

Implementation Details of a New Social Media Platform - Overlook

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Abstract—In the last two decades, a significant part of human interactions moved to digital social networks. Even with the already well-established social media platforms, new networks arise and are adopted thanks to their innovative and specific features. We propose Overlook, a new social media platform which aims to connect people with the same interests and passions through facilitating thematic event organization and many more. In this paper, we are focused on presenting the implementation details of the proposed social network platform. Overlook offers the most popular functionalities of well-established similar solutions. Clients can access the platform using all major environments: web browsers, Android and iOS. Our implementation is scalable and is ready to support a huge burst in user count, if such a striking event should occur.

Index Terms—Social Media, Cross-platform, Software Development.

I. INTRODUCTION

In less than a generation, social networks have evolved from a simple method of communication to a complex tool that allows individuals from all ethnic and social backgrounds to share experiences and form communities based on common interests.

The term “social network” traces its roots before the invention of the internet, more precisely May 24th 1844, when a series of “dots and lines” were successfully transmitted from Baltimore to Washington D.C, but the first social network that corresponds with modern standards was launched in 1997. Named SixDegrees, this ambitious project would pave the way for humans to interact online [1].

A couple of years later, Friendster follows the steps of its predecessor and launches the concept of “Friend Circle” promoting the idea that a rich community can only exist between people that share the same passions or goals. One year after its emergence, Friendster attracts over three million users and huge interest from investors [1, 2].

Even with the huge and prevailing social networks, there is still potential for new social networks to rise. This conclusion can be retrieved from the social network users’ count dynamics from the last couple of years. Therefore, proposing a new social network using the basic features and with a new approach might prove to be worth pursuing.

Before starting the actual implementation of the project, we needed to conduct a few studies about different topics, like: cross-platform application development, social

networks and application scalability.

The rest of the paper is organized as follows. Chapter II is reserved for presenting the context of social networks and their evolution. Then, we present in Chapter III the technologies and frameworks that can be used for obtaining a cross-platform application. Chapter IV briefly enumerates implemented functionalities. The application architecture is presented in chapter V. Then, different implementation details are presented in chapter VI. Here we explain some of the main flows and also discuss testing results. Chapter VII is used to present our conclusions and future work and finally, Annex A presents three screenshots of the application’s main window.

II. SOCIAL MEDIA CONTEXT

The year 2004 marks the end for a lot of small social network platforms with the launch of Facebook, a social network that would take the world by storm. It all began with a couple of Harvard students wanting to connect the campus and in just two years this innovative platform succeeded in bringing more than six million daily users [3].

With the technological advancement that occurred in the last years regarding the area of mobile devices, the impact of social networks has risen to an all-time high. Although social platforms tend to have their own set of features that distinguish them, it can be observed that the regular user has remarkably predictable behavior when it comes to the way one interacts online. Studies[4] reveal that almost half of the time spent on social networks is dedicated to liking or favoring content, with sharing occupying the second place.

FEATURES PEOPLE USE MOST ON SOCIAL MEDIA APPS

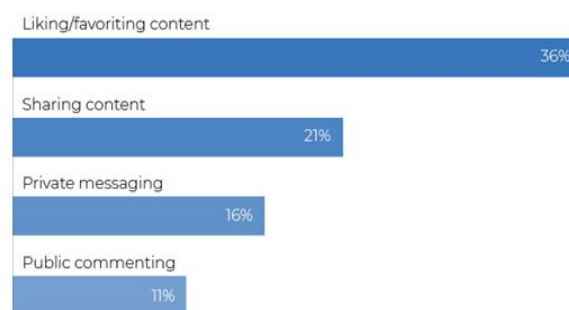


Figure 1. Most popular social media features [4]

With this in mind, it is safe to declare that the regular user prefers to consume online content generated within the social network rather than creating his/her own.

These platforms created with the purpose of connecting individuals helped different communities by allowing users to meet different individuals who share the same goals or

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hobbies regardless of the physical distance between them. Regarding politics, studies show that more and more individuals choose to use social networks as their main way of keeping up to date in this area of interest. [5]

Local and global companies alike have experienced some form of advancement too, since the launch of Facebook. The access to a broader public just a click away has determined business owners to resort to ad campaigns in the hopes of transforming as many users as possible into customers. [5]

Although the advantages are not few, there are also a series of disadvantages that should be taken into consideration when first joining a new social platform. Firstly, developers are designing these apps with the purpose of captivating the user's attention for as long as possible regardless of the fact that this can lead to addiction [6]. The clever implementation of likes received for posting an image creates a psychological reward system that may trap the regular user into an infinite cycle of requiring validation in order to sustain his self-esteem.

