THE CHINESE UNIVERSITY OF HONG KONG

FINAL YEAR PROJECT REPORT (TERM 1)

<< Collaborative Fact Check - Power of the Crowd>>

LYU1902

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0. Abstract

In the era of information explosion, fact-checking is becoming more important for people to distinguish how trustworthy are the online resources. There are numerous fact-check sites available online nowadays, well-known examples include Snopes [1] and PolitiFact [2]. However, most of these fact-check sites mainly focus on political affairs and news of Western countries. There are few fact-check sites target on Hong Kong, for instance, AFP Hong Kong [3]. Nevertheless, these fact-check sites also focus on the news but not on daily issues. Also, these existing fact-check sites seldom allow users to create their own fact-check thread or being involved in the fact-checking process. Instead, they act as an authority to collect news and fact-check through different methods and channels.

In light of that, this project aims to build a fact-checking platform for all types of issues, such as news, daily affairs, rumours etc. Geologically, this project will focus on fact-checking issues in The Chinese University of Hong Kong (CUHK). The methodology of this fact-check platform will also be different as the ordinary approach introduced above. It is believed that crowd intelligence can be used as a collaborative fact-checking approach. In this project, the power of the crowd is applied in the collection and fact-checking of data. With this crowd intelligence approach, this platform is unique in several aspects. It is the only fact-check platform in CUHK, it will be a forum-based fact-check platform, it provides location-based fact-check feature, last but not least, the fact-checking can be done on different types of issues with a higher speed and accuracy.

1. Introduction

1.1 Background

It is always believed that the power of the crowd is a kind of collaborative intelligence that exists everywhere in our daily life. Especially in this digital era, it has become easier to make use of this collaborative intelligence for different aims, ranging from providing information to fact-checking. One famous example is Wikipedia, the online encyclopedia is built on collaborative effort and it is contributing and continuously amending the knowledge in the spirit of fact-checking. It has become a major online resource for the public. Making good use of the power of the crowd can enable effective data collection and accurate fact-check of data.

At the same time, a platform which can centralize the information is considered as a powerful tool which can make lives become more convenient. Without a platform which gathers information, people have to spend time reading different web-pages or using different applications just to retrieve part of the information from each page. The advantage of a centralized platform is that it can give an overall picture for the users by providing information from different sources.

Nowadays, when using most of the mobile applications, real-time location service is frequently requested. In several applications, such as Google Maps, users can receive the latest news nearby by looking at what is happening around them currently through the map.

To conclude, fact-checking, information gathering and location tracking are also powerful and important tools which can improve the quality of lives of users significantly. However, there is not a real-time location-based centralized fact-checking platform in Hong Kong, we will explain it more in detail in the next part: Motivation.

1.2 Motivation

Nowadays, with the ease of the internet, the spread of fake news has become an alarming issue. There is a tremendous amount of online information and it is hard for an individual to analyze the authenticity of it. Starting with our university CUHK, we aim to solve this problem by building a centralized platform to gather different kinds of information on the campus and make use of the power of the crowd to verify the credibility of data. For example, data of real-time traffic conditions nearby can be collected and fact-checked by crowd effort. This approach can efficiently gather information and increase the trustworthiness of data. To sum up, our fact-checking system is based on the data gathered in the platform.

Generally speaking, many applications request for accessing users' locations in the application policy. Location data is important in nowadays. However, most of the users currently are just receiving the update news of the area nearby, they can rarely report a real-time update of their surroundings such as the breakdown of an elevator in a building. Therefore, we start to think about the possibility of working the other way round, that is user report and update the current situation of the area nearby. For CUHK, the area could be very small or rather large. It could be as small as a fallen tree near Lake Ad Excellentiam or as large as the area of whole Campus Circuit East.

After that, we begin to have an idea of integrating a fact-checking system with location service to provide real-time updates to users in CUHK. This solution can solve the current problems in CUHK. The first problem is there is not a platform which allows real-time updates of CUHK happenings, users in CUHK can neither receive nor give out the up-to-date information. The second problem is that there is a spreading of fake news not only in CUHK but also in the city recently, users in CUHK cannot determine whether the piece of information could be trusted or not if they do not receive any comments from others.

1.3 Significance of the project

The project would like to provide a centralized platform to gather the information in CUHK. The replies in every topic must be in a standardized format which is customized for each topic. In such a case, different kinds of data can be collected in an appropriate structured format and users can view the information in a clear manner. We provide different choices of reply format for users to choose from such as radio button, scale and text field. Since the reply format in each post is determined by the author of the post, the replies under the same post will be the same. This also makes CUgo stands out from the other forum app in the market because the format is restricted, it is not loose at all. We create a standardized reply format so to let the users obtain the information in the replies that they need in just a glance.

There are numerous topics being discussed in CUHK every day. This project provides customized topic suggestions for each user according to different criteria such as their indicated interests, browsing history and the topics they saved as favourite. Therefore, users can reach the topics which they might be interested in easily.

This project also emphasizes on location. An interactive map will be implemented to show replies on a location-based topic. Take 'lost and found items in CUHK' as an example, user need not scroll through all the lost and found posts on the Facebook page anymore as they can view all the lost items near the suspected locations on the map. Details such as image and text descriptions will also be shown.

The real-time feature can allow CUHK users to access information faster than before. Be it the post created or the reply submitted, the changes could be shown in CUgo immediately. All changes will be made and saved to the real-time database. The abuse case or report received from other users will be handled immediately.

1.4 Objective

The goal of the entire project is to design and implement a collaborative mobile application for gathering and fact-checking information in a real-time manner. It could be deployed on iOS and android platforms.

We want to establish a platform which is built by collaborative efforts. It can be sustainable since the users give their continued support for CUgo by either creating meaningful posts or submitting valuable replies. Most importantly, fact-checking could be achieved with the help of collaborative intelligence. The rating system is also known as the credibility system could become an important indicator for users to determine the information is trustworthy or not. We hope CUgo would become a trustworthy application that users will go to CUgo if they want to search for any queries about CUHK.

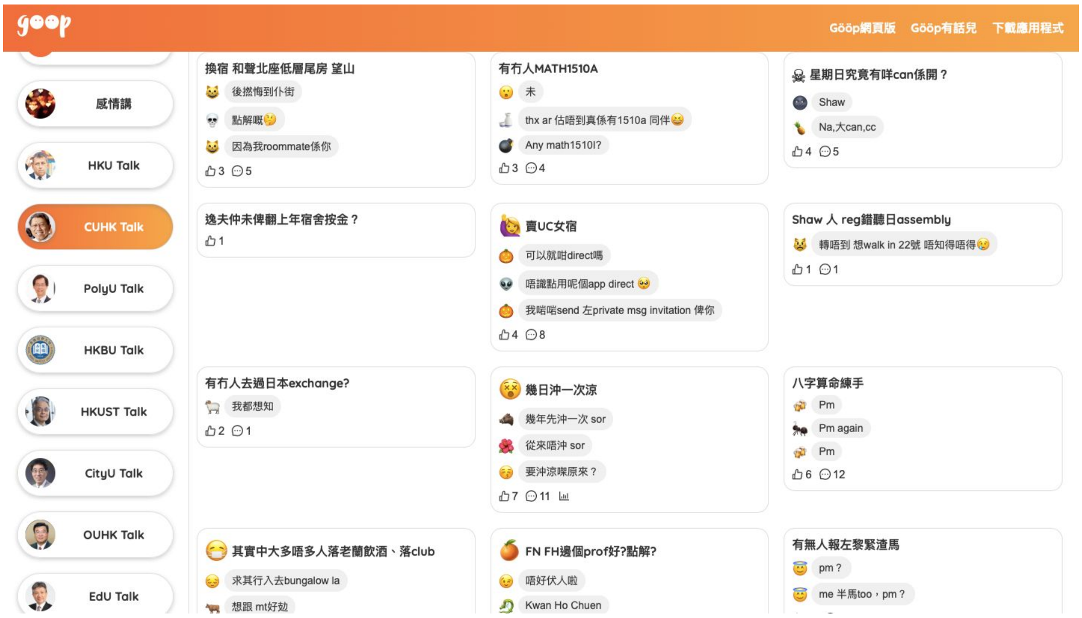
We would like to deploy CUgo on both iOS and Android platforms. Since we use Flutter for development, it allows developing the application on both platforms. Also, we cater the needs for the CUHK users, their mobiles phone are of different platforms. We want to broaden our target user pool therefore we consider launching the application on both platforms.

