Senior Design Project

Project short-name: Project Facera

Analysis Report

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1. Introduction

AR (short for augmented reality) is a technique for broadening interactive experience in a natural environment. It gives endless opportunities for manipulating the perception of reality. With today's increasing technological capabilities, AR is becoming more useful and popular. Its potential to give intuitive user experience provides developers with many possibilities to create effective and useful platforms especially in the field of entertainment.

We decided to create a video messaging platform that can enhance the user engagement and create a more memorable experience by utilizing aspects of the AR. The main purpose of our platform is to break through the conventional methods of video messaging and harness the power of AR, to make video messaging much more entertaining. This will also open in a new genre of video messaging (In future implementation video calling as well) which will feature 3D models in an interactive environment through AR instead of the conventional video message which enables users to create more realistic and feature-rich facial animation. The primary goal of the platform is to detect and track face expressions in a video-message in which will then be mimicked by a 3D avatar placed in the frame of the camera using AR.

2. Current System (if any)

Apart from normal texting, or normal video messaging apps such as whatsapp, snapchat, and messenger. We found no app working similar to ours in the sense of using AR in video messaging.

3. Proposed System

3.1 Overview

The app will reframe old-style video messaging by implementing the aspect of AR in normal day to day video messaging. The users will be able to text, or send video messages to each other using the application. The front camera will be used to record the video of one user, this video will be sent to the back end for analysis by using facial recognition libraries which will collect the facial expressions, this data will then be used by the second user who will use AR to place a 3D model in their camera frame, the 3D model can be placed on any surface available in the camera frame such as a desk or a bed. The 3D model will mimic the facial expressions received allowing for the implementation of AR in video messaging.

The 3D model mimicking the recorded facial expressions will give an interesting twist to the conventional video messaging services. The users will be able to select an avatar from a variety of preinstalled 3D avatars. Advanced technologies such as AI will be used to analyse facial expressions and libraries such as ARCore/ ARKit will be used to implement the 3D model on the camera frame.

3.2 Functional Requirements

The application system consists of two main components, the mobile applications and the cloud server for backend computations. In mobile devices, we will utilize various SDKs ARCore for placing the 3D objects in AR. For database and authentication, we will use Firebase and for other backend processing such as facial expression recognition, we will use the google cloud platform [1].

2.1.1. Mobile Application requirements

- The application should ask for the user's permission before using the camera
- The user should be able to select from an array of 3D avatars to be displayed on the camera
- The user should be able to resize and move the 3D avatar by dragging it across the screen
- The avatar mimic the user's facial expressions
- The 3D avatar should be able to perform predefined 3D animations by clicking various animation icons
- Send the captured videos to the backend for post processing
- Allow for the user to login and signup for the application
- Allow the user to add friends to call/message using the application
- Also, allow for chat messaging in addition to video messaging

2.1.2. Firebase (Backend) requirements

- The Firebase should be able to authenticate the users
- Allow the users to update their account information
- Safely store all user data
- Provide fast and safe access to user data without compromising the data
- Allow the user to delete their accounts

2.1.3. Google cloud platform (backend) requirements

- Securely and quickly process the video for facial expression recognition
- The output should be accurate enough to be mimicked by the 3D avatar

3.3 Nonfunctional Requirements

2.2.1. Availability

The application should be available 24/7 and for a large number of users.

2.2.2. Reliability

The application should be crash free. In case a crash does occur, a crash report should be Generated automatically and sent to the developers.

2.2.3. Security

Double layered authentication and password recovery system.

2.2.4. Scalability

Allow for at least 500 users to be able to use the application during the initial stages. In the later stages the application should be able to run by at least 1000 users concurrently.

2.2.5. Portability

The system should be usable across different platforms e.g. Windows, Android, iOS, and Linux.

2.2.6. Accuracy

The 3D model should be at least 80% accurate in its mimicking of the user's facial expression.

2.2.7. Maintainability

The code structure of the software should be designed to allow for easy debugging and components should not heavily rely on each other in order to decrease the chances of unwanted side effects after debugging. Agile methodology will be practiced in an effort to achieve maximum efficiency and to ease the debugging process.

2.2.8. User-Friendly environment

The UI of the application will be designed to make it easy to use and understand allowing for a short learning curve. Moreover, the 3D object will be easy to place in the environment and the user will not need to have any prior knowledge in order to use the application easily.

The messenger will have a minimal amount of buttons e.g. an capture button and a button to place the 3D avatar. This will allow the user to be able to properly enjoy the video messaging without making the screen densely populated, furthermore, the 3D avatar will also be of a feasible size to avoid taking much space on the screen.

3.4 Pseudo Requirements

- Since the app will be running on a mobile phone, the amount of space needed will be considered and the app should not hinder other phone features,
- The app should be able to run on average phones available in the market (The hardware should not consume a lot of resources).
- Licenses of third-party APIs should be valid,
- The 3D models used must be open-source to allow legal usage in our app,
- The app must work for Android Version 8.0 (Most popular by April 2020 [2]) and above.

3.5 System Models

3.5.1 Scenarios

Scenario #1

Use Case Name	Login
Participating Actors	Initiated by User
Flow Of Events	1. The user opens the applications and selects the login button 2. The user is redirected to the homepage after login is successful 3. If the login is not successful the user will

	not be sent to the homepage but instead asked to re enter their details
Entry Condition	none
Exit Condition	Application is closed

Scenario #2

Use Case Name	SignUp
Participating Actors	Initiated by User
Flow Of Events	1. The user does not have an account and selects the signup option 2. The user is directed to the signup page where they enter their name,email and password to create a new account
Entry Condition	User account not existing
Exit Condition	Back button to re-enter the login page

Scenario #3

Use Case Name	Edit Profile
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor selects the edit profile button in the homepage screen 2. The user profile appears where the user may select to change their email, password, name and profile picture
Entry Condition	Inside the homepage
Exit Condition	The user presses the back button to go back to the homepage

Scenario #4

Use Case Name	Chat
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor selects the contact from the main screen 2. The chat window appears
Entry Condition	At the home page
Exit Condition	The user presses the back button to go back to the homepage

Scenario #5

Use Case Name	Add Contacts
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor uses search bar to search for the username of the new contact 2. Selects appropriate contact from suggestions and adds to contacts
Entry Condition	Logged in
Exit Condition	None

Scenario #6

Use Case Name	Send Video message
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor taps the video message button 2. The camera app opens 3. Actor records his facial expressions 4. Video file is sent to the other user
Entry Condition	Having Chat initiated Camera Opened
Exit Condition	Record Button Released

Scenario #7

Use Case Name	View video message
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor enters the chat window 2. Opens the message that was sent to him 3. Scans for flat surface to put the 3D object on 4. Select from variety of 3D avatars
Entry Condition	Being inside the chat menu
Exit Condition	The video message ends/Exits the chat

Scenario #8

Use Case Name	Send Text Message
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor enters a text in the text field 2. The actor presses the send button 3. The text message is sent to the chat
Entry Condition	Being inside the chat menu
Exit Condition	Exiting the chat

Scenario #9

Use Case Name	Search
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor enters a username or email on the search bar 2. The actor presses the search button
Entry Condition	Being at the home page
Exit Condition	1. Clicking on one of the found profiles 2. Pressing on the back button

Scenario #10

Use Case Name	Customize Avatar
Participating Actors	Initiated by Actor
Flow Of Events	1. The user selects to customize their avatar from the homepage 2. The actor is able to see options for customizing their avatar 3. The actor selects the option they want to customize 4. The user changes the avatar's appearance 5. The user presses the save button
Entry Condition	The actor is in the homepage
Exit Condition	The user presses the save button or the user presses the back button

Scenario #11

Use Case Name	View Requests
Participating Actors	Initiated by Actor
Flow Of Events	1. Actor selects the view requests option in
Entry Condition	Being inside the chat menu
Exit Condition	Exiting the chat