TABLE I. SOCIAL NETWORKS COMPARISON

Social Network	Advantages	Disadvantages	Monthly users
Facebook	<ul style="list-style-type: none"> - Complex security system for account protection - Friendly interface for all age groups - Continuously evolving 	<ul style="list-style-type: none"> - Ads too prominent - Slowly losing young audience - Millions of accounts that are no longer used 	2.5 billion
Instagram	<ul style="list-style-type: none"> - 71% of users are young individuals - Easy to use - Increased versatility, allows the creation of accounts for all niches 	<ul style="list-style-type: none"> - It is currently impossible to attach links in the image description 	1 billion
Twitter	<ul style="list-style-type: none"> - Allows small and big companies alike to directly communicate with the target audience - High number of influencing individuals present 	<ul style="list-style-type: none"> - The platform can be bloated by complains 	300 million
Snapchat	<ul style="list-style-type: none"> - Allows users to offer much more context to their posts - 78% of the users with ages ranging from 18 to 24 years old use the platform on a daily basis 	<ul style="list-style-type: none"> - Security concerns regarding the live map feature have arose in the past 	300 million
Youtube	<ul style="list-style-type: none"> - High diversity of content posted - Allows the upload of long high quality videos 	<ul style="list-style-type: none"> - New users can have a hard time building an audience 	2 billion
Tiktok	<ul style="list-style-type: none"> - High emphasis on users with ages ranging from 16 to 24 years old - Encourages originality - Available in 75 languages 	<ul style="list-style-type: none"> - The high number of young users can attract malicious individuals 	800 million [7, 8]

With a purpose in mind and a desire to change daily routine, big software companies are carefully evaluating their options from a vast ocean of promising technologies. Although Facebook rules the world of social networks by a wide margin, its main technology is far from being something truly unique or revolutionary. It has a LAMP architecture (Linux, Apache, MySQL and PHP), which is quite interesting at a first glance. The secret formula to allowing 147 thousand images to be uploaded every 60 seconds relies on a built-in compiler that turns PHP into native code. [9]

A former competitor, now partner in Meta, Instagram relies on much more interesting choices when it comes to technologies. It uses Python for the server-side, React.js for the client-side and the highly acclaimed cross-platform framework React Native for the mobile development segment. When compared to Facebook's old fashion choices, Instagram seems to be a pioneer of change, but it should be noted that between their launches there is an 8-year gap. [10]

The year 2022 presents itself with a multitude of social networks for users to choose from, some more popular than others, but all possessing an interesting complexity. It is of no surprise that the first place is taken by the massive company, Facebook, now renamed Meta, followed shortly by Youtube.

Ever since the initial launch in 2004, Facebook has captivated its users from many points of view. The success that Meta now enjoys is the result of a series of intelligent and controlled decisions taken by the founder, Mark Zuckerberg. The first took place in 2007 when Facebook decided to allow developers from outside the company to integrate their API in order to create apps that run directly inside the Facebook engine. The second factor that led to a gigantic success was the implementation of the like button. With the help of it, users could now show their appreciation for images posted by other users. This simple but innovative feature broke the barriers of Facebook and became a key characteristic of any respectable social network.

Another key move that helps Meta extend in other sectors is the acquisition of different companies. Oculus VR, a company that offers state of the art virtual reality applications was purchased in 2014 by Meta in order to have access to the technology required for creating the new virtual social experience of the 21st century.

Although not all the companies purchased by Meta in the span of the last 10 years present the same innovative and disruptive ideas that Oculus VR presents, it is important to note that even a key feature can help Meta grow. For example, Instagram was incorporated back in 2012 with the sole purpose of allowing Meta engineers to understand how the post sharing feature can cause such a high retention rate among users.

Facebook has become the giant that it is today thanks to a large amount of financing received by angel investors during its first years. This is, nevertheless, a very good start for any business, but it is by no means the only way to gain the capital required in order to propel your startup. Other important and relevant ways to earn the required money are: integrating ads in the application, collecting and selling data, adding Premium features that require a tax to be paid by the user and selling virtual goods, concepts similar to microtransactions found in video games [11].

