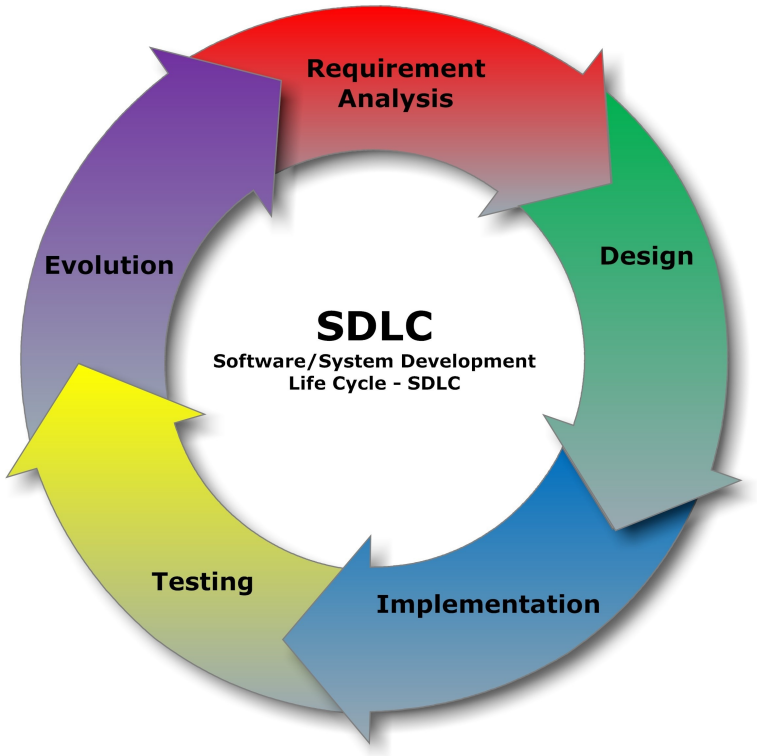

Figure 2.1: Software System Development Life Cylce

[1].

According to these requirements, the technologies to be used were selected. Interfaces were designed and implemented in detail. Necessary collections were created on the database side. Clustering was done according to the diseases of the babies.

2.1. Requirements and Diagrams

2.1.1. Functional Requirements

- Users should be able to follow each other.
- Users should be share photos
- Users should be able to like each other's photos.
- Users should be able to comment on each other's photos.
- User search feature should be available.
- Blog posts can be added.
- Must be able to edit user profile.
- The page with baby information should be updated.
- The application should suggest friends according to immunity.

2.1.2. Non-functional Requirements

- Each request should be processed within 10 seconds.
- App size should be less than 85 mb.
- Photos and all user informations should be stored securely.
- Application should suggest 3 friends accordingly to immunity.

In the light of these requirements, the necessary diagrams were created. There are Use-case diagrams in Figure 2.2 and 2.3, and the state diagram in Figure 2.4. All requirements that users can fulfill are shown in these diagrams.

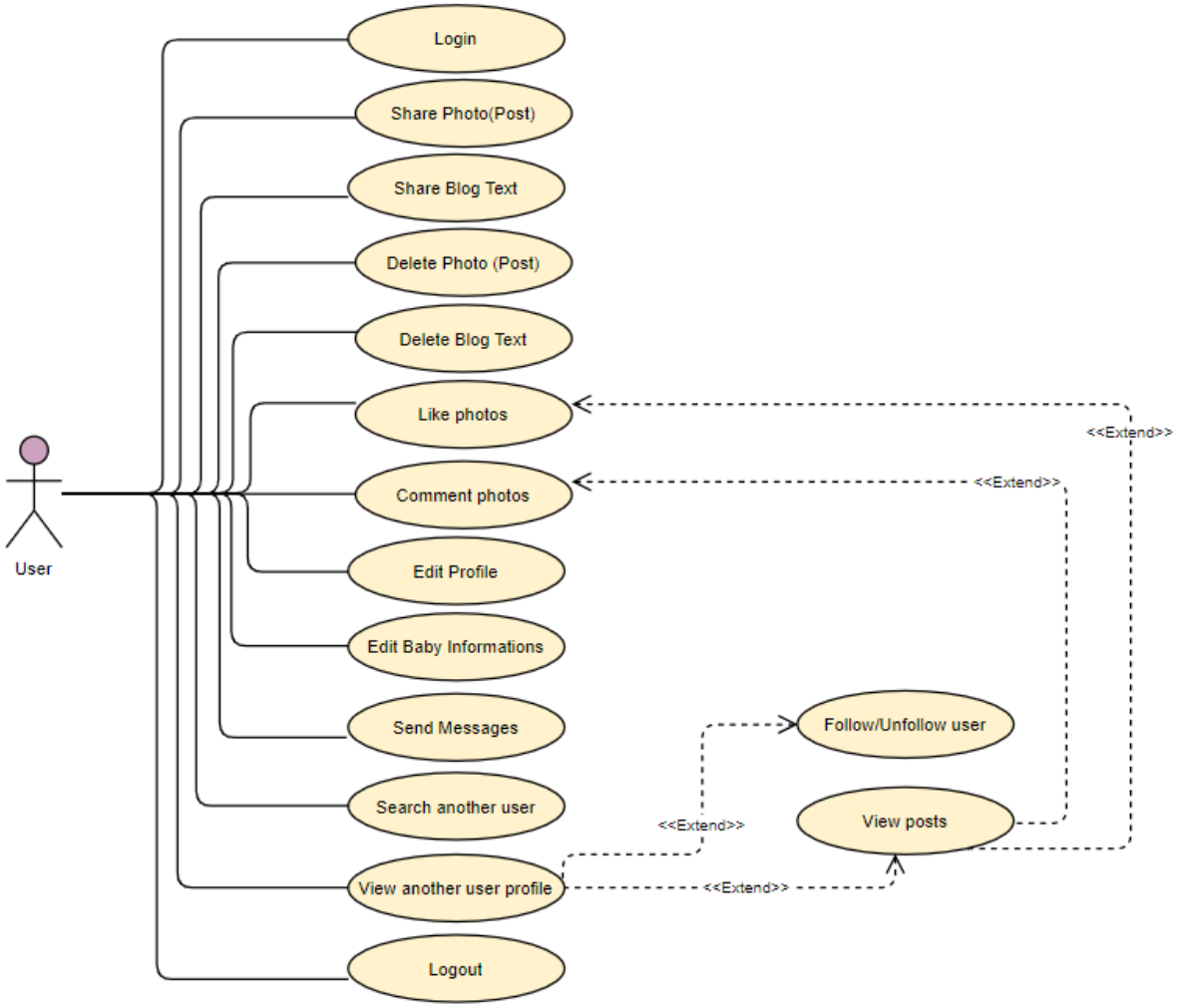

Figure 2.2: Use-case Diagram 1 for MyBaby App

[2]