3.5.2 Use Case Model

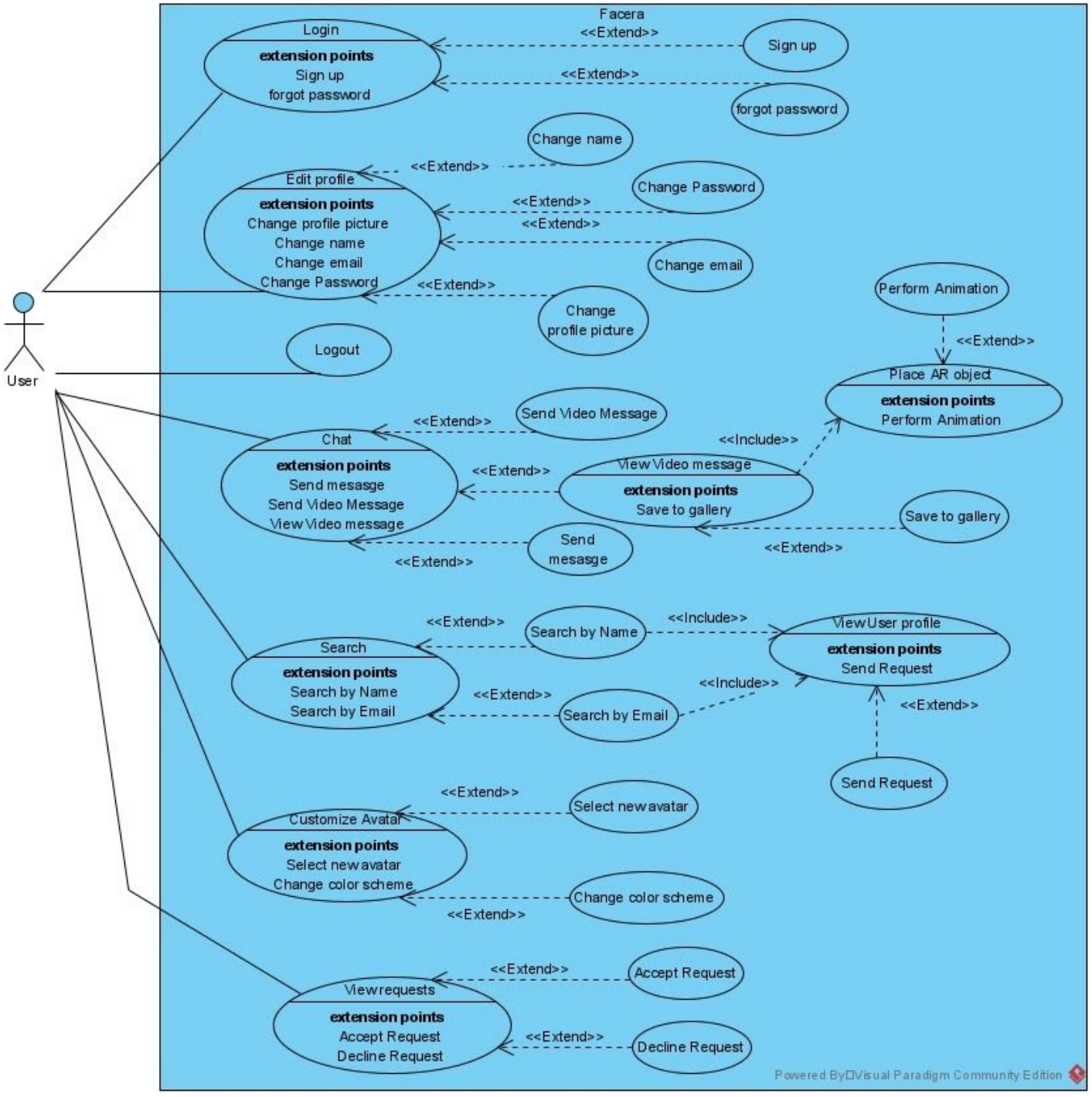

Figure 1 - The Use Case Diagram

3.5.3 Object and Class Model

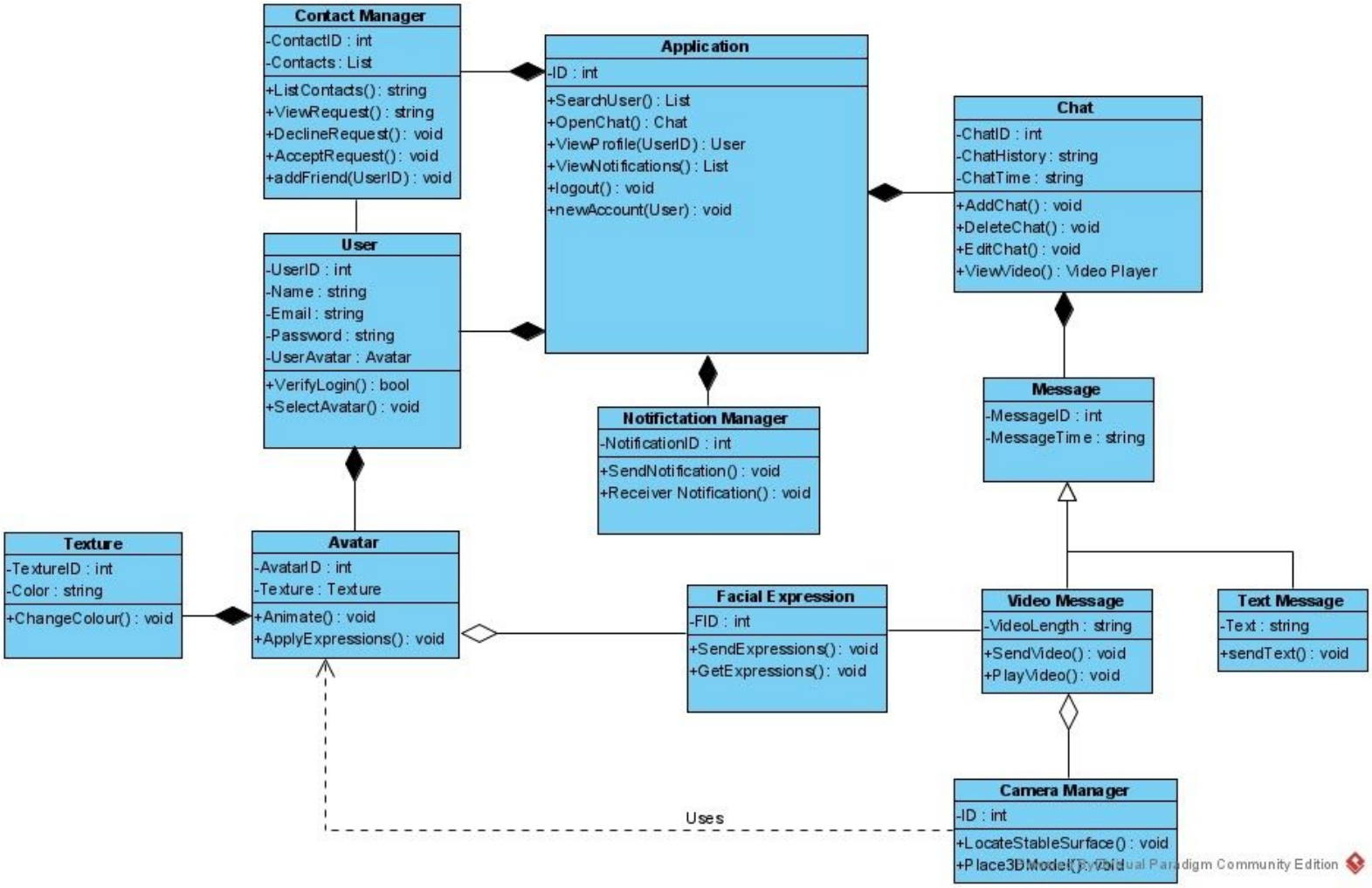

Figure 2 - The Object and Class Model Diagram for Facera

3.5.4 Dynamic Models

3.5.4.1 Sequence Diagrams

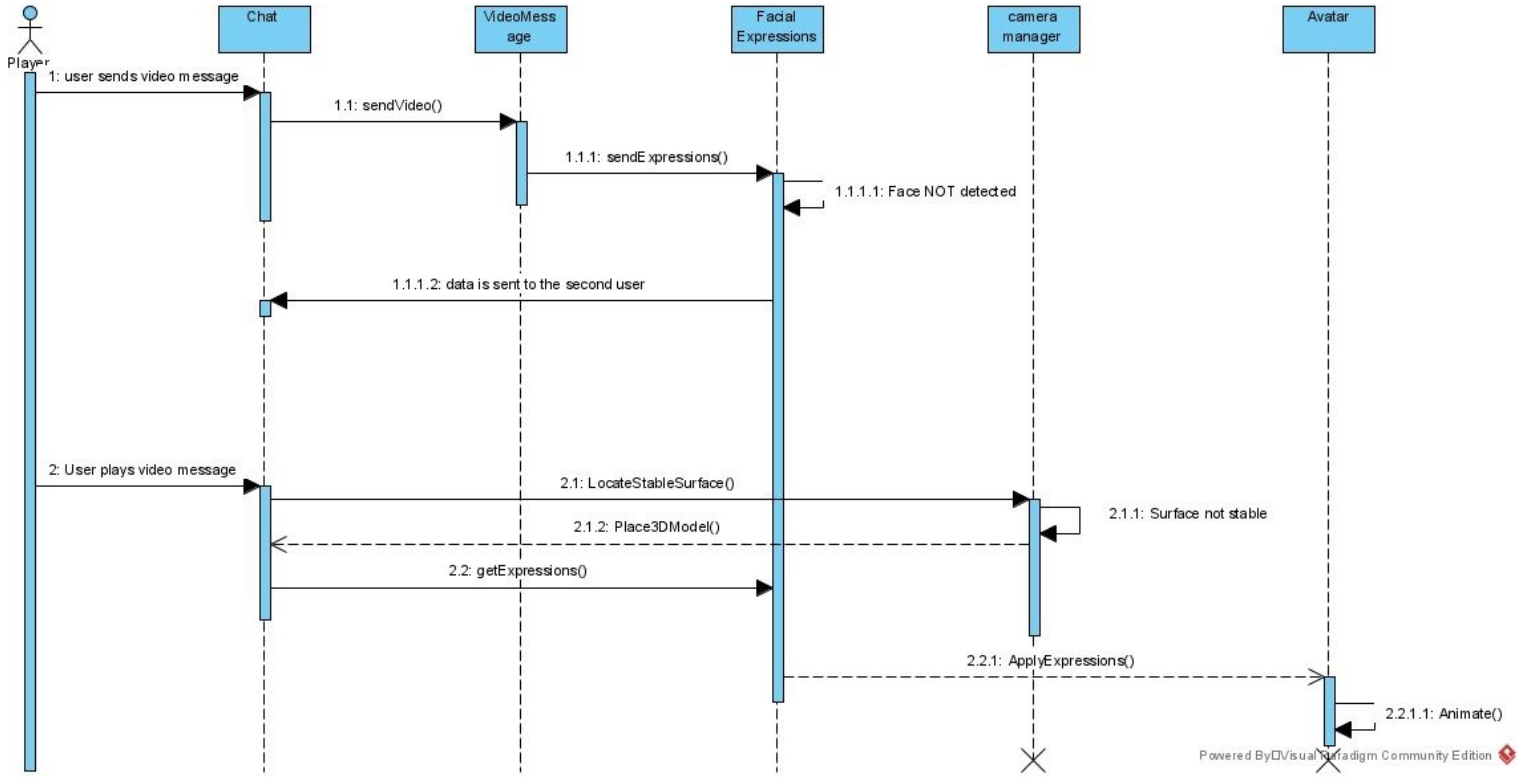

Figure 3 - Sequence Diagram for sending and viewing Video Messages in AR

Here the actor goes to chat in order to send a video. After recording, messages are sent to analyze the expressions. After the expressions are analyzed, they will be integrated to avatars and the video message will be sent.

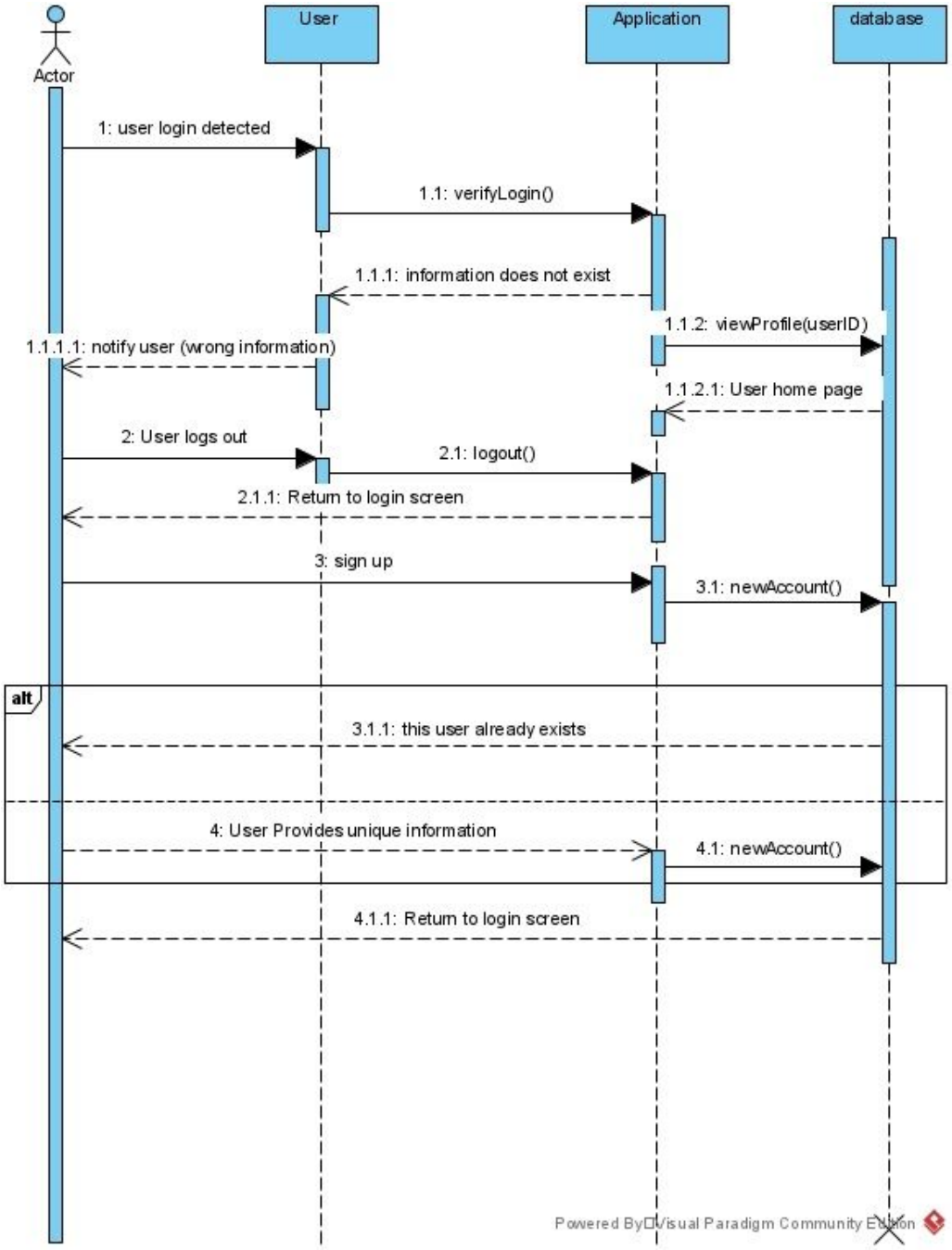

Figure 4 - Sequence Diagram for Login and Signup

Here user attempts logging in. The user will send the information and the application will check if the user exists in the database or not. If not it will send a notification. If the user is found then he/she will be redirected to the main application and kept logged in. Otherwise the user sign up, and sets up his/her information.