III. CROSS-PLATFORM APPLICATIONS

Mobile devices and the way websites are developed changes radically from one year to another. Taking into consideration the fact that not even devices from the same producer are always compatible when it comes to applications, the option to produce quality apps that can run on both Android and iOS devices seemed impossible until a few years ago.

TABLE II. THE RECOMMENDED STYLES

Framework	Advantages	Disadvantages	Average cost of development
Ionic	<ul style="list-style-type: none"> - Simple to use - Based on well-known technologies such as Angular, HTML, CSS and Javascript - Compatible with React, Vue, Angular - Support for Cordova plugins - High diversity of UI components - Big and proficient community of developers 	<ul style="list-style-type: none"> - Complex applications require good Angular knowledge - Poor app performance - Difficult navigation due to user interface complexity - Extremely dependent on plugins 	108.857 \$
React Native	<ul style="list-style-type: none"> - Good compatibility with third-party plugins - Responsive interface - Multitude of UI components and APIs - Fast Refresh - Highest contributors number on GitHub 	<ul style="list-style-type: none"> - Not exactly a cross-platform framework - The code is not 100% reusable - Inconsistent updates - Not focused on efficiency when it comes to speed or memory allocation 	20.000 - 50.000 \$
Flutter	<ul style="list-style-type: none"> - Lowest cost of development on the market - The best option for creating an MVP - Easy error correction and detection - Big collection of libraries supported by multiple platforms - Hot Reload function similar to Fast Refresh - Allows real time data manipulation - Growing community - Suitable for big projects and startups alike 	<ul style="list-style-type: none"> - Dart is not a very popular programming language - Steep learning curve - Does not support all devices - Few libraries are compatible for all the platforms supported by Flutter 	5.000 - 75.000 \$
Xamarin	<ul style="list-style-type: none"> - UI tailored to the platform used - Strong community - Allows native libraries and APIs linking 	<ul style="list-style-type: none"> - Bigger apps - Not recommended for apps that required a complex UI/UX - Limited access to open-source libraries - Free use for individuals, but paid for companies 	25.000 \$ [12]

Nowadays, users want a smooth experience regardless of the platform used. This is where the need for a way to develop applications that can run simultaneously on Android, iOS and Web arose.

Although the benefits are quite obvious, there are a lot of disadvantages compared to native app development.

The first and most important disadvantage is the fact that cross-platform applications are a lot slower than native ones because the former requires another layer of abstraction between the app and the used platform [13, 14].

The second disadvantage that deserves to be acknowledged by future developers is the inferior UI/UX that cross-platform frameworks offer. Every widget or html element has a unique structure and given its high complexity, the transposition from a platform native structure to a universal code that can support a large variety of platforms is extremely hard to achieve, if not impossible at times. This is why cross-platform frameworks tend to neglect some aspects present in the original, native, element before creating the universal one which in the long run can lead to a poorer experience for the end user [13, 14].

In the last few years, a lot of clever solutions emerged on the market, but the most popular ones are: Flutter, Ionic and React Native.

IV. OVERLOOK FUNCTIONALITIES

Overlook implements the most popular functionalities of well-known social media networks, namely:

- Available on Android, iOS and Web
- Customizable profile page that holds the user's data and shared images
- Real time messaging system
- Post liking feature
- Text to speech option
- Speech to text option
- Authentication using Google/ Facebook/ Email
- Password encryption
- Friend List feature
- News feed page
- Recent messages page
- Post sharing towards other applications such as Whatsapp or Facebook
- Liked posts page
- Message reaction system
- Comments section for posts
- Interactive real time map
- Option to see nearby users on the map
- Option to hide position on map
- Option to deactivate camera follow
- Option to show current position on map
- Option to create events
- Option to see and participate to events nearby
- Option to see other user's profile

As one can observe from the list above, the platform offers a wide range of features. As one can observe from the list above, the platform offers a wide range of features. From all of these, we would like to emphasize the interactive map feature. It gives any user the ability to check friends on a map.

V. APPLICATION ARCHITECTURE

The Overlook application has five main components: The User platforms, the Overlook Client, the Overlook backend, External Flutter Libraries, the Google Maps API and the Authentication providers.