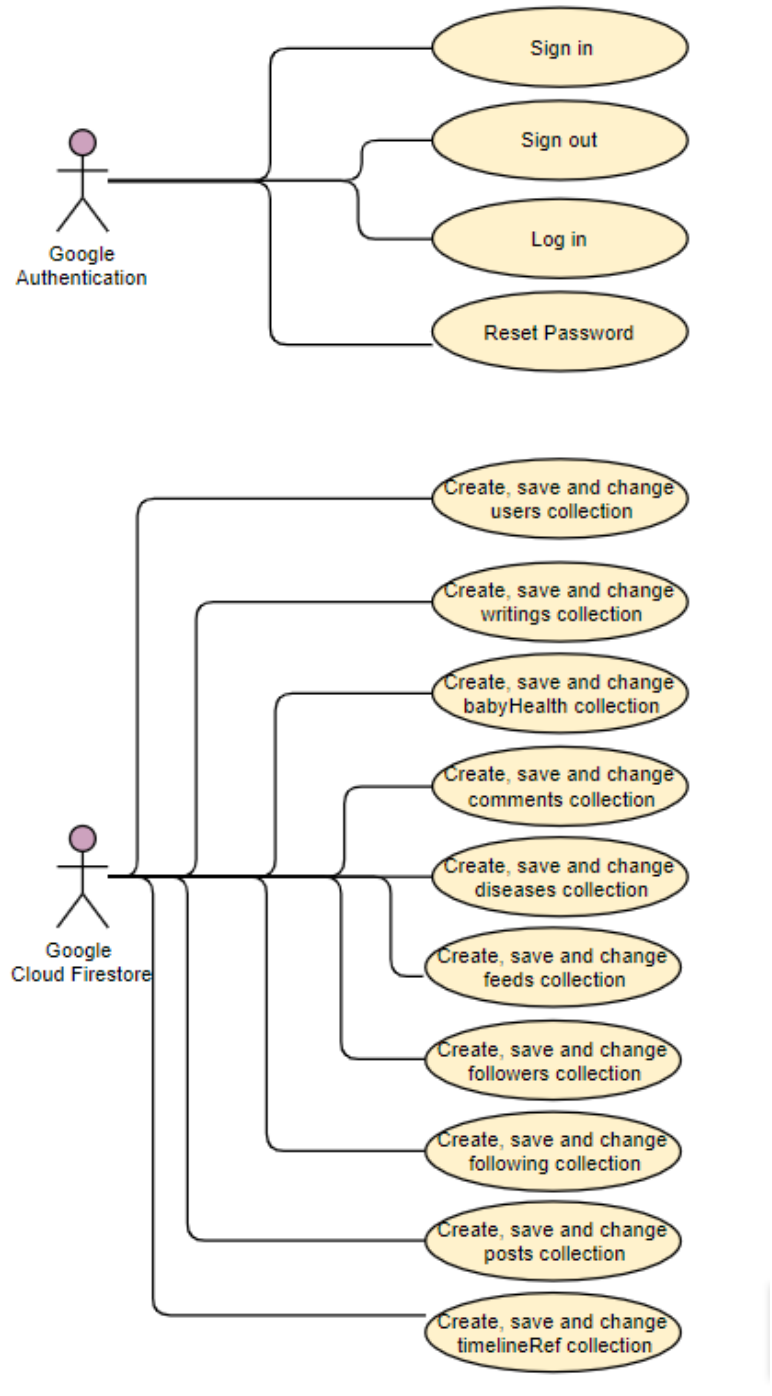

Figure 2.3: Use-case Diagram 2 for MyBaby App

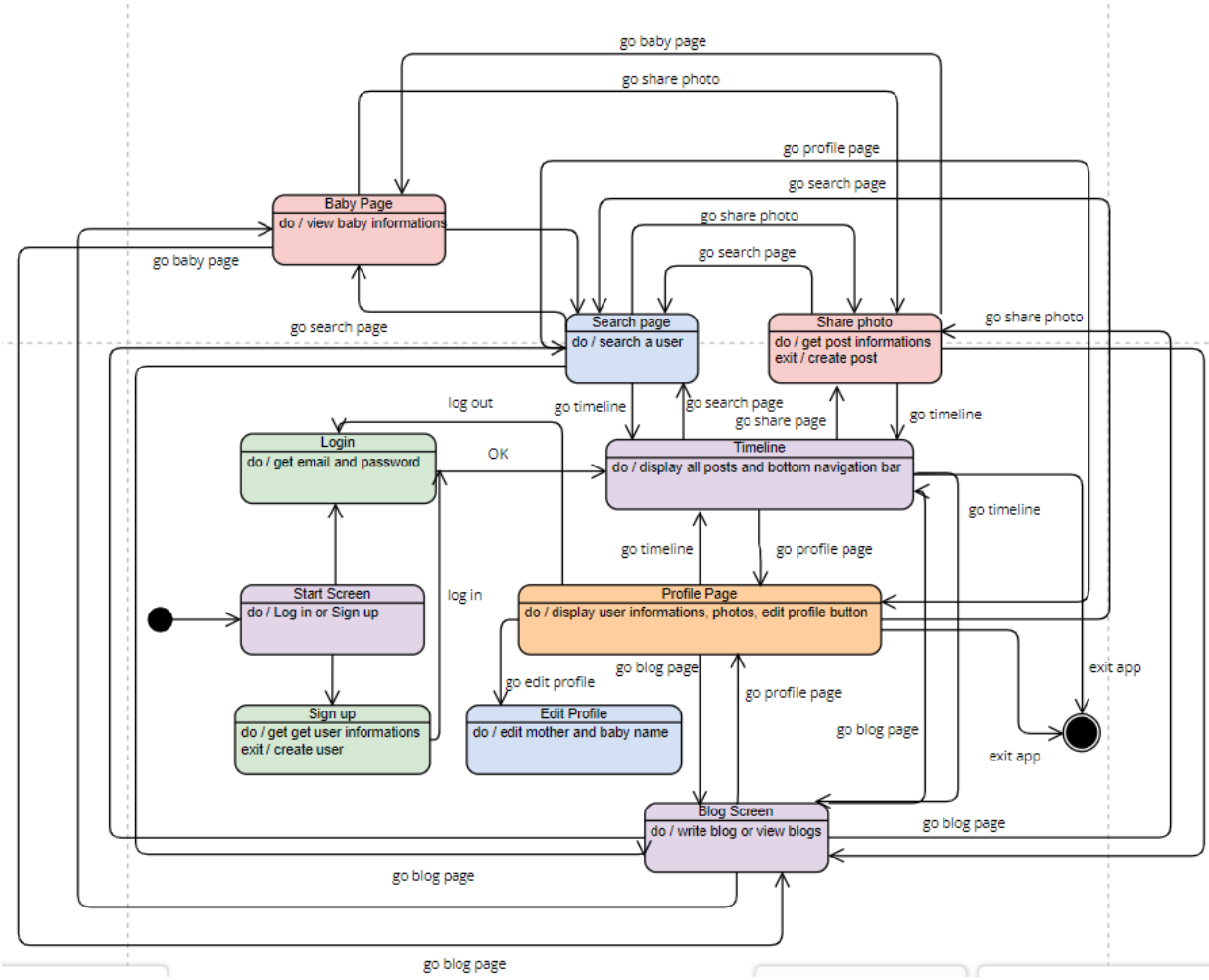

Figure 2.4: State Diagram for MyBaby App

[3]

2.2. USED TECHNOLOGIES

2.2.1. Android Studio

Android Studio is an official IDE for Android application development. Android Studio provides many more features that increase our productivity when building Android apps.[4].The Android Studio project contains one or more modules with resource files and source code files.

Android Studio was used as the development environment in this project. Flutter was installed on Android Studio and Dart language was used.

2.2.2. Flutter

Flutter is an open source framework. It is used to develop cross platform applications and is offered by Google. [5].The developed applications are suitable for platforms such as Android, iOS, Linux, Mac, Windows, Google Fuchsia, Web platform. It is written in Dart programming language.

Flutter structure was used for the developments in this project. Implementations were made with Dart language. Object oriented programming was adopted as the programming principle.

2.2.3. Firebase

"Firebase is a Backend-as-a-Service. It provides developers with a variety of tools and services to help them develop quality apps, grow their user base, and earn profit. It is built on Google's infrastructure. Firebase is categorized as a NoSQL database program, which stores data in JSON-like documents."[6]