2. Background Research

2.1 Related Work

2.1.1 Goop

Goop [4] is a forum in which its target users are university undergraduates in Hong Kong. It has both web and mobile versions. In the web version, users could browse through all the topics under different universities, however, the function of posting a comment could only be done in the mobile version. In Goop, topics are shown in the list view with the rating of each topic.



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因為我roommate係你
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逸夫仲未俾翻上年宿舍按金？
👍1

有冇人去過日本exchange?
我都想知
👍2 💬1

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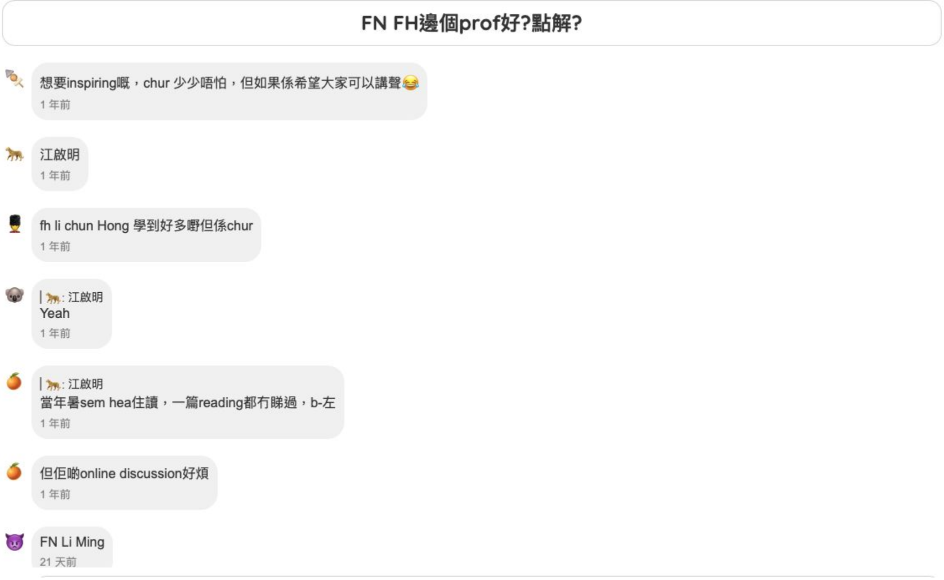
Figure 2.1.1.1 Layout of Goop web version



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1 年前

但佢啲online discussion好煩
1 年前

FN Li Ming
21 天前

Figure 2.1.2.1 Example of a discussion which exchanges information

Students could exchange their views and ideas on different topics, especially for the topics about CUHK. The reply format is loose which allows text, images, videos and GIFs, there is no specific restriction upon the format of commenting in each post.

2.1.2 CUHK Mobile App

CUHK Mobile App is an official mobile application which is developed by CUHK. It provides a lot of useful information for the CUHK campus. The data in there is static and not real-time. Users cannot interactive with the App but just read and browse the information in there.

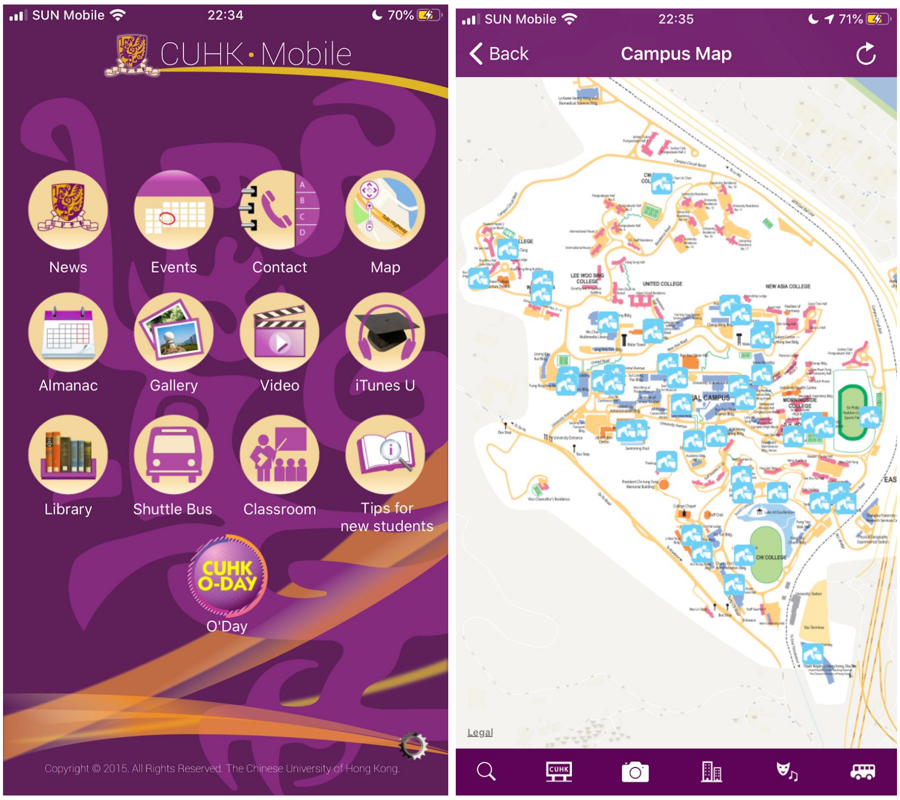
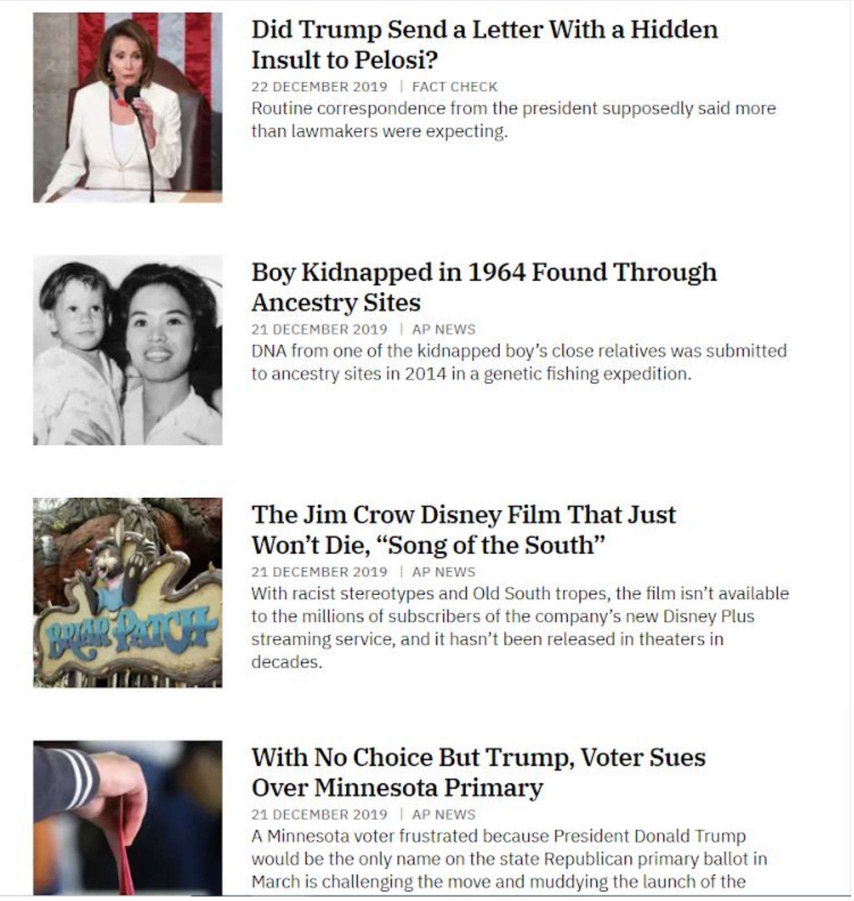


Fig 2.1.2.1, 2.1.2.2 The types of information provided by CUHK, which includes the locations of water dispenser on campus

Apart from showing university almanac and shuttle bus timetable, the app also shows the locations of different facilities on the map. However, no photos are attached and the user may need more time to find where are the dispensers placed exactly.