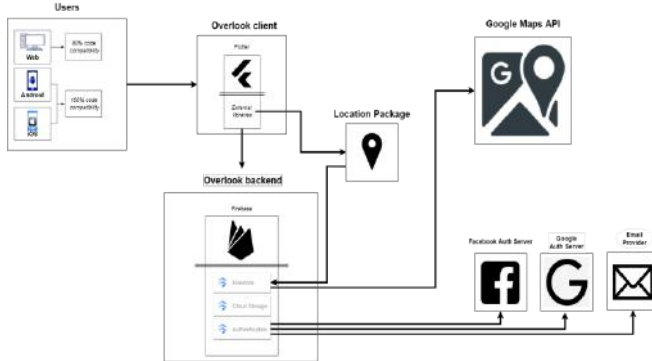


Figure 2. Overlook architecture

In order to facilitate the access to the application, Overlook has support for the three main platforms available on the market, Android, iOS and Web.

The Overlook client was built using the cross-platform framework developed by Google, Flutter. This incredibly powerful tool has three distinctive layers: the Embedder, the Engine and the Framework.

The bottom layer offers a platform specific embedder on which Overlook is executed and with the help of the operating system allows Overlook to have access to different services. The Embedder is written in a programming language tailored to the targeted platform, C++ for Android, Objective-C or Objective-C++ for iOS [15].

The next layer is written in C and C++ and is responsible for inputs, outputs, and network requests such as the render operation for frames.

The first layer is the one that most developers interact directly with. The Flutter Framework is written in Dart and encapsulates all the customizable UI elements, integrated animations, and user-platform recognition systems.

An UI element is called a widget in Flutter and it can take the shape of a button, image, icon and many more. In a broader context all the UI elements that can be found in a specific page form a widget tree. This is an endless array of parent and children widgets that creates the visual aspect of the application [15].

Regardless of its position in the widget tree hierarchy, a widget can be static or dynamic. A static widget never changes its state once it is initialized, but a dynamic widget can change its state if needed [15].

The Overlook backend was designed with the help of Firebase, another fascinating Google product. It is a Backend as a Service platform that allows developers to build apps for iOS, Android or Web.

The three components, from Firebase, used in the Overlook architecture are: Firebase Firestore, Firebase Authentication and Firebase Cloud Storage.

Firebase Firestore allows real time queries and has an impressive scalability. Moreover, it has support for a vast diversity of programming languages such as Java, Javascript, Node.js and Go. It has a hierarchical structure where developers can store data as documents, which in turn can be sorted in collections [16].

Firebase Authentication offers a clear statistics of the authentication providers used and helps developers by cutting steps from the authentication process for some providers such as Google or Email.

No social network could earn this title if there were no images shared between its users. With the purpose of allowing the users to upload images of any size and store them in an easy and appropriate way, the optimal choice for fulfilling this task was Firebase Cloud Storage.

The most important aspect when it comes to the early stages of developing a social network is costs. Although Firebase has some features that may be considered premium, it is completely free to use if there is no massive traffic. In the latter stages of development, the costs for the usage of this platform are not that high either. Firebase charges 0.026\$ for every 1 GB of data stored in the Cloud Storage, 0.18\$ for every 100.000 writing operations in the Firebase Firestore and 0.06\$ for each authentication [17].

Flutter has a large database of libraries that can shorten the production time by a significant value. There were more than 20 external Flutter libraries used in the development process for Overlook, each with its own purpose, Crypto, Path_Provider, Shimmer, Dio and Image_picker to name a few.

In order to achieve the interactive live map feature, an already established geolocation platform was needed. This is where the Google Maps API came in handy by allowing Overlook to reflect the real time changes of the user's location, event sharing and user discovery.

The last component, the Authentication providers, was used in strong correlation to the Authentication component found in Firebase. The user would choose his or hers preferred provider, enter the specific credentials for it and then as soon as the credentials were validated by the provider's server, Firebase Authentication would store the user data in Firebase Firestore (exception for the password in the case of Google and Facebook) and then save the user account type in the Firebase Authentication section.

VI. IMPLEMENTATION DETAILS

The practical objective of the project involves the integration into the application of the most popular options found within the prevailing social networks. A new and interesting feature implemented is the possibility of observing in real time, through a map, the activity of other nearby users. Still, this feature can be blocked by users in order to protect their privacy.