Firebase was used in this project to provide several different features. These are Authentication, Realtime database and Notifications. User's login information was checked by authentication. Many collections were created in the cloud firestore and information was kept. Firebase Notifications were used on login screens.

2.3. DESIGNS AND USER INTERFACES

The interfaces were finalized by making changes to the first created interfaces. In this section, these interfaces will be examined. Below are some screens and detailed information about their contents and designs.

2.3.1. Getting Started, Login and Register Screens

These screens are designed and implemented in a way that the user can easily use. The logo of the application is on the get started screen. This logo was designed on an a Tailor Brands [7]. The purpose of the design is to create an interesting pages.

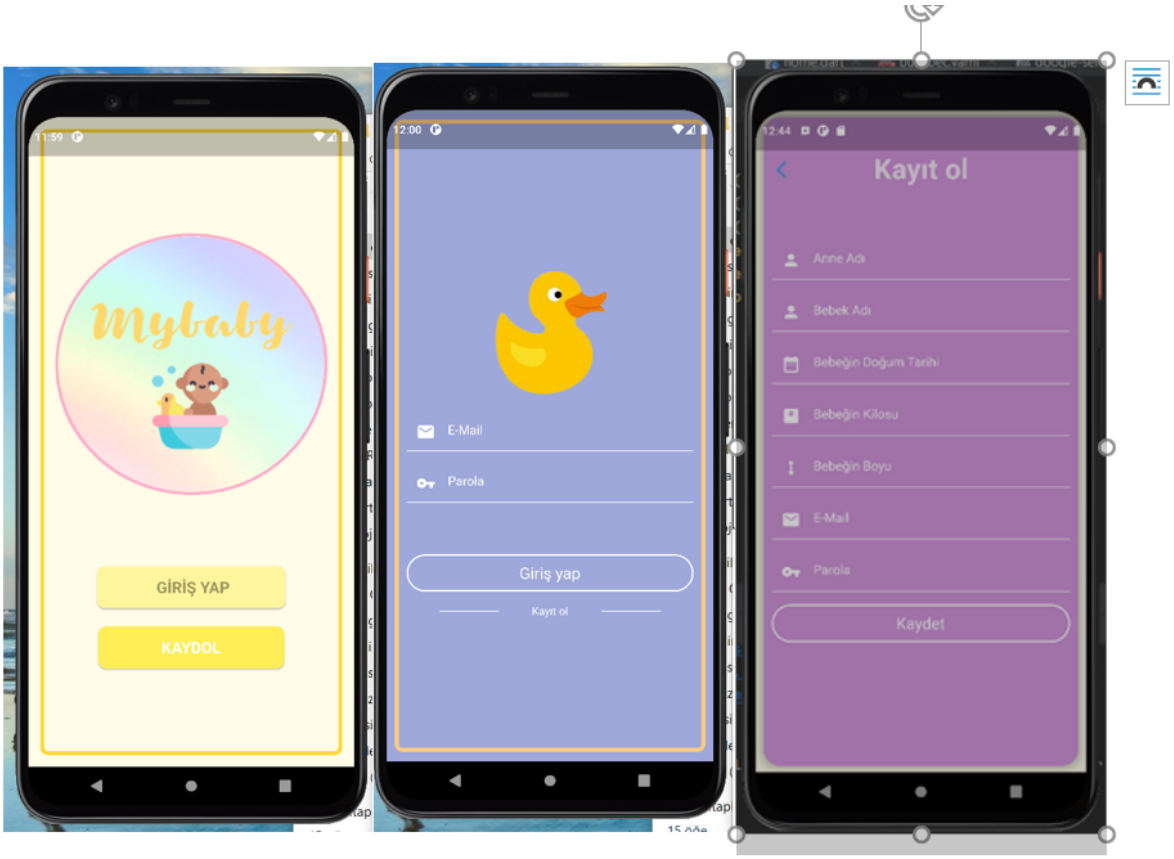

Figure 2.5: Start, Register, Login Pages

2.3.2. Profile Screen

The user's general information and posts were displayed on the profile page. The user's followers, followings, number of posts and posts are shown on this page. In

addition, when the edit profile button is clicked, a different page is navigated to and the user's information is edited there.