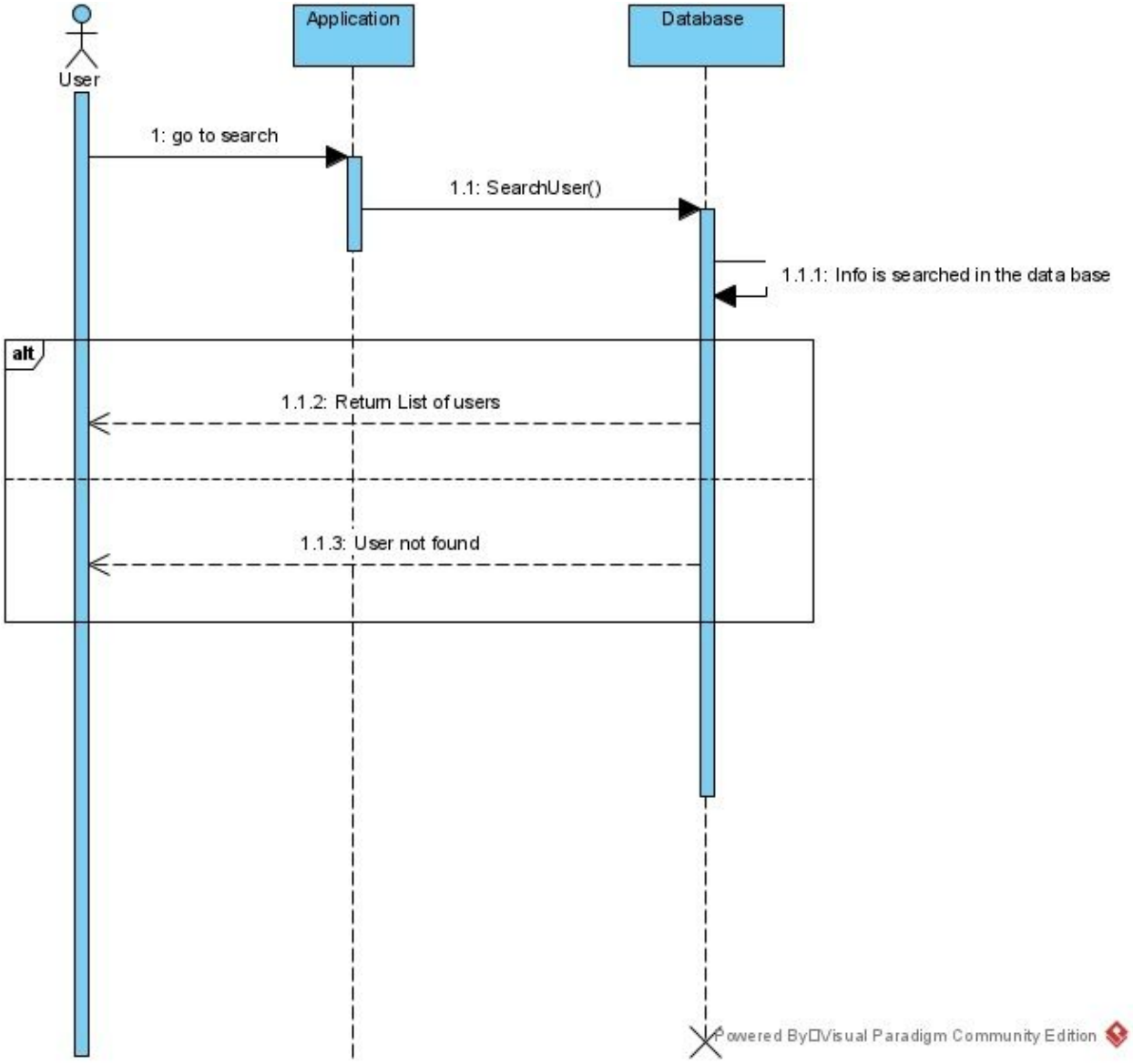

Figure 5 - Sequence Diagram for Searching users

The following diagram explains the search activity of the user. The user will provide information about another user that he/she wants to find. The system looks for those contents and returns the results.

3.5.4.2 State Diagrams

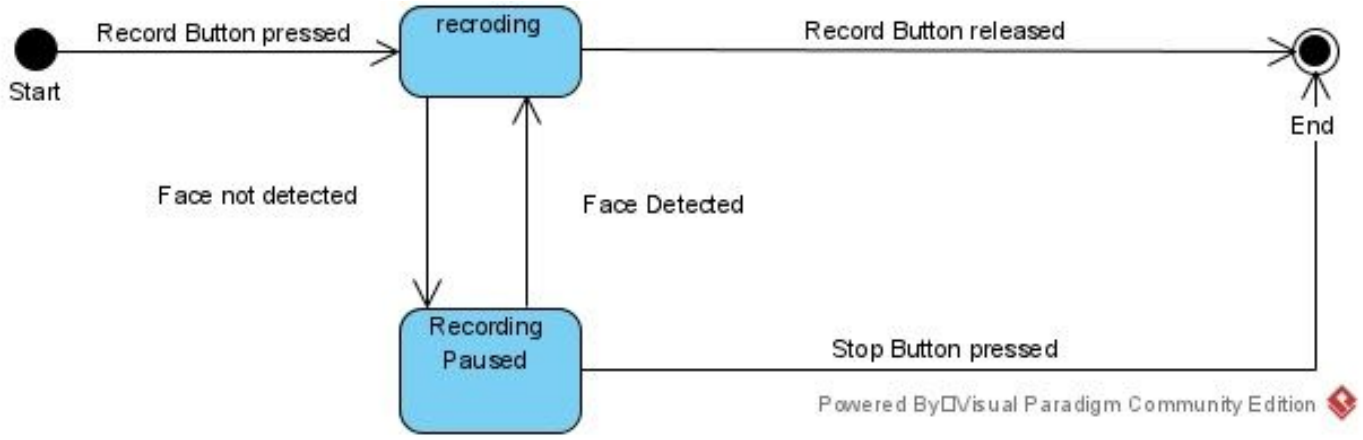

Figure 6 - User Is recording a video message to send

The following state diagram shows the states for when a User decides to send a video message to their friend, the states occur after the user presses the button and the information taken from the camera is used in the state transitioning.

State explanations can be found for figure 6 below.

Transition (Record Button pressed): The User presses the Record button which initiates the state diagram scene above.

Recording: The application starts recording the video message.

Transition (Record Button release): If the user releases the Record button this will end the recording.

Transition (User's face is not detected): The camera is unable to detect the user's face causing a transition to the 'Recording Paused' state.

Recording Paused: The application pauses recording the video message as the user's face can not be detected.

Transition (Stop Button pressed): If the user presses the stop button, the recording will end.

Transition (Face Detected): If the camera is able to detect the user's face the state will transition back into the recording state.

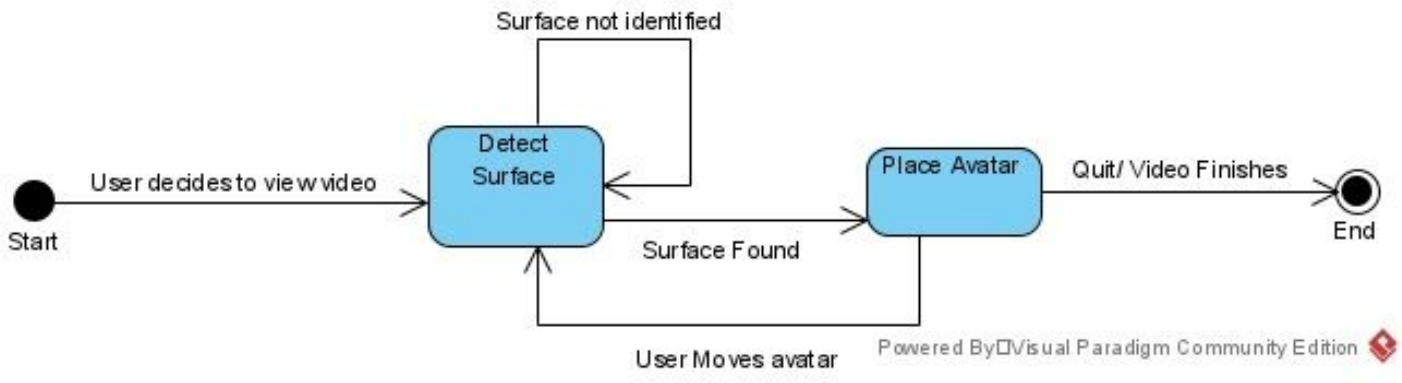

Figure7 - User selects the play video button and is placing the 3D avatar using AR

The following state diagram shows the states for when the user decides to view a video message they have recieved.

State explanations can be found for figure 7 below.

Transition (User view the video): The User presses the video message which initiates the state diagram.

Detect Surface: The application opens the camera and tries to locate a suitable surface for placing the avatar in AR.

Transition (Surface not Identifies): If the application is unable to identify any surface it will repeat the state.

Transition (Surface Found): If the application is able to find a stable surface in the camera frame it will transition into the Place Avatar state.

Place Avatar: The application in the Place Avatar state is letting the user place the 3D avatar in AR on the stable surface.

Transition (Quit/Video Finishes): If the user presses the quit button or the video message ends, the user will be sent back to the chat page.

Transition (User Moves Avatar): If the user moves the avatar in the camera frame, the application will go back to the Detect Surface state.

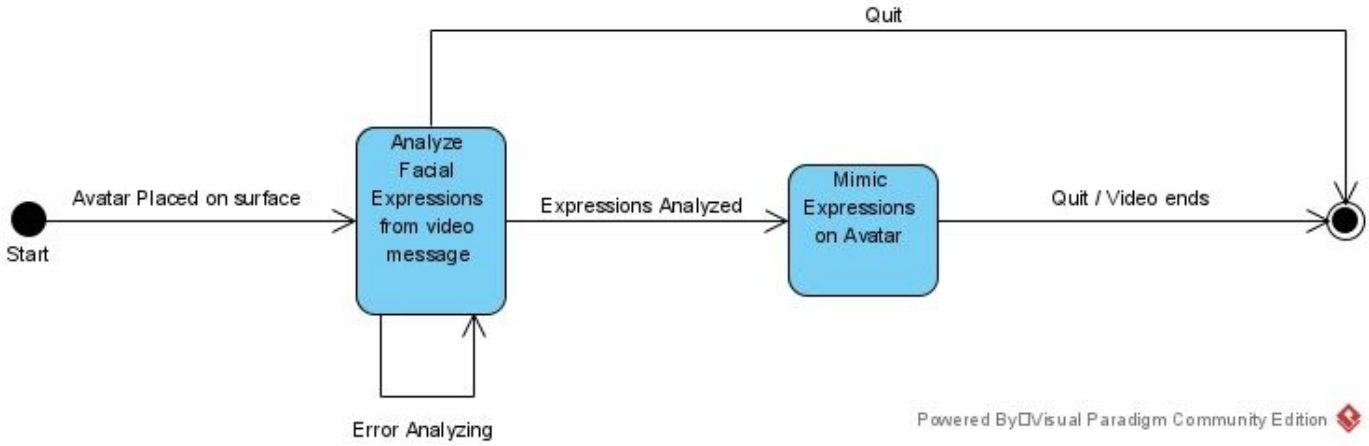

Figure 8 - The avatar has been placed and is about to mimic the facial expressions of the video received

The following state diagram shows the states after the user has placed the avatar on a suitable surface in Augmented Reality, This state diagram shows the transitioning needed for the avatar to mimic the facial expressions in the received video message.

State explanations can be found for figure 8 below.

Transition (Avatar placed on surface): The Avatar is placed on a stable surface after which the following states take place.

Analyze Facial Expressions from Video message: The application analyzes the facial expressions recorded in the video received.