The main technology used in the implementation process of Overlook was Flutter, regardless of the platform specific version of the application. Given the high number of libraries and the well-structured documentation, the steep learning curve of Dart was not as daunting as portrayed in the developer blogs. Although Flutter has a lot of strong points that make the development of cross-platform applications easy, there have been some inconsistencies regarding the libraries used for the integration of the Google Maps API. More precisely, the official library developed by licensed Google personnel does not currently have support for the web platform. This has led to the usage of an unofficial library made by external developers that does not have all the required features implemented in order to have consistency when switching from the mobile version of Overlook to the web platform.

Regarding Firebase, the backend solution for Overlook, the process of custom configuration was a success without too many problems in the long run.

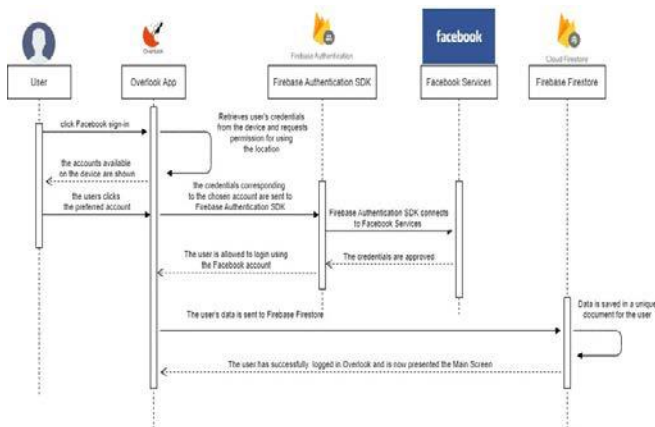


Figure 3. Authentication using Facebook

Fig. 3 presents the actions and steps required for the process of authentication using Facebook as a provider.

Regardless of the platform used, the user clicks the authentication via Facebook button in the bottom corner of the login page, his credentials are verified by the Facebook authentication server and then his data is updated in the Firebase Firestore.

An interesting advantage of using Firebase Firestore is the high scalability that it offers. In the case of a traditional database, the queries scale with the data set, so in the case of a big social network that has millions of active users, the query for a specific user takes as much time as a query for 100.000 users from the same data set. This problem was solved by Firebase Firestore by scaling the queries directly with the result set. In this case, a query that requires a single user document from a data set of 10.000 takes as much time as a query for a data set of 10.000.000 entries [16].

Fig. 4 presents the flow of the application in the case of a user that lands, after the login phase, on the main page and wants to send a message to a friend that he discovers is nearby.

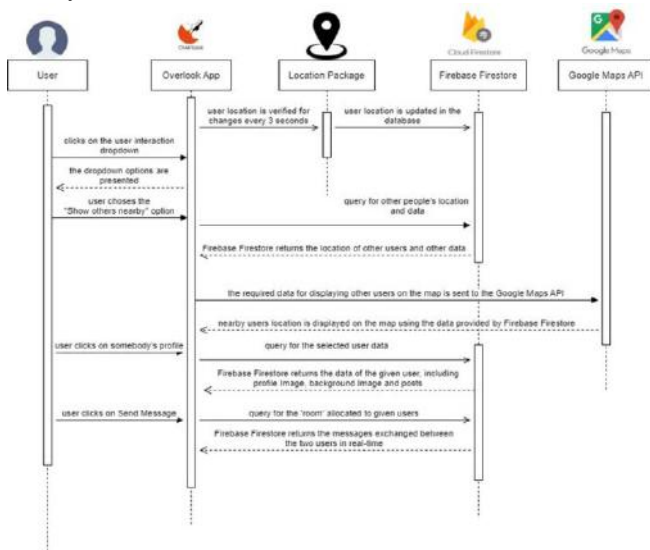


Figure 4. Sending a message to a friend spotted on the map

The user first clicks on the Map options dropdown button, selects the Show Others Nearby options and is prompted with a map full of users nearby. From the crowd of users, he

clicks on his friend, is sent to his profile and then by clicking on the Send Message button he can view the past messages exchanged and send new ones in real time.

The last location of each user is stored in the Firebase Firestore. Using the Location Package, the most recent location of the user device is captured and compared with the one stored in Firestore. In case the two locations differ by a significant margin, the location is updated in the database. In order to display changes to the location in real time, this comparison occurs once every few seconds. The location from the database is then processed by the Overlook client, a specific icon is created using the user profile image, location and his username and that icon is then sent via the Google Maps API in order to be present on the map.