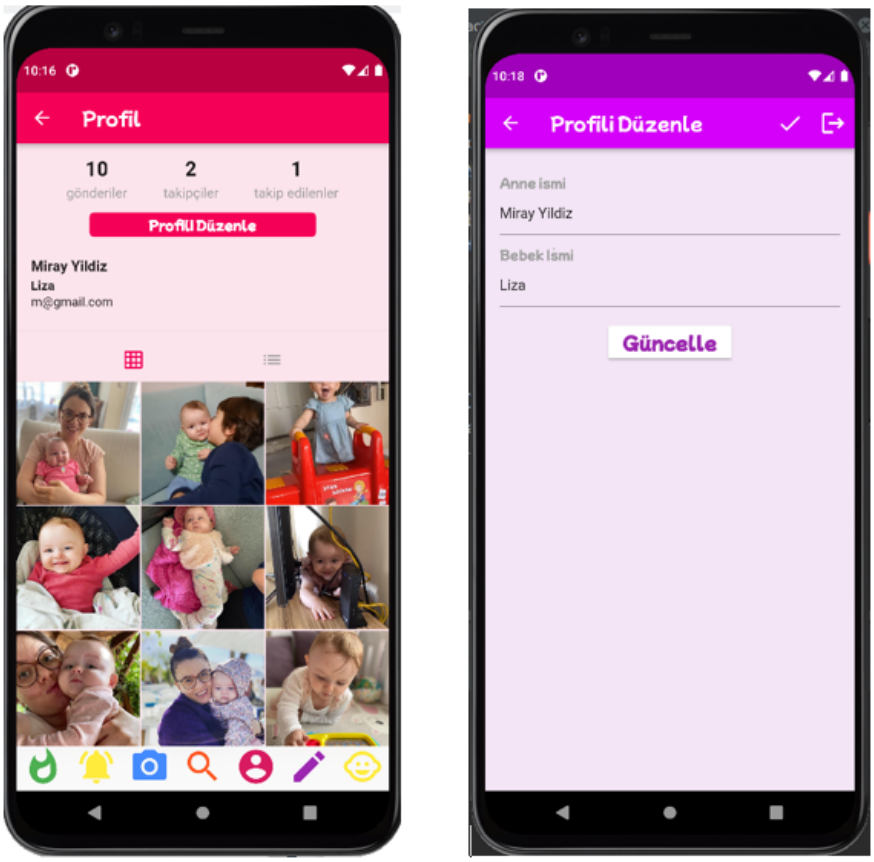

Figure 2.6: Profile and Edit Profile Pages

2.3.3. Notifications Screen

Interaction with other users appears on this page. For example, when a follower comments on your photo, that comment will appear on the notifications page as a notification. Also, the same thing happens if another user follows you and likes your photo.

2.3.4. Blog Page

On this page, you can read the blog posts shared by all users. Blog posts are listed by name, title, and content, respectively. In the next update, the option to search

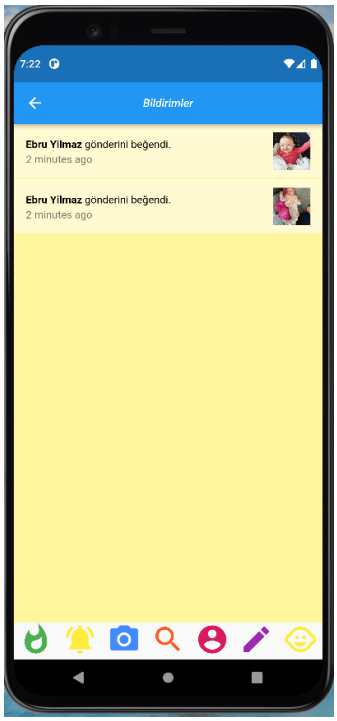

Figure 2.7: Notifications Page

through blog posts will be added to the application. The user can add a new blog post by clicking the button in the upper right corner of the blog page.

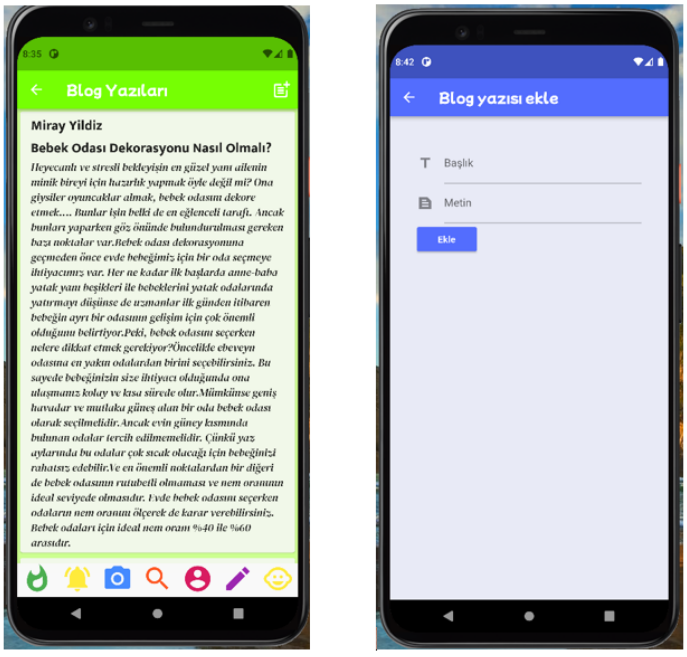

Figure 2.8: Blog Pages

2.3.5. Sharing Photo Page

On this page, the user shares photos. When the Share Photo button is clicked, 3 options appear. When "Choose Photo from Gallery" is selected from these options, it will be directed to the gallery and the photo will be selected. Title and location can be added to the photo.