2.1.3 Snopes

Snopes is a fact-checking platform focusing on Western urban legends, news and political issues. It accepts a wide range of source for fact-check including news, legends and rumours collected from the internet or submitted by users. It is a well-established and comprehensive fact-check site with a long history and high accuracy [5]. The fact-check methodology used for Snopes is to assign their experts to do research on that topic, for example contacting the primary source provider and use non-partisan resources to analyse the topic [6].



Did Trump Send a Letter With a Hidden Insult to Pelosi?

22 DECEMBER 2019 | FACT CHECK

Routine correspondence from the president supposedly said more than lawmakers were expecting.

Boy Kidnapped in 1964 Found Through Ancestry Sites

21 DECEMBER 2019 | AP NEWS

DNA from one of the kidnapped boy's close relatives was submitted to ancestry sites in 2014 in a genetic fishing expedition.

The Jim Crow Disney Film That Just Won't Die, "Song of the South"

21 DECEMBER 2019 | AP NEWS

With racist stereotypes and Old South tropes, the film isn't available to the millions of subscribers of the company's new Disney Plus streaming service, and it hasn't been released in theaters in decades.

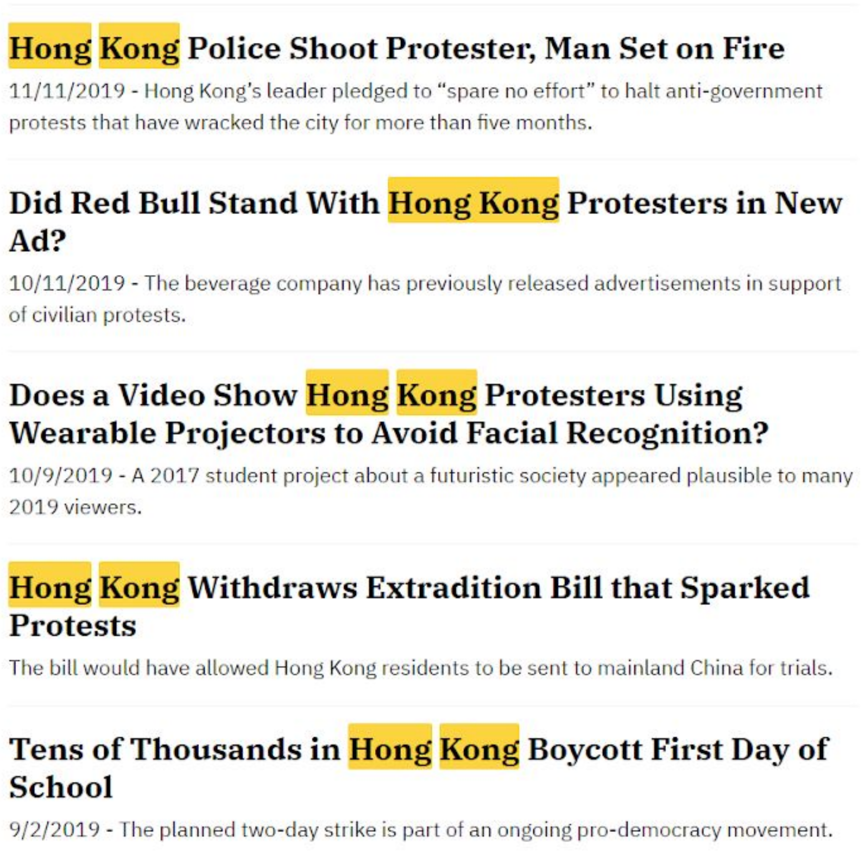
With No Choice But Trump, Voter Sues Over Minnesota Primary

21 DECEMBER 2019 | AP NEWS

A Minnesota voter frustrated because President Donald Trump would be the only name on the state Republican primary ballot in March is challenging the move and muddying the launch of the

2.1.3.1 Snopes homepage

However, Snopes seldom updates issues about Hong Kong, ranging from 1-2 topics per month. Topics about Hong Kong are mostly news and political issues. Some examples are shown below.



Hong Kong Police Shoot Protester, Man Set on Fire

11/11/2019 - Hong Kong's leader pledged to "spare no effort" to halt anti-government protests that have wracked the city for more than five months.

Did Red Bull Stand With Hong Kong Protesters in New Ad?

10/11/2019 - The beverage company has previously released advertisements in support of civilian protests.

Does a Video Show Hong Kong Protesters Using Wearable Projectors to Avoid Facial Recognition?

10/9/2019 - A 2017 student project about a futuristic society appeared plausible to many 2019 viewers.

Hong Kong Withdraws Extradition Bill that Sparked Protests

The bill would have allowed Hong Kong residents to be sent to mainland China for trials.

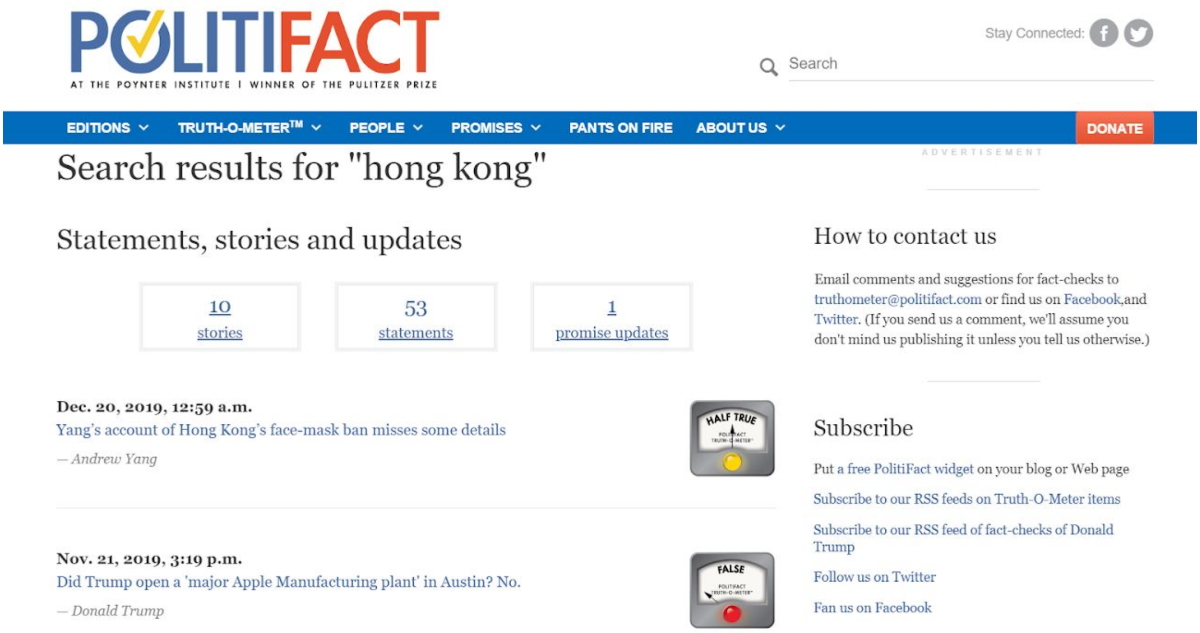
Tens of Thousands in Hong Kong Boycott First Day of School

9/2/2019 - The planned two-day strike is part of an ongoing pro-democracy movement.

2.1.3.2 Search result of "Hong Kong" in Snopes

2.1.4 PolitiFact

PolitiFact is a fact-checking website founded by the Tampa Bay Times. Its main focus is on news and political affairs of the U.S. PolitiFact collects issues for fact-check from news reports, social media, speeches, reader contribution etc., then send their experts to do research through various means such as primary source verifying, searching the online database and referencing previous fact-checked sources [7]. As PolitiFact has its focus on American issues, issues in Hong Kong are seldom being reported.