With the purpose of avoiding any unfortunate events where the feature of live location tracking is used with malicious intents, Overlook presents the option to disable the location at any time.

A. Testing Results

In order to detect any possible flaws with the design or the implementation of Overlook, a series of tests were conducted.

The first series of tests were targeted at the authentication using provider's feature. Google and Email proved to work perfectly fine from the beginning, but there were some impediments regarding Facebook as a provider for authentication. Although the mobile version of Overlook was working as expected, when it came to Facebook authentication from the browser the applications seemed to have come across some problems even though no errors or warnings were present. After closer investigation, it was discovered that the environment used for testing the web version did not have a https connection which was required by Facebook as of 2021.

The second series of tests was focused on the real time aspect of the Firebase Firestore. At the early stages of Overlook, the data changes did not reflect without a refresh on the targeted page. In order to achieve the real time feature present in all the major social networks, a special widget name StreamBuilder was required. Its main characteristic is the ability to compare its last save of the data present in the database and the data currently stored in the database. In the case of discrepancies, this widget is capable of rebuilding the widget tree in order to correctly display real time changes in the database.

Now that the display of simple data in real time was possible, the next test required in order to officially proclaim that Overlook is a real time application was the one regarding the live location tracking feature from the interactive map. The position of a user commuting by bus was observed and due to the use of the StreamBuilder his location was visibly changing at set intervals of time.

It was observed that for the message "haay, how are yoi?", the text to speech service succeeds in pronouncing correctly the words that have wrong characters that are similar to the right ones, but fails to pronounce the word "yoi" correctly because the sound for "i" is not close enough to the one for "u". The text to speech service succeeds in offering users a minimal prediction in case of spelling errors [18].

For a prolonged pronunciation of the word “hello” in the sentence “hello how are you?” it can be noticed that the speech to text system does not allow the unnecessary extra characters in words that might emphasize the targeted word. Another problematic aspect of this service is the need to specifically pronounce “question mark” in order for the sentence to end with “?”. It is safe to say that it does not automatically detect whether the sentence is a simple reply or a question.

There have been cases though where the Speech to Text [19] service responded impressively well to the messages received. For example, it succeeds in correctly identifying words even in the case of loud background noises. This can prove extremely beneficial to the modern user that does not always have a quiet room in order to record vocal messages.

A surprisingly interesting feature of the Speech-to-Text service is its ability to create emoticons from words. For a user that says “smiley face” the system is clever enough to send back a relevant emoticon as a response.

VII. CONCLUSION

In order to fully understand how people interact online, it is necessary to analyze the data generated by a social network. To obtain reliable information without resorting to third parties who could provide false or erroneous data, one faces the necessity of implementing its own social network.

In this paper, we propose Overlook - a social media platform implementation available cross-platform and offering the most common functionalities of a social network. Additionally, Overlook offers the user the ability to track on a map the activity of other users.

Along with the application overview and architecture, we also present implementation details and internal flows. The main improvements of the platform would be improvement of the user experience and ability to generate analytics tools for admins to analyze user behavior.

Finally, we can conclude that the application example presented in this paper represents a solid starting point for building a social network that can compete with the companies that dominate this field.

APPENDIX A

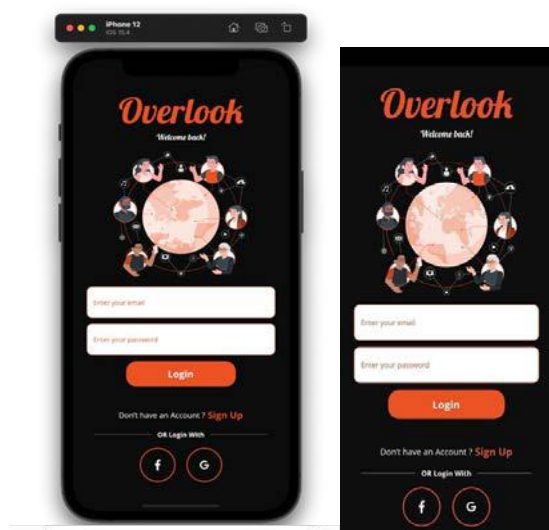


Figure 5. Overlook screenshot for iOS and Android

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