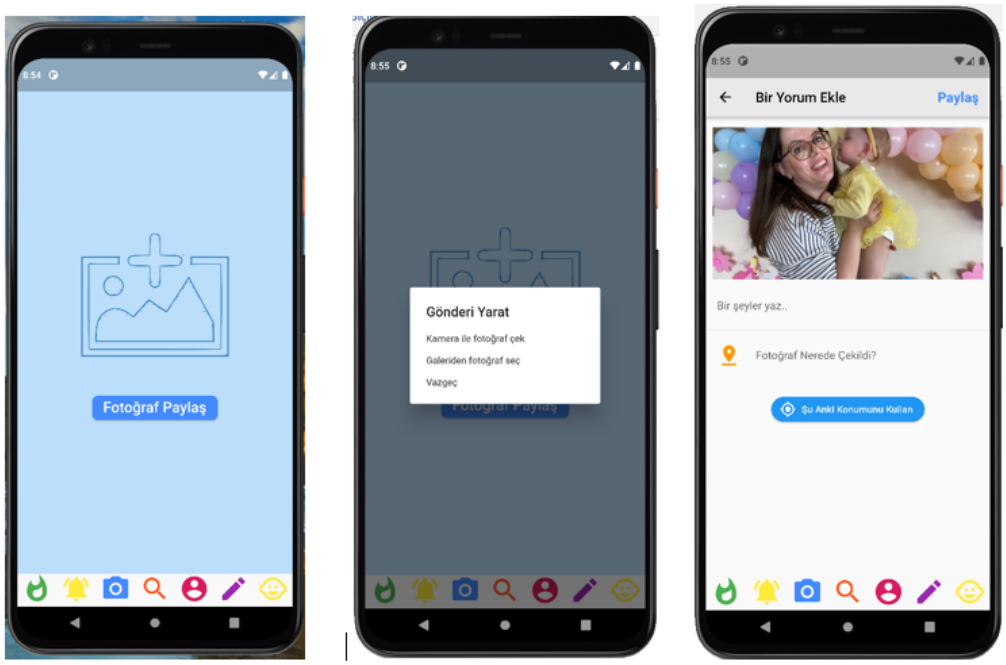

Figure 2.9: Upload Photo

2.3.6. Search Page

Search is performed by user name on the Search page. Usernames are listed as a result. When any user name is clicked, that user's profile is redirected.

2.3.7. Timeline Page

On this page, the posts of the users followed are displayed. This page is refreshed by the actions of the users. On this page, you can go to the profiles of the users by clicking their names. You can also add comment and like photos.

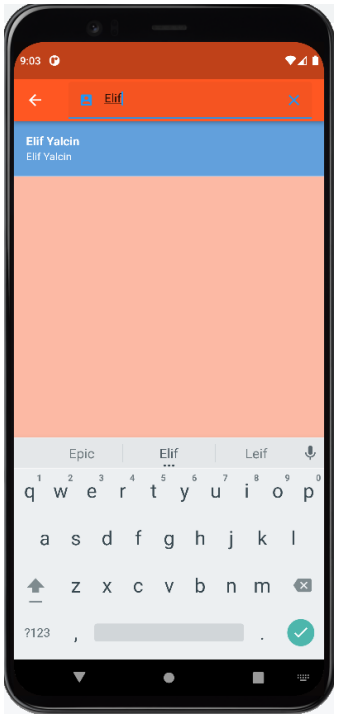

Figure 2.10: Search Page

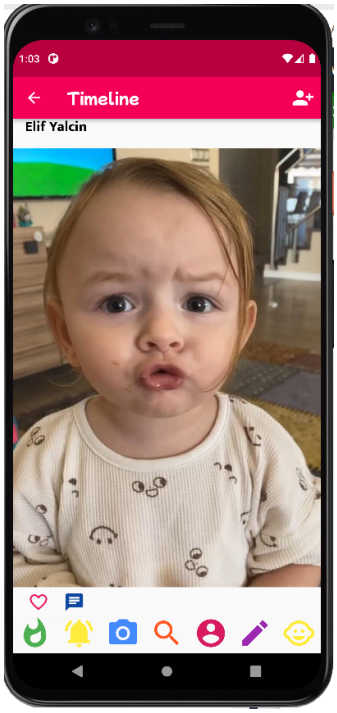

Figure 2.11: Timeline Page

2.3.8. Baby Page

The baby page displays the baby's information. The diseases of the baby are indicated and changes can be made in these diseases. The disease screen comes by default when the user is registering and it is mandatory to fill in. When you want to make changes, click on the diseases section on the baby page and make changes. In addition, on this page, general information according to the month of the baby is presented to the user.

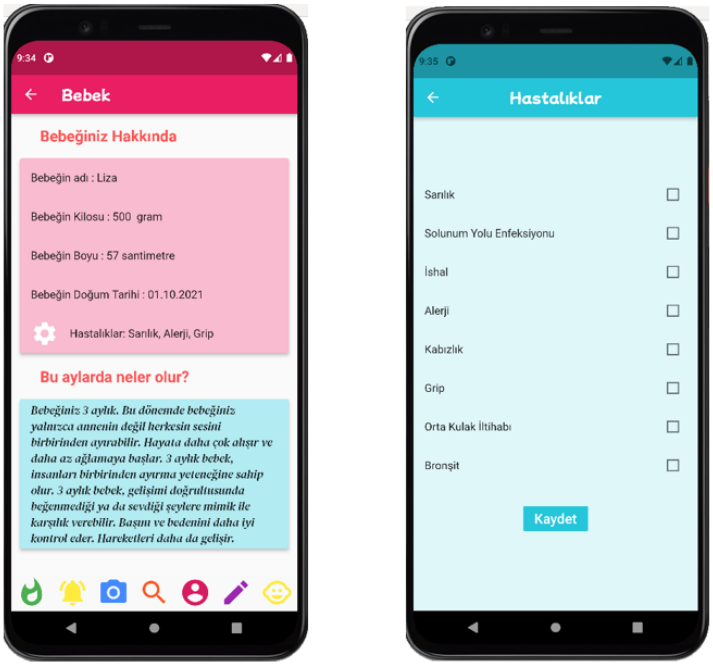

Figure 2.12: Baby and Disease Page

2.3.9. Suggestion Page

This page recommends a friend to the user.