Search results for "hong kong"

Statements, stories and updates

10 stories | 53 statements | 1 promise updates

Dec. 20, 2019, 12:59 a.m.
Yang's account of Hong Kong's face-mask ban misses some details
— Andrew Yang

Nov. 21, 2019, 3:19 p.m.
Did Trump open a 'major Apple Manufacturing plant' in Austin? No.
— Donald Trump

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Put a free PolitiFact widget on your blog or Web page

Subscribe to our RSS feeds on Truth-O-Meter items

Subscribe to our RSS feed of fact-checks of Donald Trump

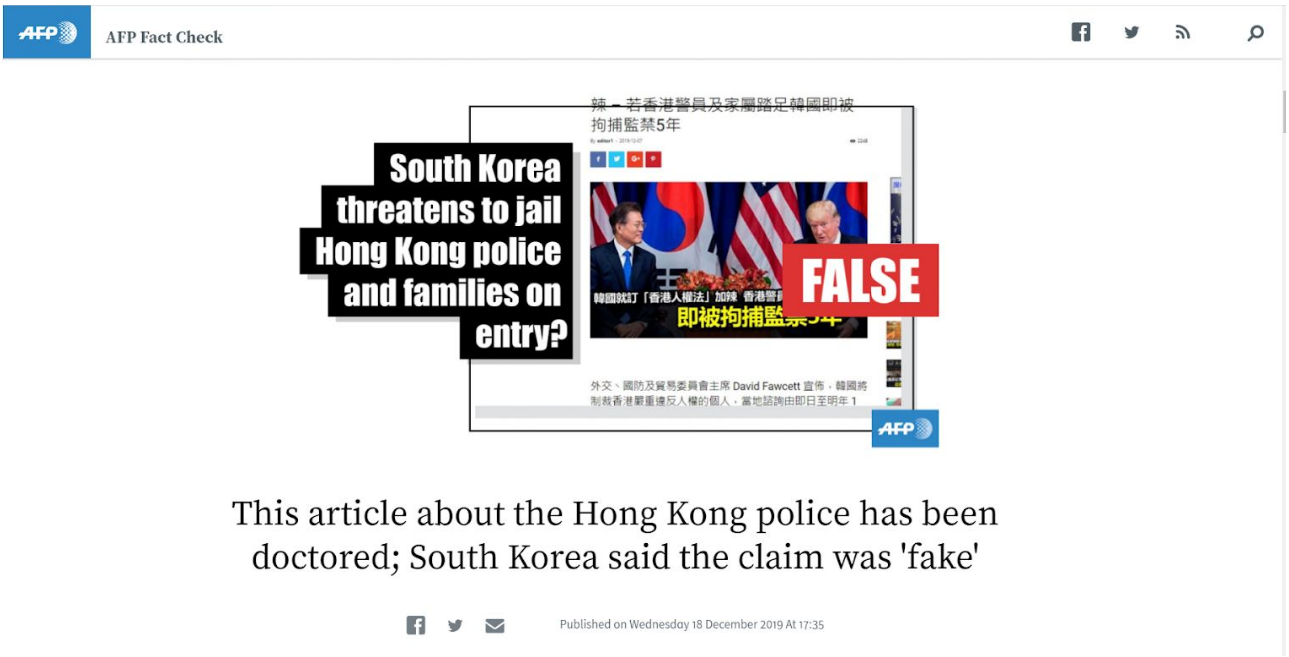
Follow us on Twitter

Fan us on Facebook

2.1.4.1 Search results for “Hong Kong” in PolitiFact

2.1.5 AFP Hong Kong

AFP Hong Kong is operated by the Agence France-Presse (AFP). The AFP fact check Hong Kong is a branch of the AFP fact check focusing on Hong Kong local issues. The experts in AFP Hong Kong fact-check sources from the internet, news stories etc. through different methods such as tracing the source and verifying images and videos [8]. AFP Hong Kong team is still in a developing stage with limited experts, it becomes an obstacle to verify a wide range of issues. The website mainly focuses on verifying news and political rumours recently.


AFP Fact Check

This article about the Hong Kong police has been doctored; South Korea said the claim was 'fake'

Published on Wednesday 18 December 2019 At 17:35

AFP
South Korea threatens to jail Hong Kong police and families on entry?
辣 – 若香港警員及家屬踏足韓國即被拘捕監禁5年
韓國就訂「香港人權法」加辣 香港警員
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外交、國防及貿易委員會主席 David Fawcett 宣佈，韓國將制裁香港嚴重違反人權的個人，當地諮詢由即日至明年 1
AFP

2.1.5.1 AFP Hong Kong homepage

2.1.6 Uniqueness and Superiority of CUgo

CUgo gathers all kinds of information about CUHK. Be it official news or some private information provided by other users, it can also be found in CUgo. Most importantly, after collecting sufficient information from the crowds, fact-checking can be carried out. Users can determine whether that piece of information is trustworthy or not by different parameters such as the rating of that reply. By using CUgo, users become both a viewer who enjoys the fact-checked result and a contributor who helps to provide information.

2.2 Technology Overview

2.2.1 Flutter

Flutter is a development platform targets at building cross-platform mobile applications for both iOS and Android. Dart language is used in which its syntax is similar to C-style languages and it could be trans-compiled into JavaScript. It provides various user interface widgets for these two different platforms respectively according to their own user interface.

There is also a key advantage of Flutter. It provides a live debug function called "hot reload" [9] which users can redeploy the changes made in the code while having the debugging process, this does not require recompilation and redeployment.

Apart from Flutter, React Native is another platform that is popular among software developers. In the first phase of implementation, we chose React Native as well. However, we found that Flutter provides high compatibility with its own database which is called Firebase. By using Firebase, user authentication [10] could be performed easily.

Considering the styling, Flutter definitely does a better job than React Native. The latter only has basic components so users have to put a lot of effort into styling. Fortunately, the former provides adaptive widgets and the user could customize their design easily by using the same widget on both iOS and Android platforms.

Lastly, Flutter ranks higher in the list when it comes to the most wanted framework for developers to develop on it continuously.

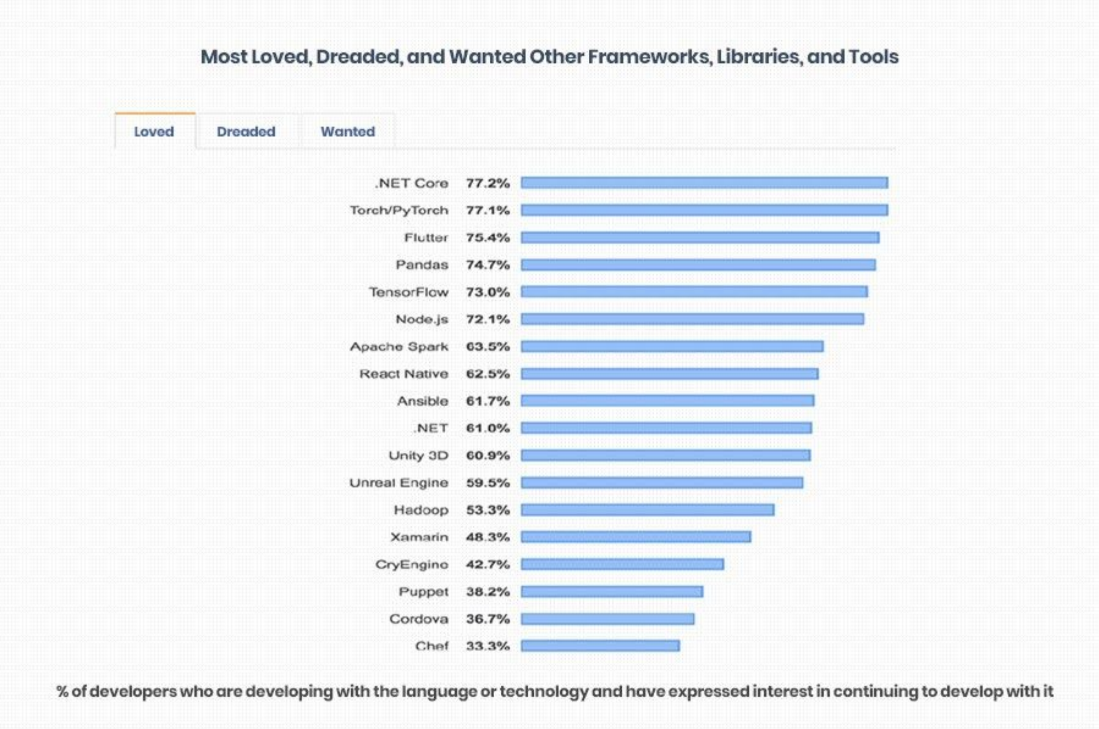


Figure 2.2.1.1 Percentage of developers who express their interest in continuing to develop the framework

2.2.2 Android Studio

Android Studio is developed by Google, it is an official Integrated Development Environment (IDE) for the Android system. Although it is specifically designed for Android development, it still allows iOS simulator [11] to run. Tools from Android Studio help to build mobile applications in a faster and efficient manner.