Transition (Quit): If the user presses the quit button the application will return to the chat screen.

Transition (Error Analyzing): If the application is unable to analyze the facial expressions in the video received it will return to the Analyze Facial Expressions from Video message state.

Transition (Expressions Analyzed): After the application has analyzed the facial expressions from the received video it transitions to the Mimic Expressions on Avatar state.

Mimic Expressions on Avatar: The application places the facial expressions data on the avatar's face which results in the facial expressions captured in the received video being displayed on the avatar's face along with the audio of the video. (This is how the AR aspect of the video message will be seen i.e. the Avatar will be mimicking the expressions along with the audio inside of the camera's frame using AR).

Transition (Quit/Video ends): If the user presses the quit button or if the video ends, the user will be taken back to the chat menu.

3.5.4.3 Activity Diagrams

Scenario #1 - Login activity diagram

This diagram shows the basic workflow of creating a user account. Basically when the users open the application, they are directed to the login page. There they have the option to create a new account or login with an existing one. In case they forget their password, they have the ability to change it in a secure way through email.

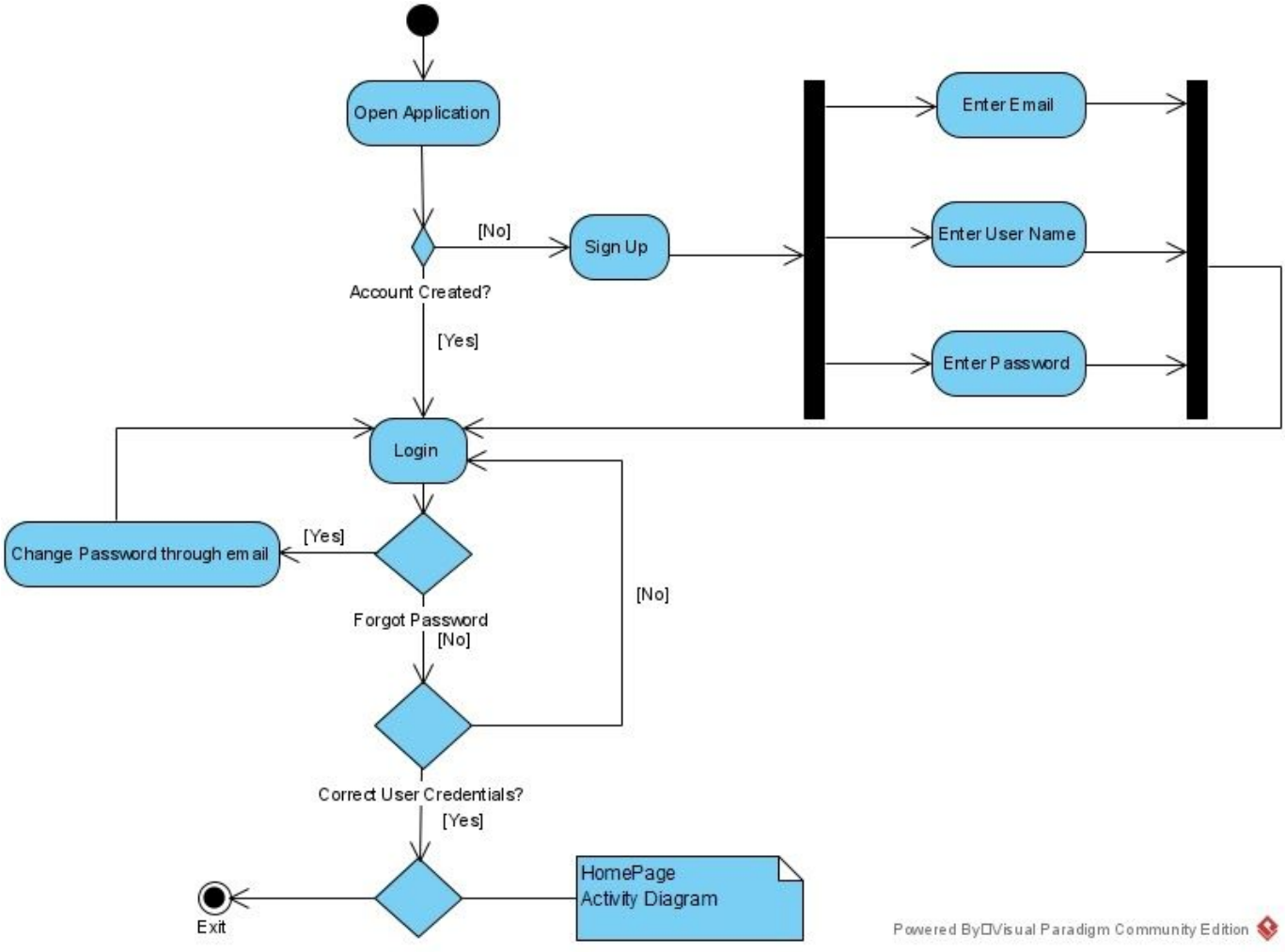

Figure 9 - Login/Signup Activity Diagram

Scenario #2 - Home Page activity diagram

The users are directed to the homepage once they login. There they have several options. They may view their profile page and change their information as required. Furthermore, they can go to the chat page to start a conversation with their friends. There they can either send a text message, including emojis and stickers, or record a video message to record their face to be used on the avatar seen by the receiver on the other end. Moreover, the users may search for other users to send requests to or view their notifications to see information such as received messages or friend requests from other users.

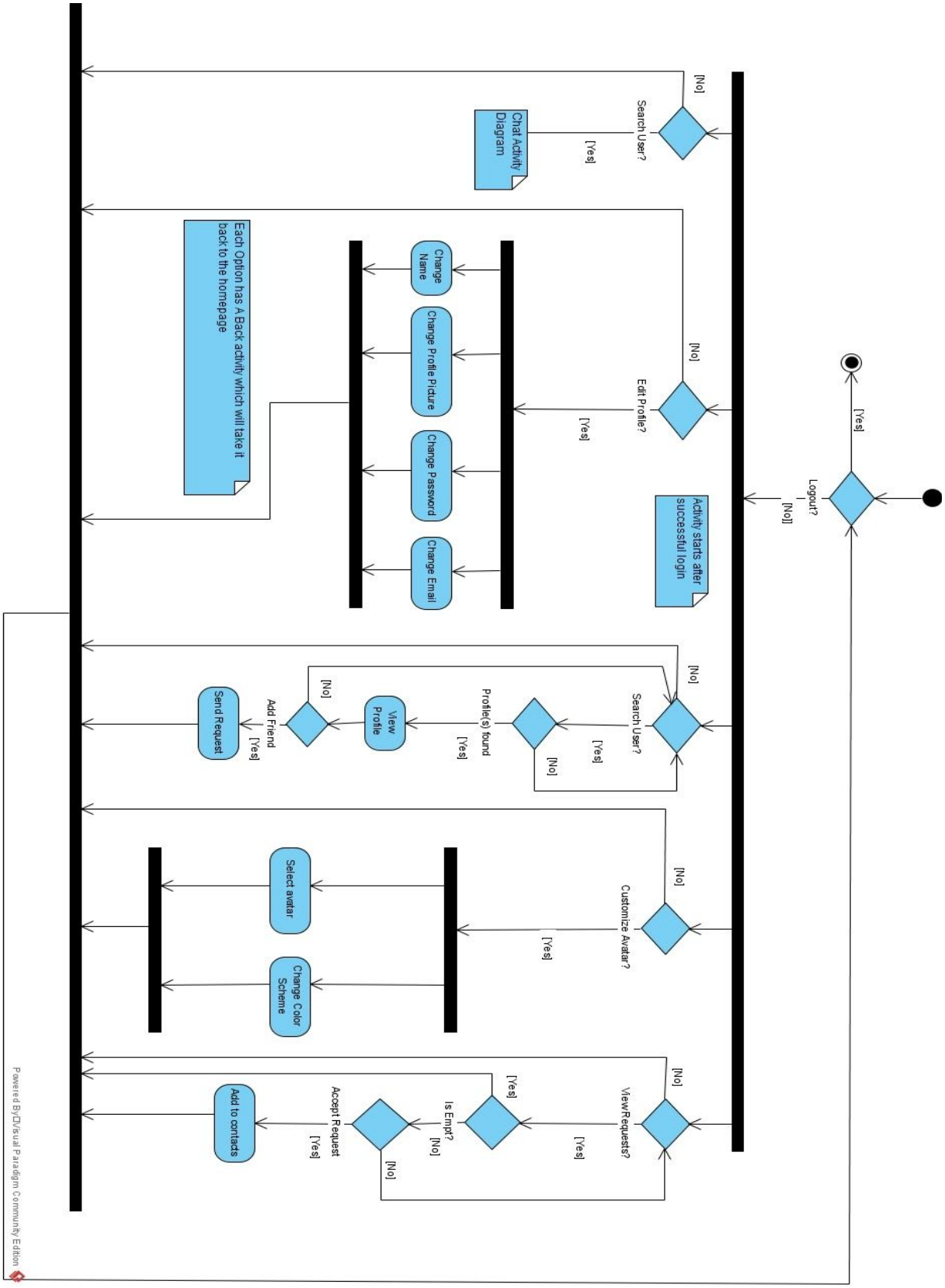

Figure 10 - Home Page Activity Diagram

Scenario #3 - Chat activity diagram

Once the users enter a chat they have the option to either send/recieve a text message or a recorded video. When they record the video, their facial expression will be analyzed and recorded by the application. That data will be sent to the user on the receiving end. When the receiver plays the video, his/her back camera will be opened. The application will try to identify a stable surface, create the avatar and place that avatar on the surface. The avatar will mimic the facial expressions of the sender such as lip and eye movement and facial expressions. Furthermore, the user will have the option to save the received video to the gallery.