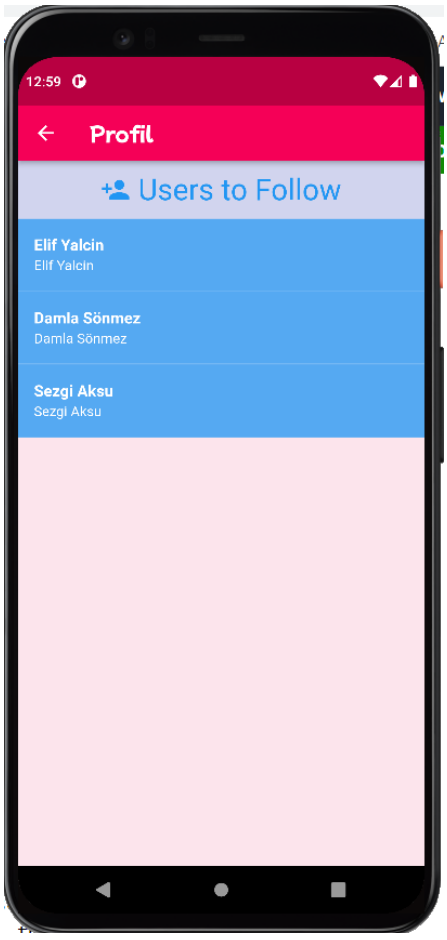

Figure 2.13: Suggest Friend

2.4. DATABASE

Firebase was used in the project, which provides real-time synchronization between all clients. In Firebase Realtime Database, data is stored as JSON and synchronized in real time per client. Users get the latest updates thanks to Firebase Realtime Database.

Real-time synchronization was very important in the Mybaby app. In this context, 9 tables are created in Firebase Cloud Firestore. These tables will be explained in turn below and the contents of the tables and their relationship with each other are shown in the Figure 2.14.

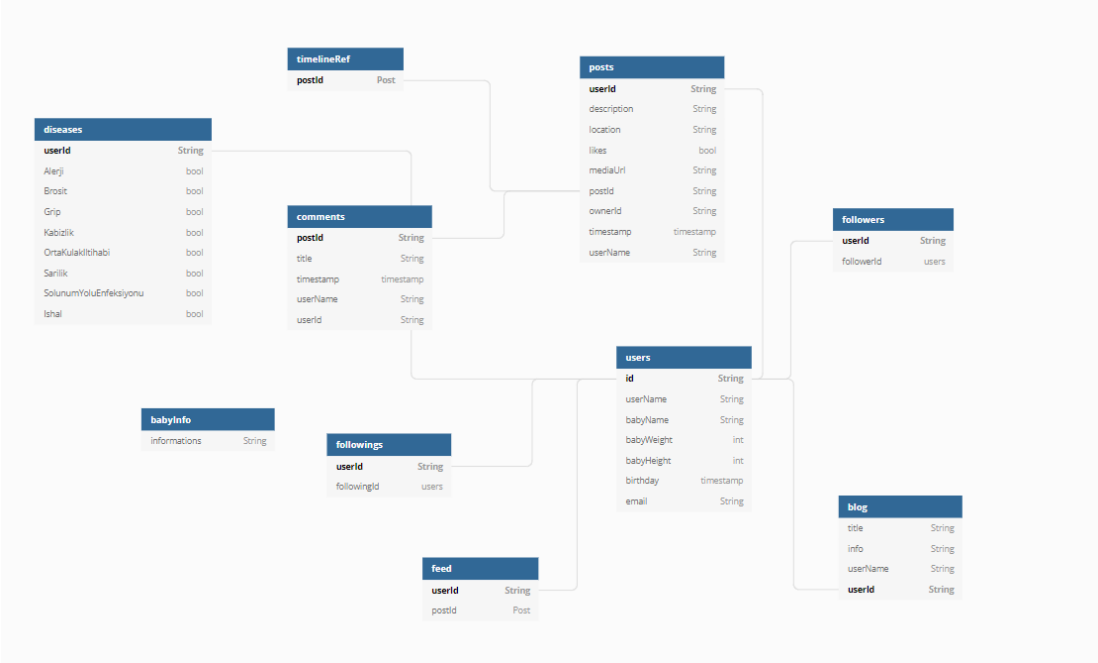

Figure 2.14: Database Tables Diagram

[8]

2.4.1. Users Table (users)

A collection is created for each user in the user table. Document ids of these collections are uniquely created for users. In each user collection, username, baby name, baby's weight, baby's height, baby's birthday, email address and unique id of the user are kept.

2.4.2. Posts Table (posts)

The post table contains photos shared by users. There is a separate collection for each user, and these collections contain the photos shared by that user. Description, likes, location, media url, owner id, post id, timestamp and user name information are kept for each post.

2.4.3. Followings Table (following)

This table contains the people each user follows. There is a collection for each user and these collections contain the unique id of the users followed by that user.

2.4.4. Followers Table (following)

This table contains the followers of all users. There is a collection for each user and these collections contain the unique id of other users following that user.

2.4.5. Timeline Table (feed)

This table has separate collections for all users. These collections contain the posts of people that users follow.

2.4.6. Diseases Table (diseases)

This table contains the disease information received from the user. Each user's collection has whether they have the diseases that are asked in the app.

2.4.7. Comments Table (comments)

The comments table has collections named with post ids. In these collections, the comments made for the post with that post id are kept. For each comment, there is the name of the owner of the comment, the time the comment was made, and the comment information.

2.4.8. Baby Informations Table (babyInfo)

In this table, baby development information is kept by month.

2.4.9. Blog Table(blogs)

In the blog table, blogs are grouped by their titles. Each title is a collection. Each collection contains a title, text, user id and username.