2.2.3 Firebase

Firebase is a Backend-as-a-Service (BaaS) backend service platform developed by Google. It provides backend services such as realtime database, cloud storage and built-in authentication. As both Flutter and Firebase are developed by Google, they are highly compatible and many built-in functions can be used with ease.

Comparing with AWS, Firebase is younger. fast-growing backend solution. It is more user-friendly to small-scale projects in terms of server management, ready-to-go functionalities and APIs as it avoids complicated setup and server-side management.

In this project, Firebase Realtime Database is employed as the backend database. It is a cloud-hosted NoSQL database that automatically synchronizes all data in realtime to every user. It supports cross-platform application and offline access.

Built-in authentication simplifies the development process of the user authentication system. Cloud Storage is used to store different kinds of data in this project, such as images. Google Analytics [12] is also a featured service provided by Firebase, which enables analyses of user behaviour to enhance application experience.

3. Development

3.1 Feature

3.1.1 Reply Format

The format of replying in each post is determined by the post creator. For example, if he wants the replies below to be a photo together with some description. Then all the replies in that post would be a photo plus some text. Replies are restricted in a specific format requested by post creator could allow the creator himself and other users to browse the post and retrieve information in a more systematic and clear way.

3.1.2 Interactive Map

The posts which are location-based would be shown in map view. The location appears as a flag marked on the map, by clicking it, a window pops up and further details are shown.

‘Lost and found’ map is a featured function of the app. When an item is reported to be lost by the user, a flag will be placed on the reported location. Fortunately, if another user finds that item, they can contact each other by using the details shown on the map. Upon successful recovery, the item will be disappeared on the map.

3.1.3 Rating/ Credibility

A user could give a rating to posts, either a thumbs up or thumbs down. Other users could have a picture on whether the post is useful or not by checking the rating of the post. Post with high ratings would be considered as a popular and hot topic that would be pushed to the top of the page so that more users could take a look at it.

3.1.4 Privacy

Each user is anonymous while using the app. Upon registering the app, email verification is required. However, once the identity of the user is verified to be real and valid, the information of the users would not be disclosed to other users. The user could interact with each other by using his or her username. Anonymous user system allows users to comment and discuss as freely as possible without being traced by others.

If the user refuses to allow the app to access the location services, part of the functions on the map would be disabled. For example, the user cannot locate the lost and found items nearby without turning on the location services for the app.

3.2 Functionality

Functions	Description
Search hashtags/keywords in posts	Users can search for desired posts by inputting single or multiple keywords on a search bar after clicking the search button at the bottom navigation bar. Hashtag function is added in each post for filtering out the unwanted posts when the user searches for certain keywords.
Create a post	Users can create a post by clicking the add button at the bottom navigation bar. The application will redirect to the create post page to allow users to input the post's title, content, hashtag and reply format.
Customize reply format	User needs to specify a customized reply format when creating a new post. The application provides various components such as text field, radio button, scroll bar, date, image and location. Users can assemble the reply format by simply drag-and-drop these components.

Reply a post	Users can reply to a post by clicking the reply button on the top right corner inside the post. Users will be redirected to a reply page where the user needs to input according to the standardized reply format of that post.
Browse a post	Posts are classified into categories. Users can browse posts from different categories. Replies of the post will be displayed in the standardized format of that post.
Vote for authenticity	There is an authenticity voting system for each topic and reply. Users can vote for the authenticity of that topic or reply according to their own knowing. This makes use of the collaborative effort and crowd wisdom to determine the authenticity of the source.
Recommend Topic	The “For You” category provides a list of recommended posts tailor-made for each user. System analysis user’s indicated interest, browse history and favourite post to generate the set of recommended posts.

Add to my favourite	Users can add posts into My Favourite by clicking the heart button on each post. Users can always refer to their list of favourite posts in the “My Favourite” inside side menu.

3.3 Architecture Design

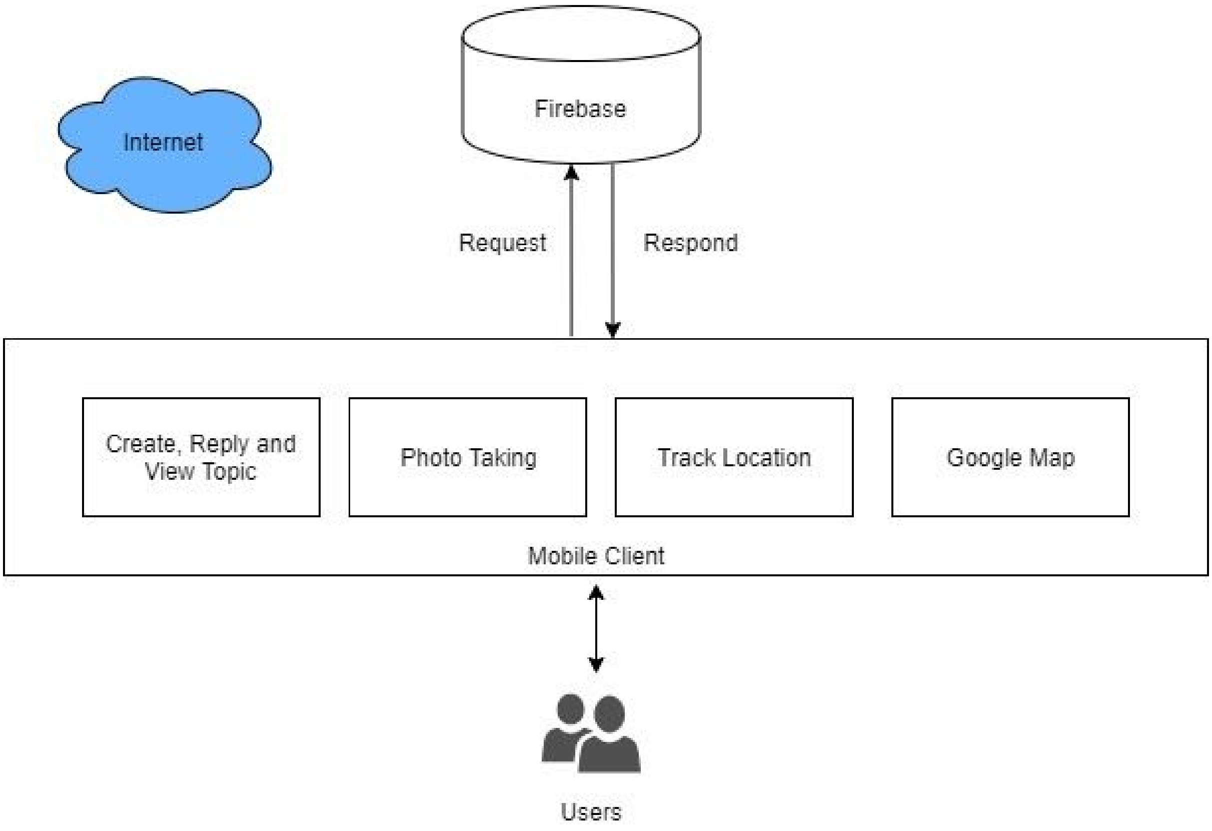


Fig. 3.3.1 Architecture Design Diagram

CUgo consists of two main part, the mobile client and the database. Main functions such as create, reply and view topics require communication between database and mobile client. Because CUgo is a forum-like fact check platform, data are expected to be updated frequently, users are expected to be connected to the internet most of the time for synchronization of data. Meanwhile, Firebase also supports offline data persistence by caching the data from the database and synchronizes the data once connected [13].

The application also makes use of the photo-taking function in mobile client to upload images as proof in related topics for the fact check purpose.

One of the features of CUgo is location-based fact check, with the use of Google Map and track location function in mobile client, it enables the application to show nearby replies and pin a new reply on the map on a topic.