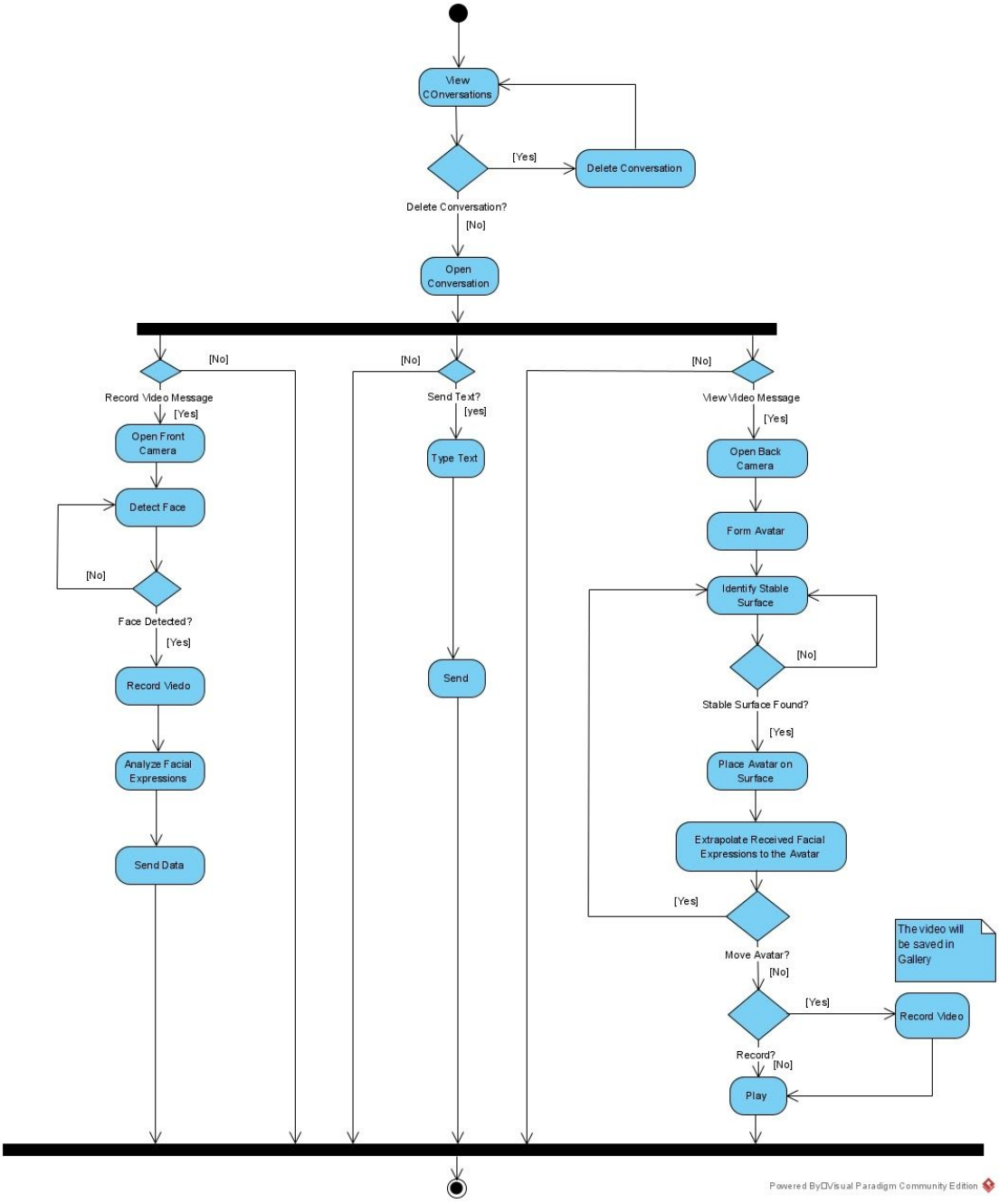

Figure 11 - Chat Activity Diagram

3.5.5 User Interface - Navigational Paths and Screen Mock-ups

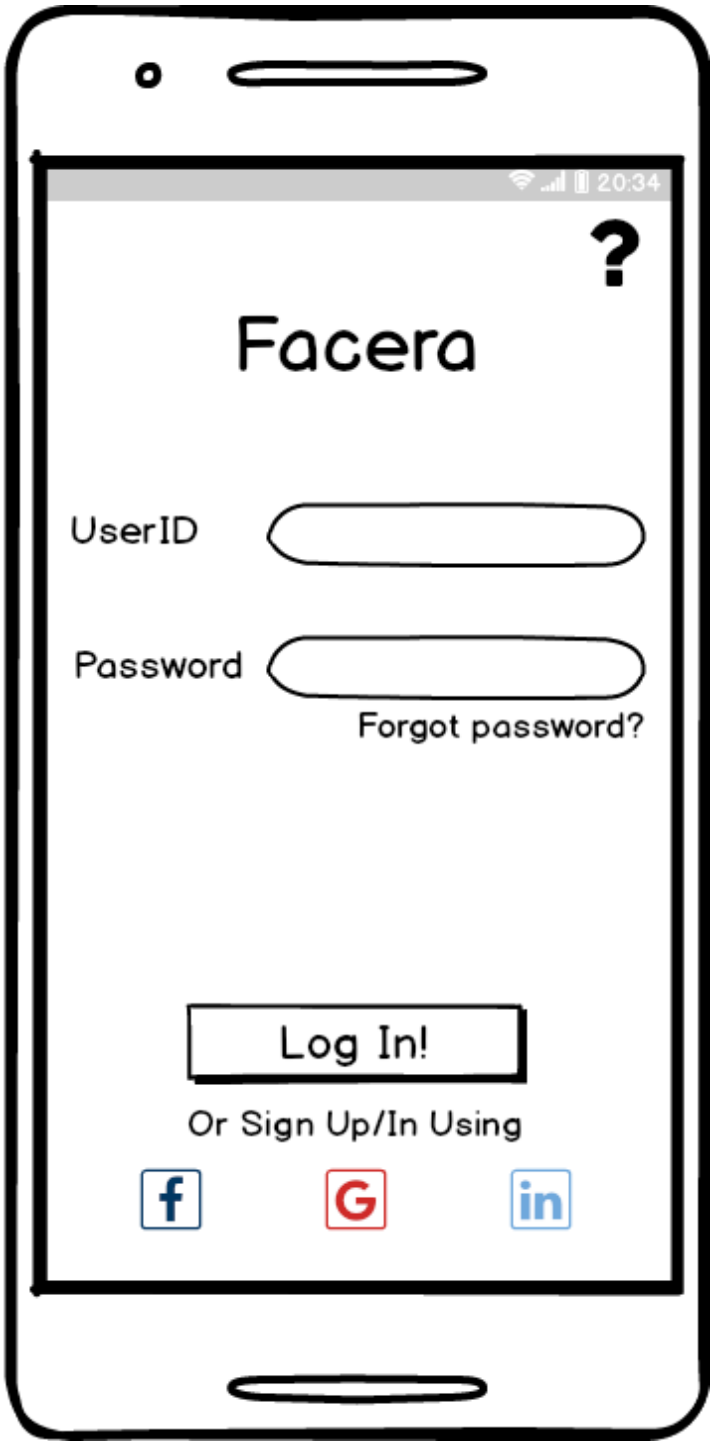

Figure 12 - Login screen

In the Login screen user can login using his userID or Login using his social media account or Google mail. In the figure "forgot password" is also reflected. The question mark in the top right corner corresponds to the "how to use" feature, where the user is guided through the app.

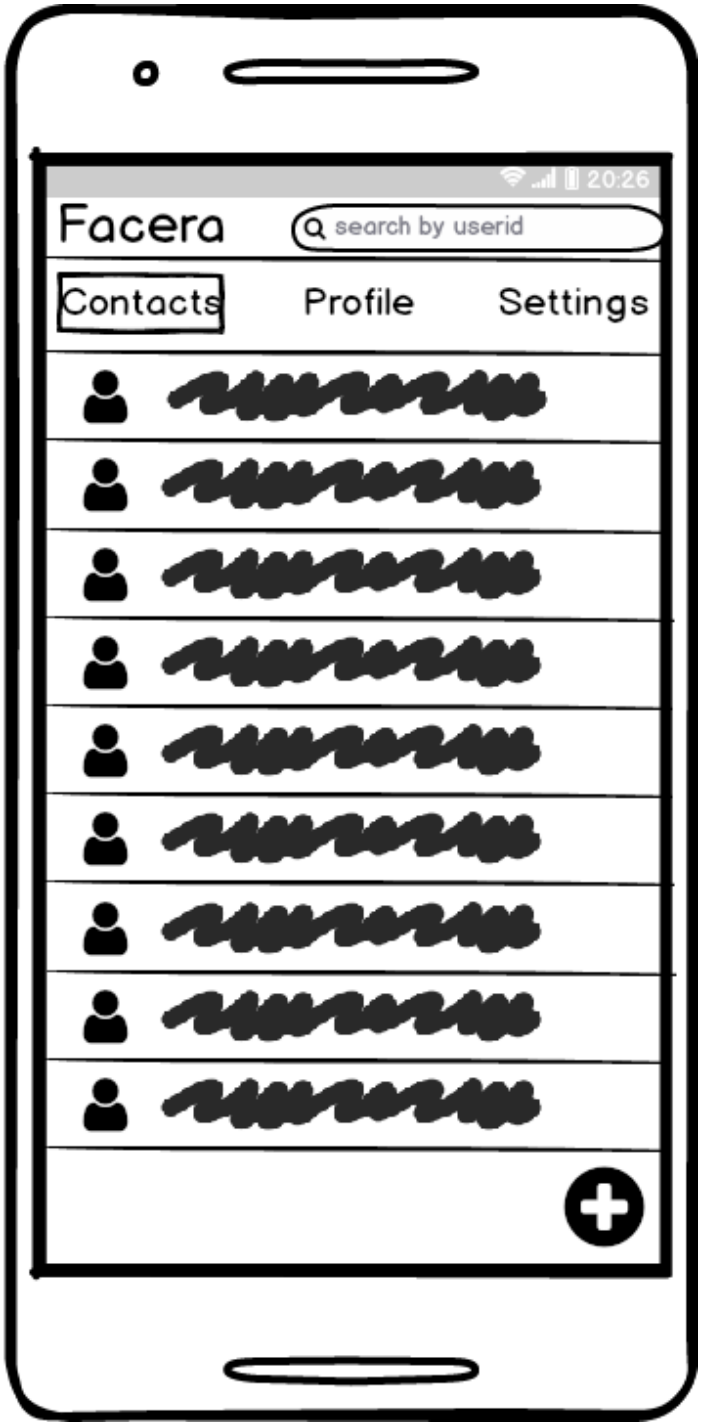

Figure 13 - Home screen

The figure depicts the home screen of the app with various initiated chats corresponding to different contacts of the user. Plus sign in the bottom right corner is reserved to add new contact to contacts. Also, there is a search bar to find other users by their id in order to create new connections.

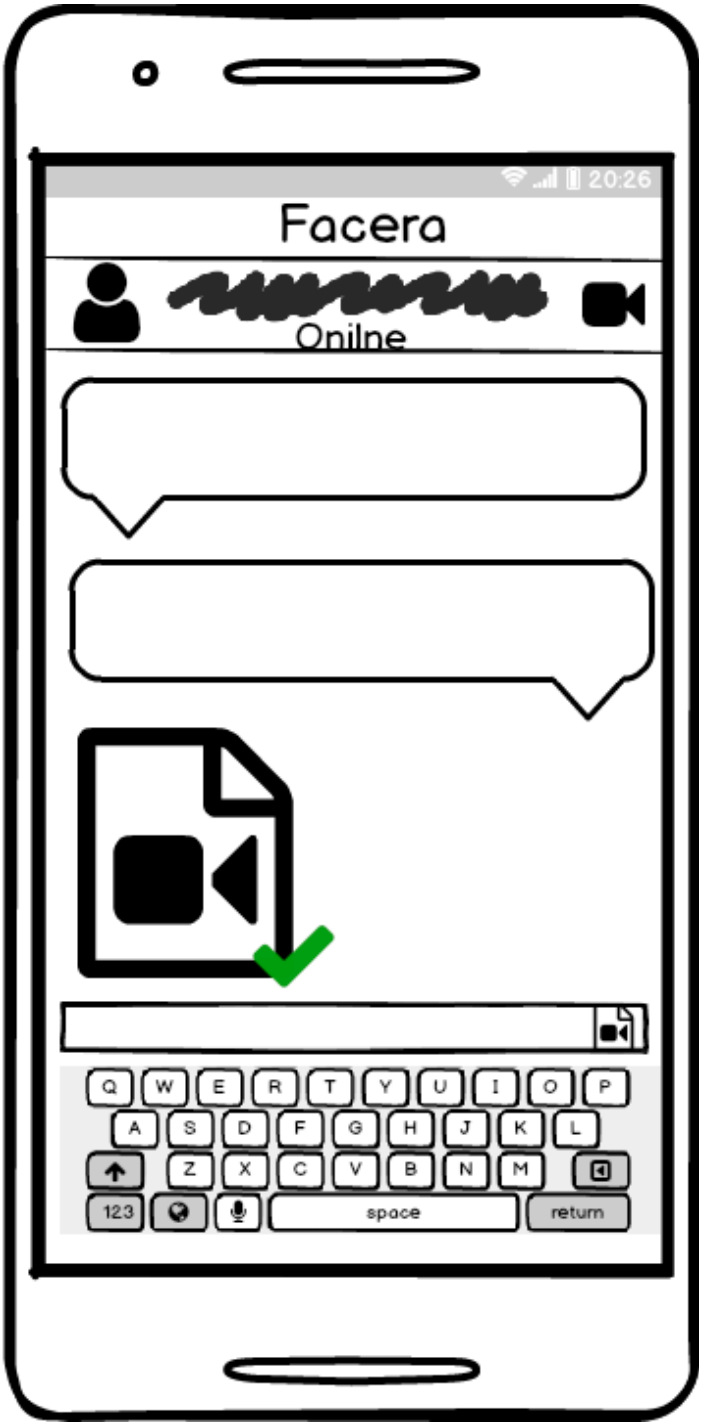

Figure 14 - Chat window

The chat window is representing chat functionality of the app. Here users can chat and send AR videos to each other. The video camera button to the right of the typing field is reserved for the video capture from which facial features will be extracted in the system. Also it is possible to check whether the specific user is online or not by checking the status info under the username on the top of the screen.