2.5. K-MEANS ALGORITHM

Clustering is one of the data analysis techniques used to obtain an estimate about the structure of the data. Homogeneous subgroups are formed according to a similarity measure. The similarity measure is application specific.

K-means is a clustering method. It is one of the most used clustering algorithms due to its simplicity and intelligibility. It divides a dataset consisting of D (Examine Figure 2.14) data objects into K sets as parameters. The purpose of clustering is that the similarity within the cluster is maximum and the similarity between the other clusters is minimum. In Kmeans, each data point belongs to only one group. Its most important advantage is that it can cluster large-scale data quickly.

It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster. [9]

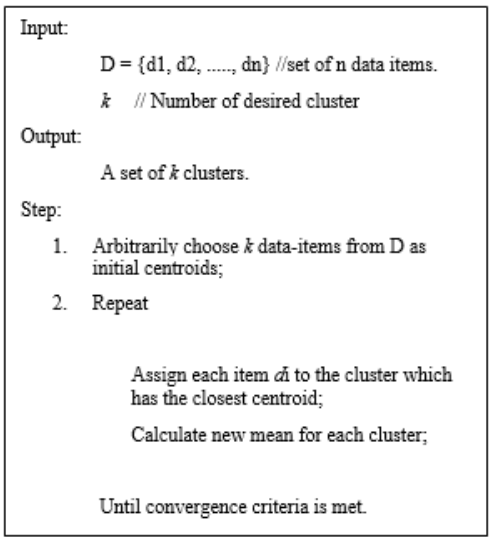

Figure 2.15: Kmeans Pseudocode

[10]

The Kmeans algorithm is shown in the Figure 2.15. According to this algorithm, D is the set in which the number of diseases of all babies is kept.A total of 8 diseases were presented to the user as a check box, and the user made her selections among these diseases. As a result of the elections, clustering was realized according to the number of diseases. 3 different clusters were created. These clusters were determined as low immunity, medium immunity and high immunity clusters. According to this information, our cluster number, k, is equal to 3. Each user was suggested 2 random friends on the "Recommend a friend" page, and 2 friends based on immunity. For example, a user with a low immunity baby was recommended another user with a low immunity baby.

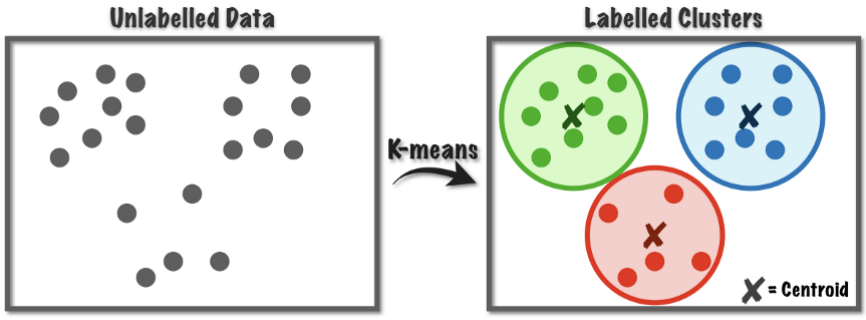

Figure 2.16: Kmeans Representation

[11]

To explain over the Figure 2.15, unlabelled data refers to the number of diseases. Each baby can have a different number of diseases. After applying the algorithm, babies with a similar number of diseases are clustered. In this way, the goal is achieved.

Dart language "'package:kmeans/kmeans.dart" [12] library is used in the implementation of the Kmeans algorithm. A list of type KMeans was created with the data taken from the database. It has been determined that the clusters will contain the maximum and minimum number of data. In the light of this information, clusters equal to the value of K(3) were created from this list.

3. RESULTS

In this section, the results of device and user tests are processed. 2 emulators and 2 real devices were used. In the user test, the application was tried by 6 people and scored out of 4 according to the categories.

3.1. Device Tests

3.1.1. Nexus 4 (Emulator)

Features of the emulator :

- Screen Size: 4.7 inches
- Internal Storage: 16 GB.
- Memory (RAM): 2 GB.
- 4.7 inches, 768 x 1280 .
- Qualcomm Snapdragon S4 pro
- Android Oreo 5.1 (API level 22) x86

All pages worked fine in this emulator. Only on the baby page, there was an render problem because the screen size. This issue is illustrated in the image below. The problem is solved by using SingleChildScrollView.

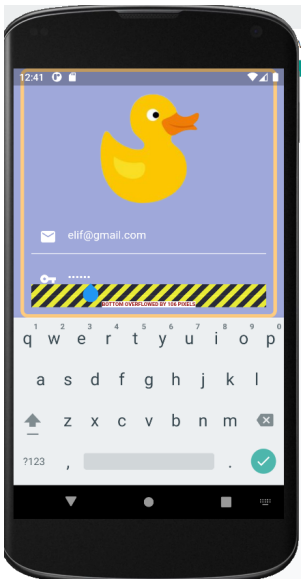

Figure 3.1: Login Page Problem on Nexus 4

3.1.2. Pixel 4 (Emulator)

Features of the emulator :

• Screen Size: 6.3 inches

• Internal Storage: 8 GB.

• Memory (RAM): 2 GB.

• 6.3 inches, 160.4 x 75.1 x 8.2 mm .

Everything worked flawlessly on this model. There was no render problem. Below is the image of the part that got an error in the previous emulator in this emulator.

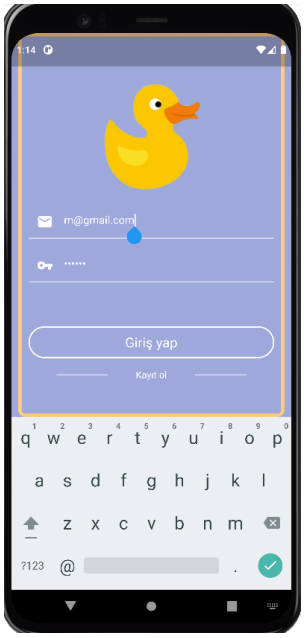

Figure 3.2: Login Page on Pixel 4 Emulator

3.1.3. SAMSUNG Galaxy A32 (Real Device)

Features of the SAMSUNG Galaxy A32 :

• Screen Size: 6.4 inches

• Internal Storage: 128 GB.