3.4 Use Case Diagram

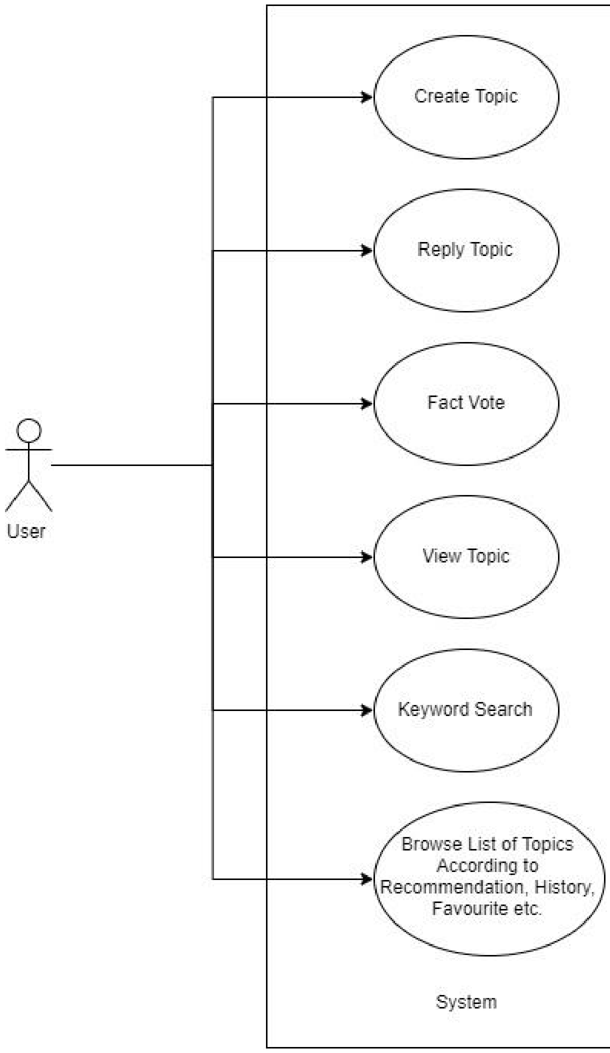

Create Topic
Reply Topic
Fact Vote
View Topic
Keyword Search
Browse List of Topics According to Recommendation, History, Favourite etc.
System
User

Fig. 3.4.1 Use Case Diagram

There are several main functionalities in CUgo, such as create, view and reply topics, fact vote for the credibility of a reply, perform keyword searching and browse the list of topics according to different criteria like categories, recommendation, recent history, my favourite etc. These functionalities act as basic components to build up the entire fact-check platform.

3.5 Data Flow Diagram

3.5.1 Authentication and Profile System

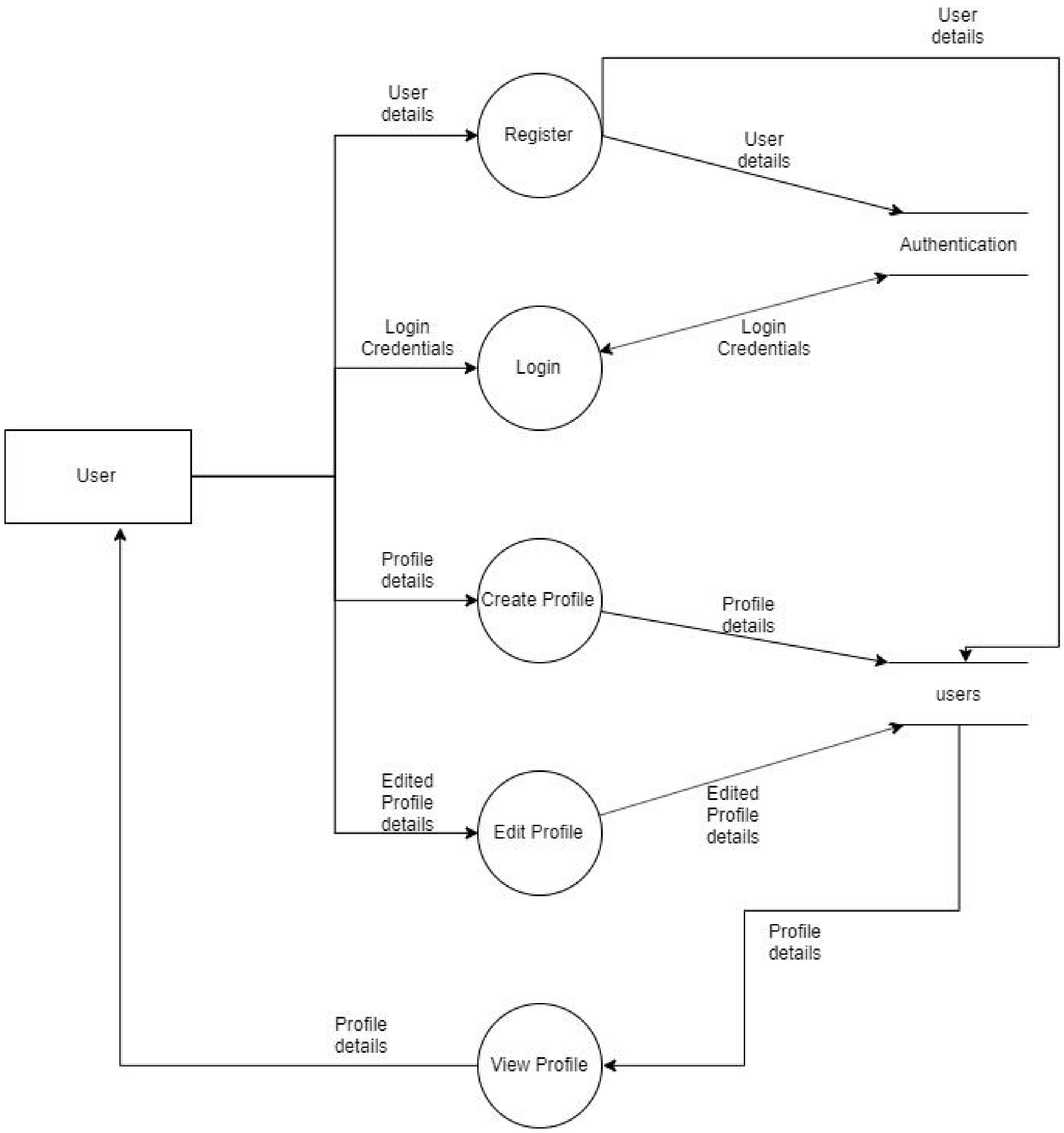


Fig. 3.5.1.1 Authentication and profile system data flow diagram

This diagram demonstrates the data flow of authentication and profile system. It is worth mentioning that authentication database is separated from user database as the application makes use of the built-in authentication system of Firebase which will automatically store the login information in an authentication database, which is separated from all other databases.

1. Register

   Register function requires the user to input user details such as username, email and password. After passing them to the authentication database and passing the email authentication step, a new account is set up. User details such as username and email will also be sent to users database to set up a new user profile.

2. Login

   Login function requires the user to input login credentials such as username and password. This information will be passed to the authentication database for authentication check, the result will be passed back indicating whether the login is successful or not.

3. Create a Profile

   Create a Profile is performed after a successful registration. User needs to input profile details such as the topics interested. Data will be stored in the users database.

4. Edit Profile

   Edit Profile allows the user to update user profile information into the users database. Users are allowed to change their username and their interests declared.

5. View Profile

   In view profile function, profile details will be retrieved from users database.