Figure 15 - Camera app (Sending)

After pressing the video camera button on the previous figure, the camera app will be initiated, where the user will be asked to record his face and facial expressions to forward it to the system.

Figure 16 - Camera app (Receiving end)

Once a video message is received and tried to be watched, the camera app will launch again and ask the user to find the stable surface on which the 3D object will be placed on the next step. Once the surface for the 3D object is found, the user is expected to tap the tick in order to confirm the aforementioned.

Figure 17 - Camera app (Placing 3D object)

Once the surface is found the user is asked to select the avatar for his friend's video message on which facial expressions are going to be applied to the 3d avatar that was selected, and the object will be placed on the surface that was found before.

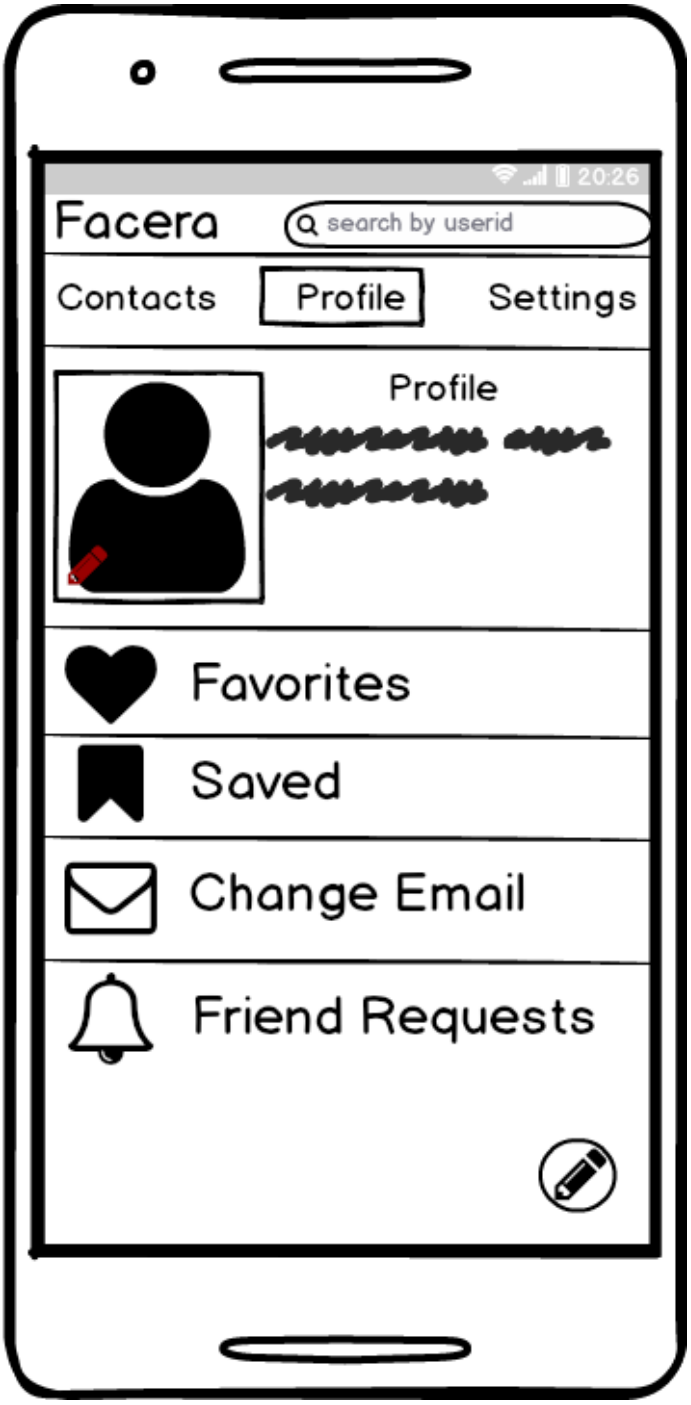

Figure 18 - Profile

In the profile tab it will be possible to change the email address of the user as well as profile picture. The Favorites section is for favorites among the contacts. Saved subsection is for saved videos and friend requests is for the coming requests from other users. Also the name and email of the user will be displayed here.

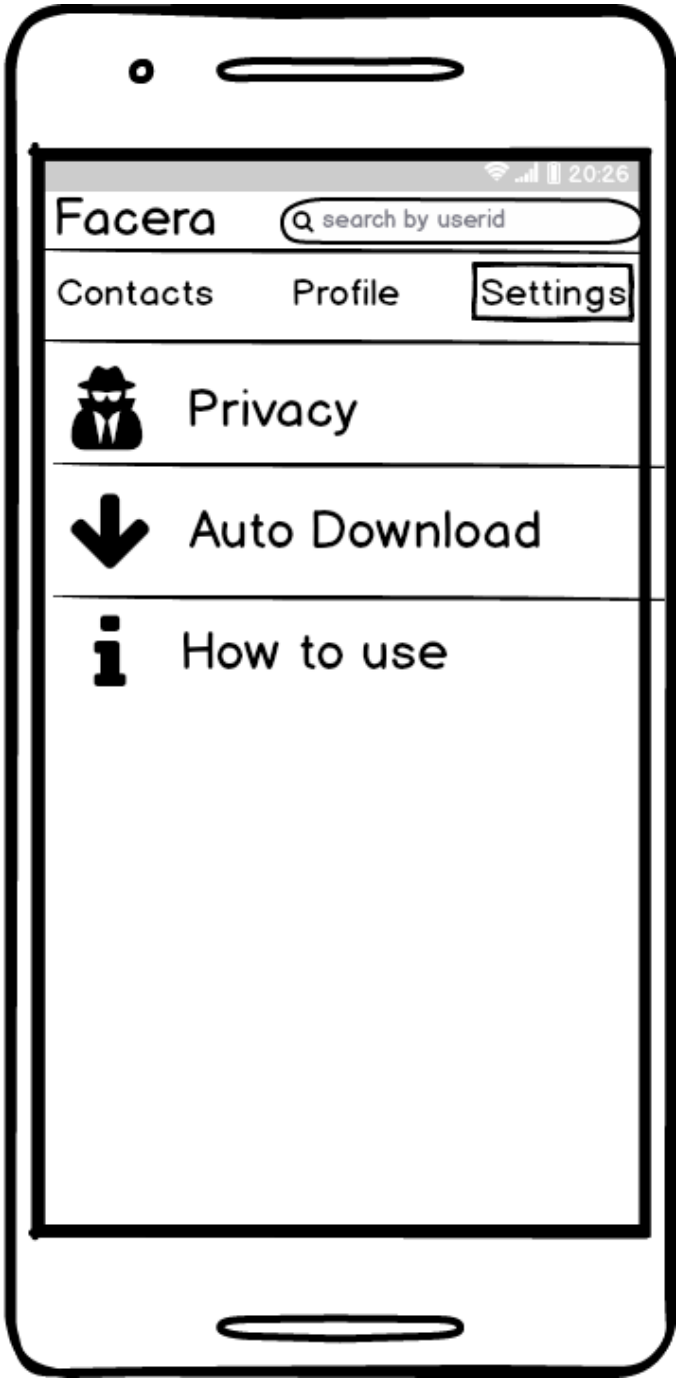

Figure 19 - Settings

The settings screen is reserved for some preferences of the user where s/he is able to get through the app again using how to use the function. Also, the Auto Download function will ask whether to download the videos directly to the gallery. Moreover, the privacy tab is related to the privacy of the video messages sent which will restrict other end from downloading their videos.

4. Other Analysis Elements

4.1. Consideration of Various Factors in Engineering Design

Our application is designed to provide entertainment as a means of social service. On a large basis, an application may prove to be useful or harmful the society it is meant to serve. Here we will start discussing various factors that may address certain design concerns which are expected to be challenging from ethical and social perspectives. Main issues encompass data privacy, health and distraction, cultural differences and market competition.

4.1.1 Data Privacy

Our application due to its communicational features, has a potential to pose an intermediate threat to user privacy. These communicational features include video transmission and text messaging. To eliminate all the risks that would otherwise cause a discontent for the user experience, we will implement safe methods. Video transmission features include video messaging and face recognition. We will use public APIs to add face recognition to our project. We will select these APIs carefully and selectively, to avoid any potential concerns regarding image privacy. To avoid user's data getting into the wrong hands, we will deploy trustable servers (most probably Google Public DNS). Similar technology will be used for text messaging as well. Chat connections will be end-to-end encrypted.

4.1.2 Effect Of Cultural Differences

Our application will have two main features that concerns one's individuality. Users will only be able to select avatars that are in the catalog. In order to avoid gender bias we will upload two avatars that have the same characteristics, only with different sex. To avoid racial bias we will also multiply avatars with the same characteristics, with different recognized races.

Second main feature is its computer vision design. We will use pretrained models in order to integrate face recognition features to our application. We will double check our models and make sure that face recognition characteristics of our application are fair.

Another ethical concern is undesired messages. Every user will be allowed to block certain individuals who are bothering with calls. We will also implement additional features in order to stop users from messaging sensitive content. Therefore we will have report features later on.

4.1.3 Health and Distraction Concerns

Our application, as well as other social connection applications, has a risk of user obsession. Fortunately, the functionality of our application solves this issue on its own. It has lower probability to cause distraction since the user experience will be temporary. Usage of our application will be preplanned, therefore no risk of distraction. Due to temporary experience, we expect negligible health risks.

4.1.4 Evaluation of the Constraints

All these factors affecting our design strategy are worth mentioning, but they do not have the same priority levels. In this table we display our priorities when we will manage our design strategy.

	Priority level	Influence to the Application
Data Privacy	7	May lead to judicial process and as a result shut down of the application
Cultural Differences	10	May be subjected to criticism by the audience and therefore shrinkage of its popularity
Health and Distraction Concerns	4	May lead to the unsatisfactory user experience.

4.2. Risks and Alternatives

In this section we will discuss potential problems that may occur while utilization of the app as well as alternative solutions for these problems. As discussed above the application will have dependencies related to the computational power of the device that runs the app, as well as the hardware dedicated for the camera of the device. Moreover, the possibility of potential data leakage might be a problem as well. The power consumption of the app should be considered as well, since a lot of computational power requirements may lead to heavy battery usage, which should be considered as well.

4.2.1 Computational Ability of the Mobile Device

As we have discussed earlier, our application will include features such as face recognition, video transmission and video processing. It is planned that mobile phone’s processing power will do the heavy lifting on these computationally expensive features. Phones with old hardware and OS, may not function well with our application. Therefore it is recommended that an Android 8 or higher version is installed on

the device. In future upgrades, when group calls are made, computational ability in particular, will be very challenged.

4.2.2 Data Privacy Issues

As we have previously discussed, our application may cause potential privacy issues for the users. We have specified that we are going to use trustable servers to avoid any data leakage [3]. This leakage occurs because the user's vocal and visual information is sent to private servers. This in return creates a risk that can have many repercussions.

4.2.3 High Power Consumption

Due to high level processing, which will require higher power consumption, which itself may heat up the phone. In particular the video recording with high duration can cause such phenomenon. This may lead to an undesired collateral damage to the phone and limit the user experience. Therefore, we recommend users to limit the duration of the video messaging. We will also put forth a break point where users will not be able to continue recording. This will be implemented to avoid overheating.