• Memory (RAM): 6 GB.

• 6.4 inches, 158.9 mm x 73.6 mm x 8.4 mm.

The application worked perfectly on this device. The problem with the Nexus emulator was not seen on this device. The Login page image on this device is given below.

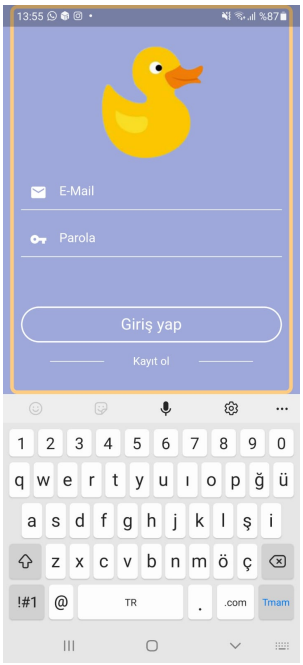

Figure 3.3: Login Page on SAMSUNG Galaxy A32

3.1.4. Huawei P Smart 2019 (Real Device)

Features of the Huawei P Smart 2019 :

- Screen Size: 6.2 inches
- Internal Storage: 64 GB.
- Memory (RAM): 3 GB.
- 6.2 inches, 150.1 x 72.1 x 7.5 mm

The app had the same rendering problem with the Nexus emulator on this device. Likewise, the problem was solved. The rendering problem on the login screen is given below.

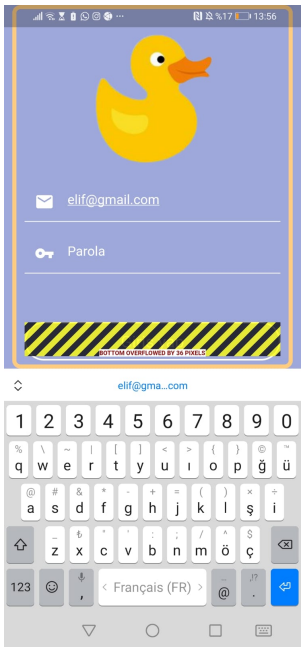

Figure 3.4: Login Page Problem on Huawei P Smart 2019

3.2. User Tests

In user tests, the application was tested on 2 men, 2 childless women and 2 women with children. Some features were presented to users and asked to rate them out of 5. These are: simplicity, usability, speed, design.

In the table in Table 3.1, users rated these features. Changes were made according to the feedback. For example, the intelligibility of the design has been increased.

Table 3.1: User Tests Table

USERS	Usability	Simplicity	Design	Speed	Have you used an app like this before?	Do you use this app?
Man 1	4	4	5	5	1	1
Man 2	4	4	5	4	1	1
Woman 1 (Childless)	5	4	5	5	1	1
Woman 2 (Childless)	4	5	4	4	1	1
Woman 3(With Child)	4	5	5	3	1	4
Woman 4 (With Child)	4	5	4	4	1	3
Averages	4.1	4.5	4.6	4.1	1	1.8

The results are graphed in Figure 3.5. When we examine the graphic, we can see that users have made similar ratings.

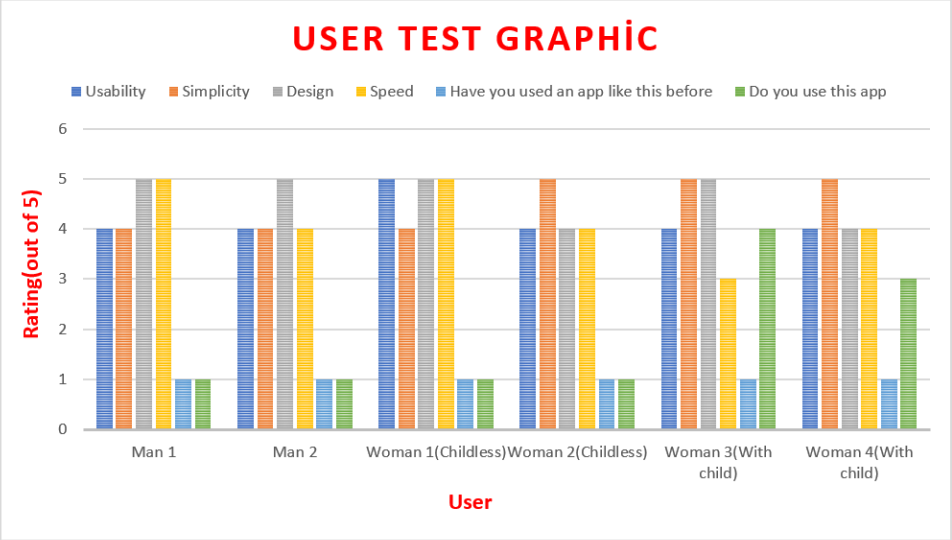

Figure 3.5: User Tests Graphic

3.3. CONCLUSION

3.3.1. Test Results

This application that I made as a graduation project is a mother-baby application. The target audience of the application is mothers. In this context, the question "Will you use the application", which was asked to the test users, received lower scores than the childless mothers and men. The tests should be done more on the target audience. At the same time, the question "Have you used such an application before" received the same return. Apart from this issue, the feedback received for the application shows that the application is an easy to use and beautifully designed application. It shows many similarities with today's social media applications. The difference is the blog post section and the information about babies. At the same time, in this application, unlike others, users are recommended other users with similar diseases. This feature was added using the Kmeans algorithm. The application is open to development. For example, a search feature can be brought to the blog page. The application requires network connection because timeline is refreshed with user posts.

The application can be developed and used for commercial purposes. It has features that will increase competition among its peers.

3.3.2. Results of Success Criterias

Before the application started to be developed, 3 success criteria were determined. These criteria are

- Response time will be less than 2.5 seconds.
- App size will be less than 85 mb.
- The app should suggest the user with at least 3 similar profiles so that they can add them as friends.

These criteria have been met. The application size has reached 84.6 mb with the latest regulations.

Response time was less than 2.5 seconds overall. However, internet speed and phone occupancy rate affected this period.

The application suggested 3 users according to the user's immune system. Clicking on these users to access and follow their profile has been enabled.

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