3.5.2 Main system

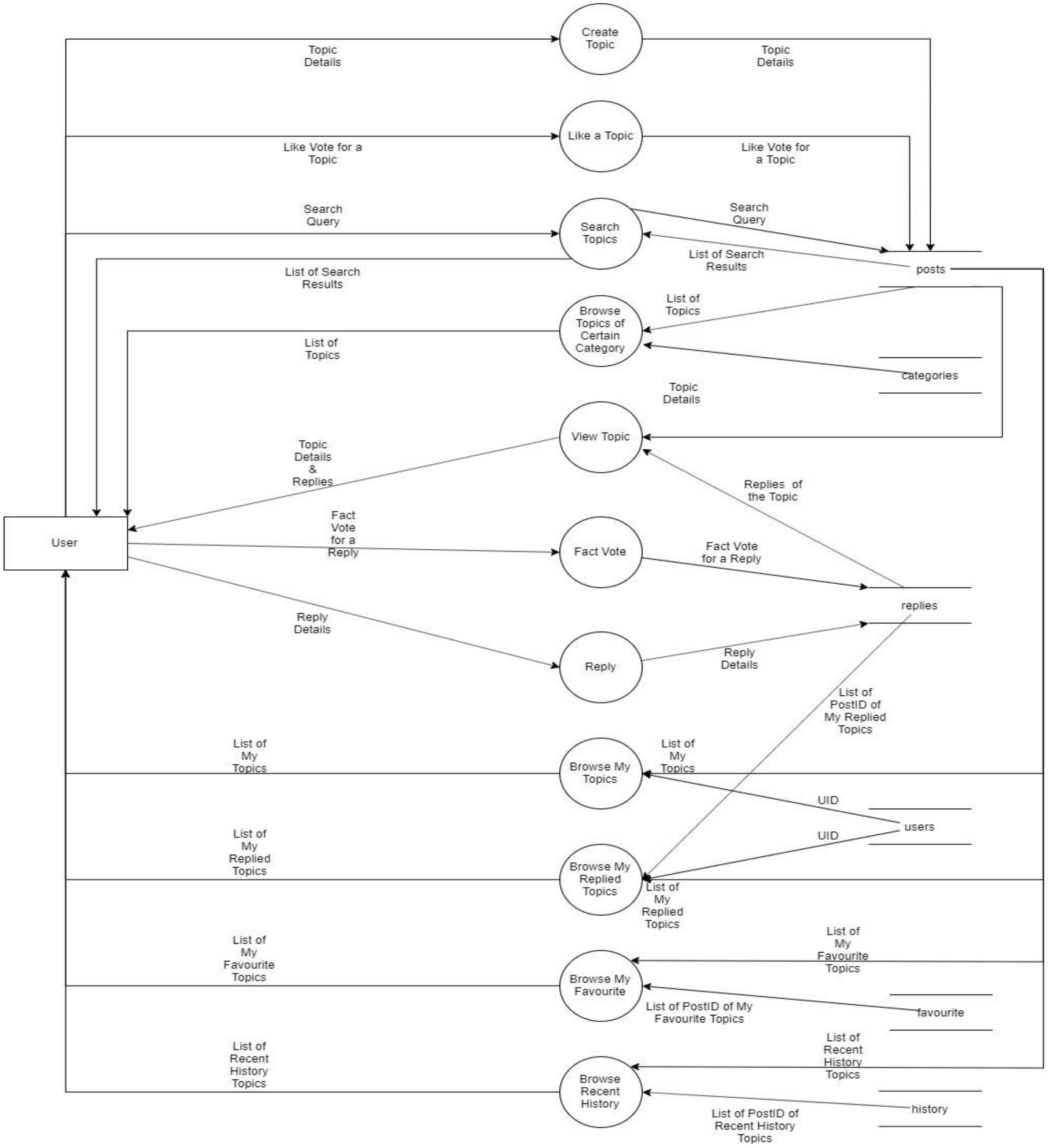


Fig 3.5.2.1 Main system data flow diagram

This diagram is to show the data flow in the main system of CUgo. There are six databases used in total. The main system is basically classified into eleven main functions.

1. Create a Topic

   When a user creates a new topic, topic details input by the user such as topic title, body, reply format and other automatically generated data such as author, create time will be passed to posts database.

2. Like a Topic

   User can like or dislike a topic. The vote count will be stored and updated in the posts database.

3. Search Topics

   User can perform a keyword search on the topic title. A search query will be passed to posts database. After performing the search query, a list of search results will be passed back.

4. Browse Topics of Certain Category

   When the user browses topics on a certain category, the query will be done between categories database and posts database to retrieve the list of topics in that category.

5. View Topic

   When a user views a topic, topics details from posts database and replies of that topic from replies database will be shown.

6. Fact Vote

   User can vote for each reply by clicking agree or disagree button. The vote will then be stored and updated in replies database. This function serves as an important component for the fact check feature.

7. Reply

   User inputs along with generated information such as author, reply time will be passed into replies database.

8. Browse My Topics

   User can browse the topics he/she created in this function. The query will be done between users database and posts database by matching the authorID with UID.

9. Browse My Replied Topics

   User can browse the topics he/she replied in this function. The query will be done between users database and replies database by matching the authorID of replies with UID to generate a list of postID. The list of postID will be used to retrieve replied topics from posts database.

10. Browse My Favourite

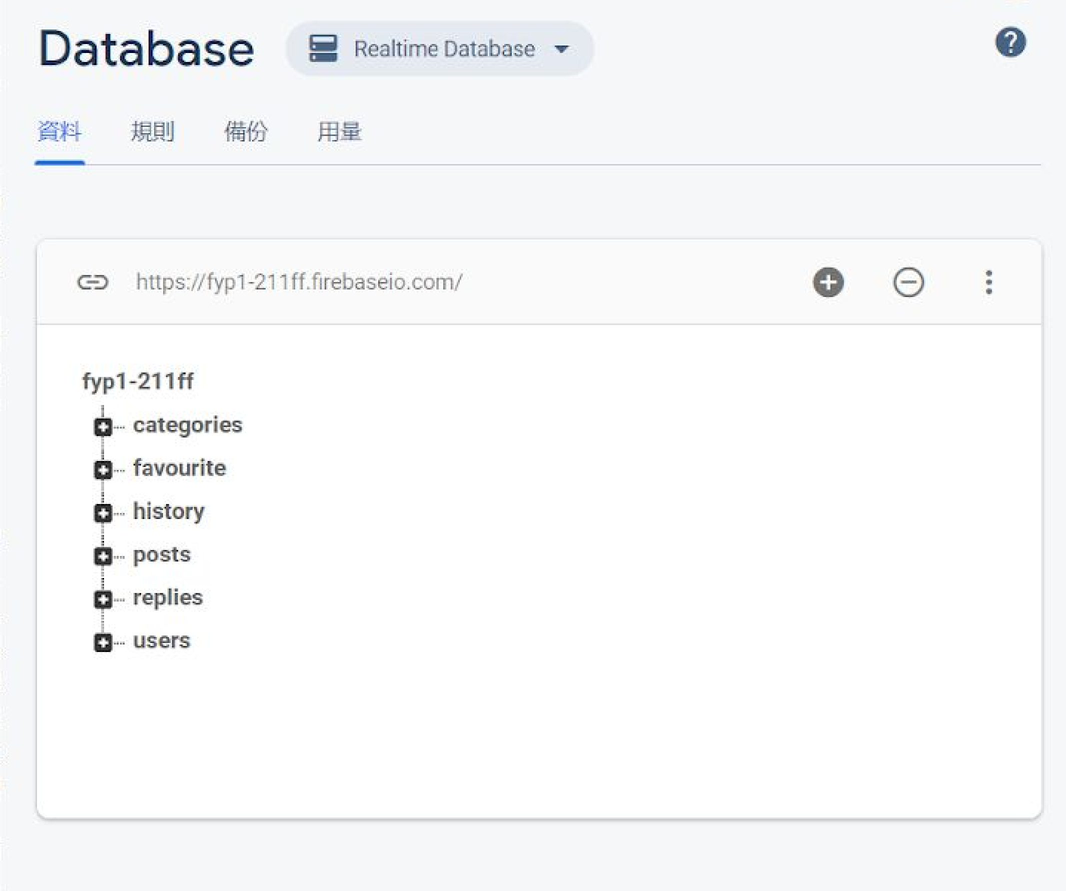
    When a user browses the My Favourite section, the system will get a list of postID of My Favourite topics from favourite database and query with posts database to return a list of favourite topics.

11. Browse Recent History

    When a user browses the Recent History section, the system will get a list of postID of Recent History topics from history database and query with posts database to return a list of recently visited topics.