4.2.4 The Plan B

Due to aforementioned issues, plan B will consider providing an acceptable solution that could solve these problems.

Plan B:

1. The application usage will be limited to certain Android versions.
2. The app will create a 2d rather than 3d avatar for better performance. However in this case, the whole body instead of just the faces can be analyzed and mimicked by the avatar due to improved performance.
3. Time duration of video recording and certain processing features will be limited to Android versions.

These measures are taken as an alternative to previously discussed concerns. Much more practical information is also needed to safely conclude that any of these risks are worth taking into consideration. If the security concerns are dealt with there will be no reason to impose the processing on the phone.

4.3. Project Plan

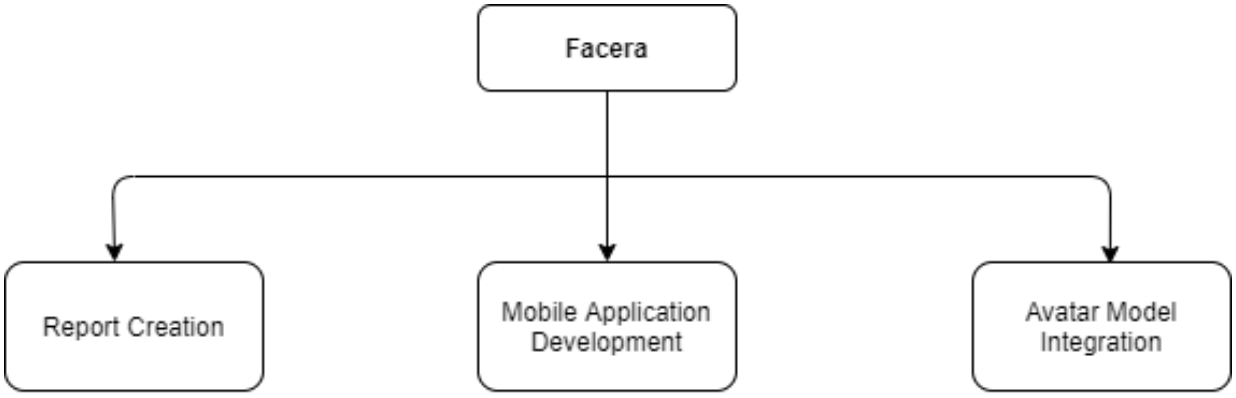

Figure 20 - The WBS diagram of Facera

Based on the main functionality of our application, the project has been divided into 3 main parts. The subsections are defined below:

- Report Creation: This work package deals with the Projects Specifications, Project Analysis, High Level Design, Meeting, and Progress Reports. Each deliverable will have its unique date of delivery and will be expanded upon below in the Report Creation WBS subsection.

- Mobile Application Development: This work package deals with the creation of the mobile app using react native, the mobile application is aimed to be launchable on both iOS and Android. This phase consists of several steps such as setting up the environment, setting up the skeleton, the login phase, chat and video call features etc. All features will be further elaborated in the Mobile Application Development WBS subsection below.

- Avatar Model Integration: This phase consists of integrating the avatar functionality to the application. This step includes implementing the face recognition feature in order to extrapolate it to the face of the avatar among other things. Details are provided below.

4.3.1 Report Creation

As a part of the requirements of the course CS 491/492 there are 3 different reports
that are necessary to be delivered to our supervisor and the jury members. For three different

reports 3 different work packages are required. The illustration of the work packages is shown Below:

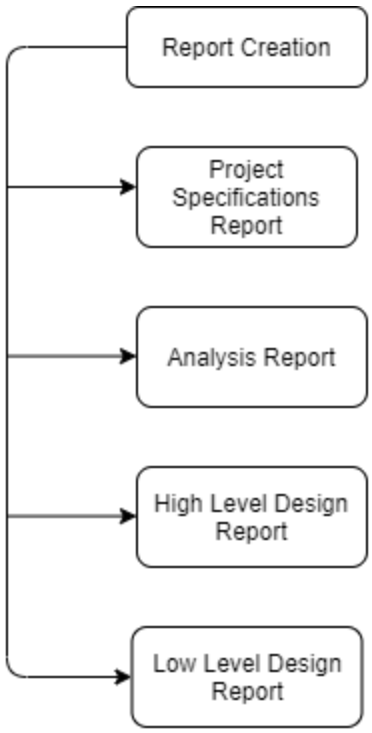

Figure 21 - WBS of Report Creation

Project Specification Report:

WP 1: Writing Specifications Report			
Start Date: Week 1 End Date: Week 4			
Leader:	Emil Alizada	Members Involved:	All Members
Objectives: The project specifications report gives a title to and brief description of the proposed project. The initial project requirements are also identified. This document must also contain a section that discusses the project constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			
Tasks: 1: Work to be done is to be distributed among all members. 2: All the work is to be written. 3: The work is proofread by all members in order to search for mistakes and to add upon the details.			
Deliverables:			

D1: Project Specifications Report. D2: Project Website. D3: Innovation Expert evaluation form.

Analysis Report:

WP 2: Writing Analysis Report			
Start Date: Week 4 End Date: Week 9			
Leader:	Zeynep Berfin Gökalp	Members Involved:	All Members
Objectives: Analysis Document of a project is produced as a result of the analysis of the system to be developed. The requirements specifications provided by the customer are analyzed carefully and this document is produced as a result of a thorough analysis of the system at hand.			
Tasks: 1: Work to be done is to be distributed among all members. 2: All the work is to be written. 3: The work is proofread by all members in order to search for mistakes and to add upon the details.			
Deliverables: D1: Project Analysis Report. D2: Report Uploaded on the website.			

High Level Design Report:

WP 3: High-Level Design Report			
Start Date: Week 9 End Date: Week 14			
Leader:	Umer Shamaan	Members Involved:	All Members
Objectives: The report will be used to show the functionalities of the system along with class diagrams.			

Tasks: 1: Work to be done is to be distributed among all members. 2: All the work is to be written. 3: The work is proofread by all members in order to search for mistakes and to add upon the details.
Deliverables: D1: Project High-Level Design Report. D2: The High-Level Design Report is uploaded to the website.

Low Level Design Report:

WP 4: Low-Level Design Report			
Start Date: Week 15 (Next Semester) End Date: Week 28 (End of Semester)			
Leader:	Taha Khurram	Members Involved:	All Members
Objectives: The Low-Level Design report will be used to specify the finalised implementation details to the supervisor and jury members.			
Tasks: 1: Work to be done is to be distributed among all members. 2: All the work is to be written. 3: The work is proofread by all members in order to search for mistakes and to add upon the details.			
Deliverables: D1: Project Low-Level Design Report. D2: The Low-Level Design Report is uploaded to the website.			

4.3.2 Mobile Application Development

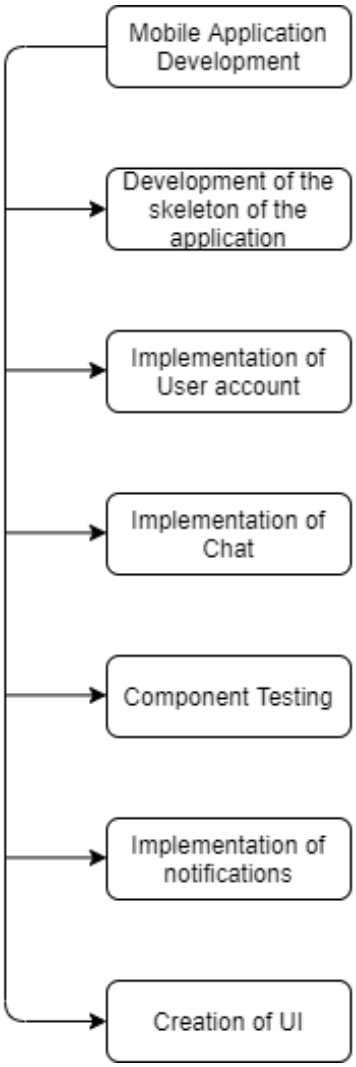

Figure 22 - WBS of Mobile Application Development

Development of the skeleton of the application:

WP 5: Development of the skeleton of the application			
Start Date: Week 10 End Date: Week 12			
Leader:	Verdiyev Zulfugar	Members Involved:	Verdiyev Zulfugar Umer Shamaan Taha Khurram
Objectives: The Skeleton for the mobile application is to be created in order for ease of coding before the demo and in the implementation of the project.			

Tasks: 1: Set up the development environment for the application. 2: Github repositories are made. 3: Create a very basic UI. 4: Setting up the database.
Deliverables: D1: Bare minimum skeleton code ready for further coding.

Implementation of User account:

WP 6: Implementation of User Accounts			
Start Date: Week 12 End Date: Week 14			
Leader:	Zeynep Berfin Gökalp	Members Involved:	Zeynep Berfin Gökalp Emil Alizada
Objectives: The Application allows for a basic sign up and login activity which leads the user to the homepage.			
Tasks: 1: Create the signup feature. 2: Create the login feature. 3: Implement account recovery. 4: Implement additional security measures.			
Deliverables: D1: Application allows for user login and signup.			

Implementation of Chat:

WP 7: Implementation of Chat

Start Date: Week 13 End Date: Week 16			
Leader:	Taha Khurram	Members Involved:	Taha Khurram Umer Shaaman Verdiyev Zulfugar
Objectives: The User will be able to send text, and video messages to his/her contacts. The user will also be able to view the video messages received.			
Tasks: 1: Implement basic text messaging features. 2: Implement video messaging features. 3: Decryption and encryption of messages. 4: Extracting Facial expressions from the video messages sent.			
Deliverables: D1: A basic WhatsApp-esque app allowing for both text and video messaging. D2: The facial expressions from the user are extracted to be used in the AR implementation.			

Component Testing:

WP 8: Component Testing			
Start Date: Week 14 End Date: Week 28			
Leader:	Taha Khurram	Members Involved:	All Members
Objectives: The project members will be testing and debugging their code throughout the work phases, each member will be responsible for testing their own code. The group leader will later merge the codes for final testing along with the group members input.			
Tasks: 1: Each member tests the code they have written. 2: The code is merged. 3: The merged code is tested and debugged.			
Deliverables:			

D1: The final application is created without any bugs.

Implementation of notifications:

WP 9: Implementation of Notifications			
Start Date: Week 16 End Date: Week 17			
Leader:	Verdiyev Zulfugar	Members Involved:	Verdiyev Zulfugar Emil Alizada
Objectives: The application will be able to show notifications regarding messages and friend requests received.			
Tasks: 1: Create notifications for friend requests. 2: Create notifications for messages. 3: Create UI for notifications.			
Deliverables: D1: Application displays notifications for messages received.			

Creation of UI:

WP 10: Creation of UI			
Start Date: Week 17 End Date: Week 19			
Leader:	Umer Shamaan	Members Involved:	Umer Shamaan Verdiyev Zulfugar Zeynep Berfin Gökalp
Objectives: The UI for the application will be done, along with the basic beautification of the already existing UI.			
Tasks: 1: Creation of Icons and logo.			

2: Creating a consistent color scheme for the interface. 3: Basic components' animation.
Deliverables: D1: The application UI is ready.

4.3.3 Avatar Model Integration

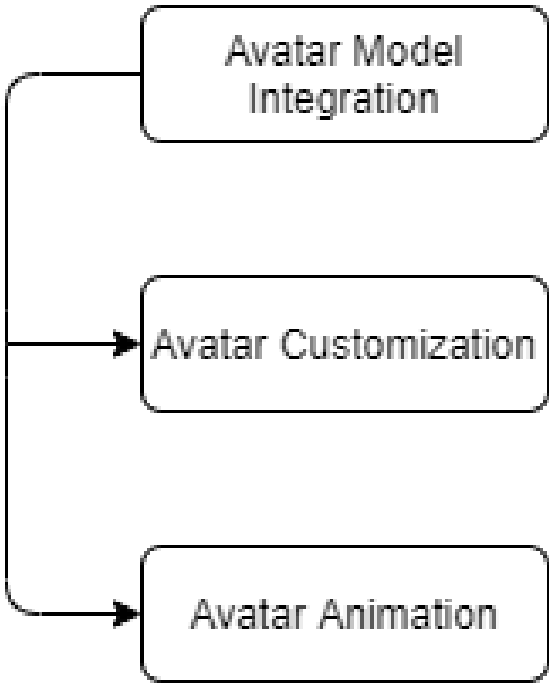

Figure 23 - The WBS for Avatar Model Integration

Avatar Customization:

WP 11: Avatar Customization			
Start Date: Week 17 End Date: Week 20			
Leader:	Emil Alizada	Members Involved:	Emil Alizada Taha Khurram
Objectives: To implement the feature for the user to select and edit the avatar according to their choosing.			

Tasks: 1: Import several pre-made 3d AR avatars for the users to choose. 2: Implement avatar customization to enable users to select color schemes and different hair and clothes styles. 3: Create custom animations for the avatar to perform. 4: Implement the feature to allow the user to drag the avatar across the screen and change its size.
Deliverables: D1: Support for avatar selection and customization, pose animation and change its position and size.

Avatar Animation:

WP 12: Avatar Animation			
Start Date: Week 20 End Date: Week 24			
Leader:	Taha Khurram	Members Involved:	Taha Khurram Umer Shamaan Verdiyev Zulfugar
Objectives: To make the avatar actually mimic the user's facial expression and move the lips in sync with the words spoken by the sender.			
Tasks: 1: Extrapolate the facial data analyzed from the video recorder on the avatar. 2: Stable surface locating mechanism to place the avatar.			
Deliverables: D1: The final application.			

4.3.4 The Gantt Chart

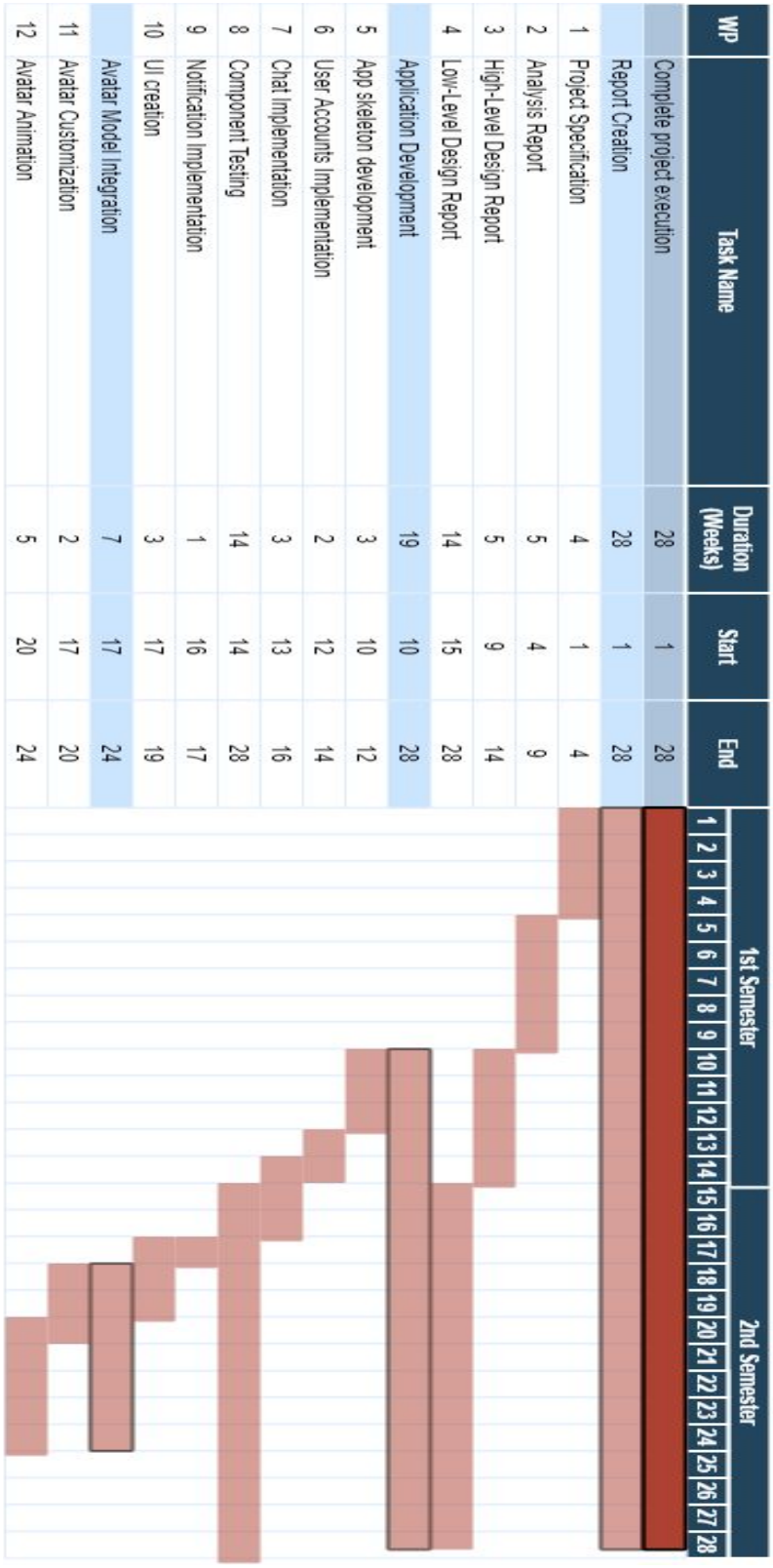

Figure 24 - The Gantt Chart for Facera

4.3.5 The Final WBS diagram

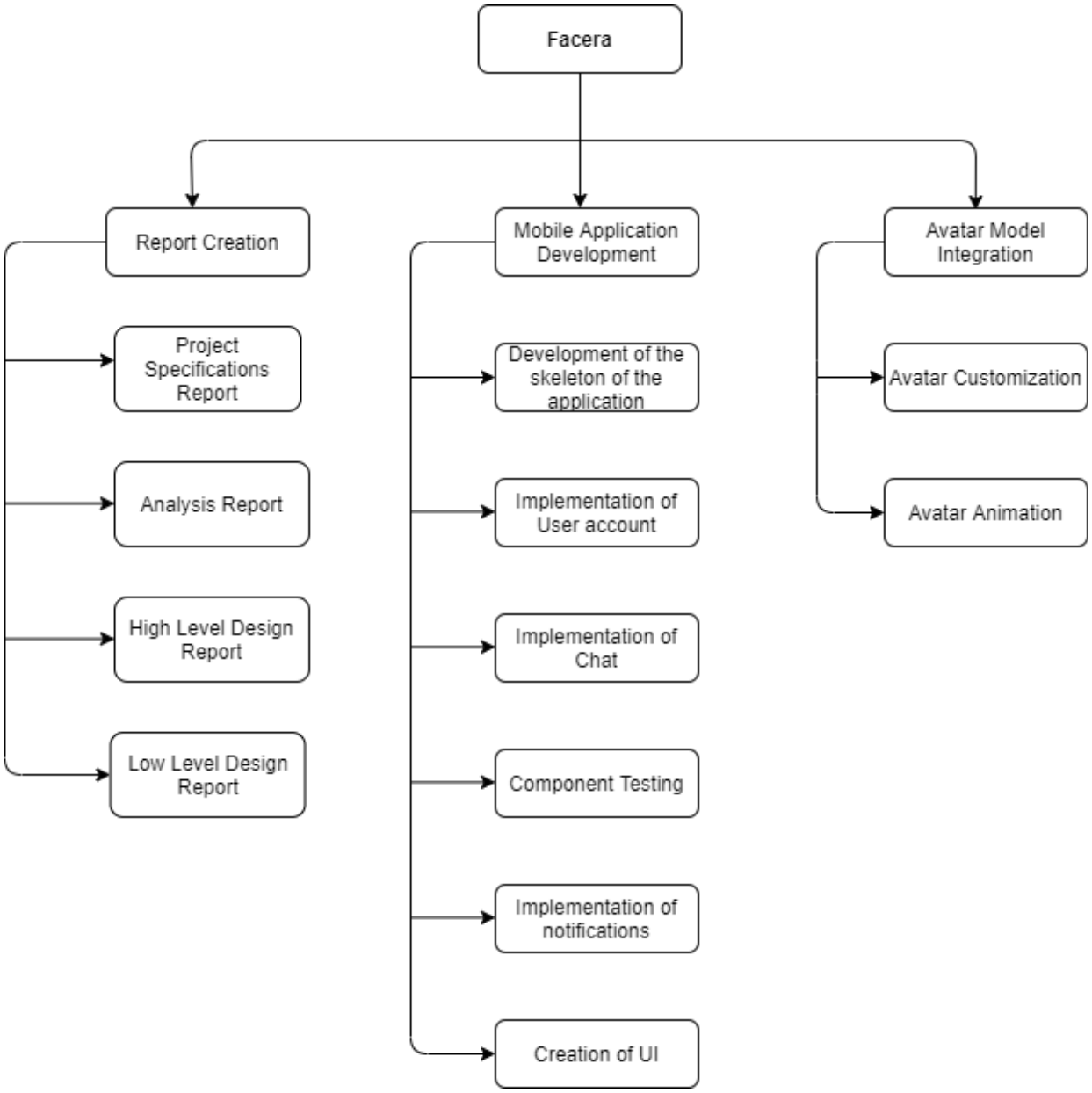

Figure 25 - Final WBS of Facera showing all components

4.4. Ensuring Proper Teamwork

The project splitted into work tasks to let all of the team members to be a leader in those project tasks. The necessary tasks will be maintained considering the deadlines, we have formed small teams for these packages and also we have assigned and are going to review these tasks respectively. Large parts of work packages are separated according to weight of the work, to have a fair workload. Furthermore, if an individual's work is completed, the individual will also help other team members to gain more momentum in progress and a proper equal teamwork.

The code base and process of the application will be managed in a suitable way. Thus, we are going to be using Github repositories, which all of the project members will contribute. The commitments of the team members will also be monitored by the supervisor, by granting necessary permissions to her.

4.5. Ethics and Professional Responsibilities

We have determined following issues regarding background research about ethical issues in software development:

- In terms of privacy, none of the offered qualifications request storage of any personal data except the application will keep only the contact information. The data kept will not be shared to any third party without users' permission. Furthermore, the user data that is going to be kept in the application will be stored and processed within the domain of GDPR.
- Terms and Conditions Agreement will be provided during the registration process.
- Open-source option will be used to avoid copyright problems.

4.6. Planning for New Knowledge and Learning Strategies

The platform that will be built involves augmented reality technologies, thus we are required to learn AR techniques. Furthermore, this domain also contains some computer vision methods we need to make further research about computer vision, too. Regarding all these aspects, there are several learning methodologies that we are required to use. The strategies mostly depend on online learning. Literature review and research regarding this domain will also be made to get information about the technologies that we are going to use. In addition, we also need to search for existing implementations; Github repositories which includes computer vision and AR, leads us for selecting the suitable libraries, frameworks etc. for the project. We will also take advantage of Stack Overflow, if we encounter any bugs or issues.

5. References

[1]“Google Cloud,” *Google*. [Online]. Available: https://cloud.google.com/. [Accessed: 12-Oct-2020].

[2] “Android operating system share worldwide by OS version from 2013 to 2020*”. [Online}. Available:https://www.statista.com/statistics/271774/share-of-android-platforms-on-mobile-devices-with-android-os/#:~:text=Pie%209.0%20was%20the%20most,smartphone%20devices%20as%20of%20then. [Accessed: 20-Oct-2020].

[3] “IEEE Code of Ethics,”. [Online]. Available: https://www.ieee.org/about/corporate/governance/p7-8.html. [Accessed: 19-Oct-2020].