3.6 Database Schema

3.6.1 Overall Structure

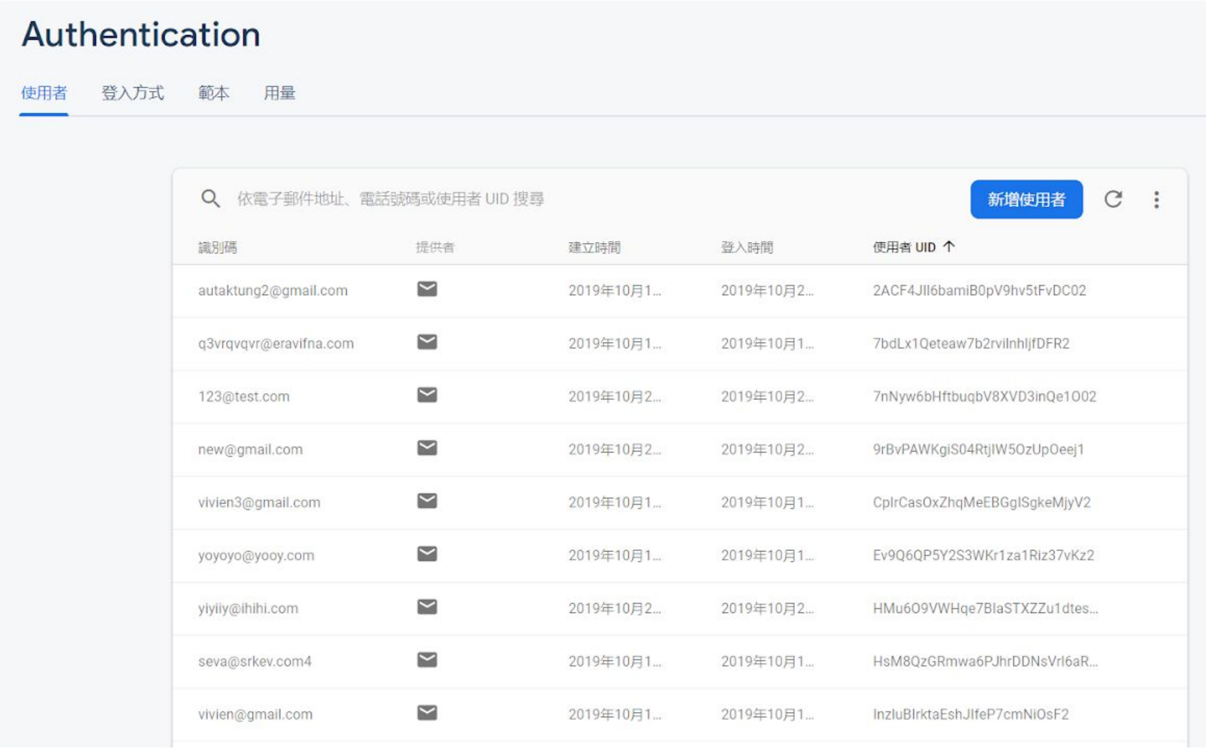


fyp1-211ff
- categories
- favourite
- history
- posts
- replies
- users

Fig. 3.6.1.1 Database schema

There are seven main databases in the database system of CUgo. Posts database stores the topic details such as title, body, format, author etc. of each topic. Categories database stores information on different categories such as category name. Replies database stores reply details of every reply such as content, author etc., grouped by each topic. Users database stores user details of each user including username, email and interests. The favourite database stores the “My Favourite” for each user while history database stores recent visited post of each user. While the last database is the authentication database.

3.6.2 Authentication

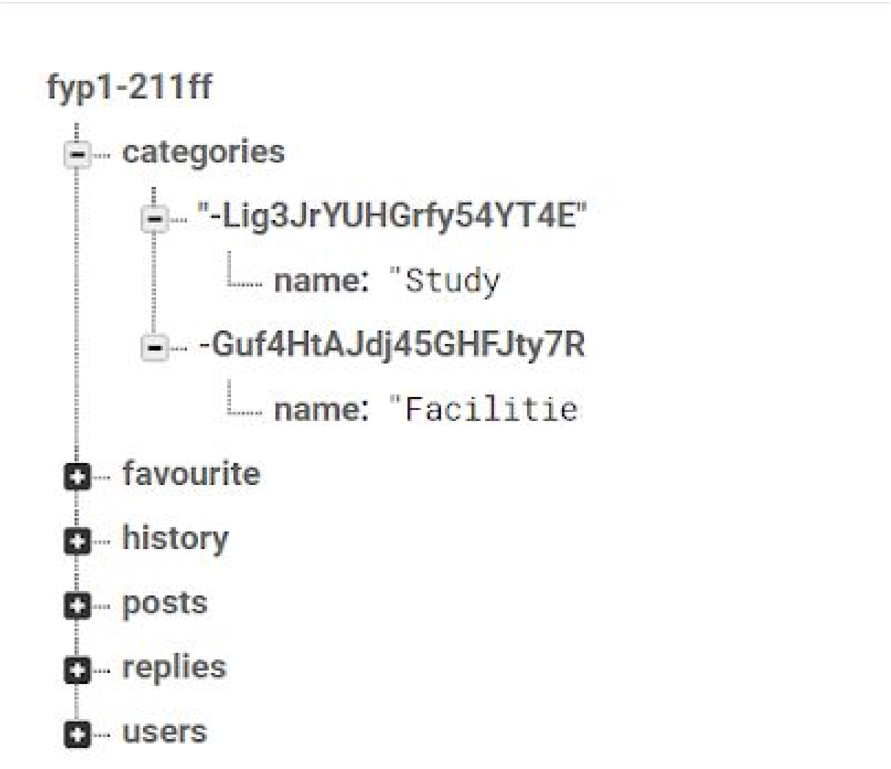


識別碼	提供者	建立時間	登入時間	使用者 UID ↑
autaktung2@gmail.com	✉	2019年10月1...	2019年10月2...	2ACF4JIl6bamiB0pV9hv5tFvDC02
q3vrqvqvr@eravifna.com	✉	2019年10月1...	2019年10月1...	7bdLx1Qeteaw7b2rvilnhljfDFR2
123@test.com	✉	2019年10月2...	2019年10月2...	7nNyw6bHftbuqbV8XVD3inQe1O02
new@gmail.com	✉	2019年10月2...	2019年10月2...	9rBvPAWKgiS04RtjIW5OzUpOeej1
vivien3@gmail.com	✉	2019年10月1...	2019年10月1...	CpIrCasOxZhqMeEBGgISgkeMjyV2
yoyoyo@yooy.com	✉	2019年10月1...	2019年10月1...	Ev9Q6QP5Y2S3WKr1za1Riz37vKz2
yiyiiy@ihihi.com	✉	2019年10月2...	2019年10月2...	HMu6O9VWHqe7BlaSTXZZu1dtes...
seva@srkev.com4	✉	2019年10月1...	2019年10月1...	HsM8QzGRmwa6PJhrDDNsVrl6aR...
vivien@gmail.com	✉	2019年10月1...	2019年10月1...	InzluBIrktaEshJIfeP7cmNiOsF2

Fig. 3.6.2.1 Authentication database schema

Authentication database stores the email, authentication provider, created time, last login time and UID of an account. It is a component of Firebase built-in authentication system.

3.6.3 Categories database

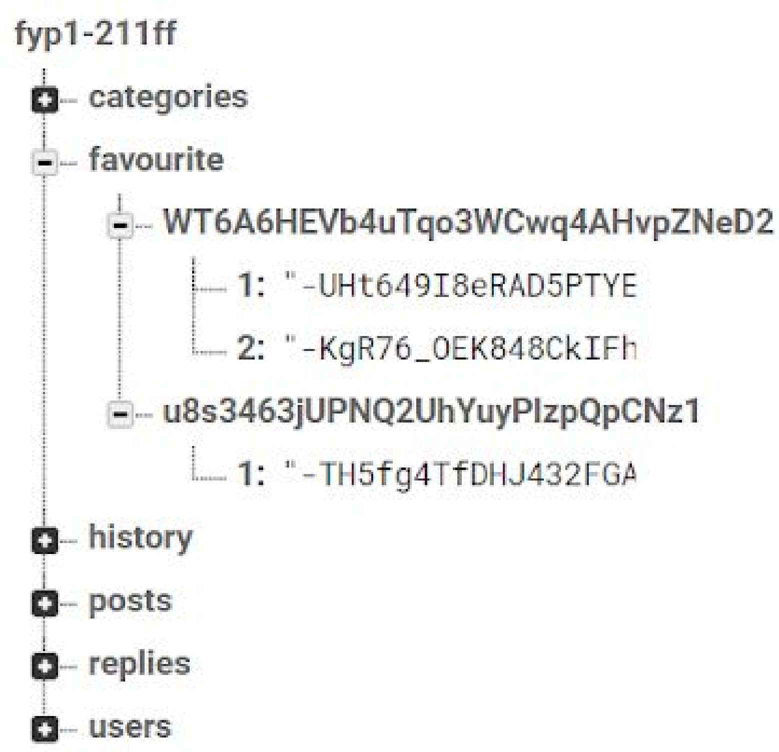


```
fyp1-211ff
  categories
    "-Lig3JrYUHGrfy54YT4E"
      name: "Study
    -Guf4HtAJdj45GHFJty7R
      name: "Facilitie
  favourite
  history
  posts
  replies
  users
```

Fig. 3.6.3.1 Categories database schema

In the categories database, it simply has two attributes. The first one is the categoryID generated by the firebase automatically and the second one is the name of the category. In the example, two categories namely study and facilities and their respective ids are shown.

3.6.4 Favourite database

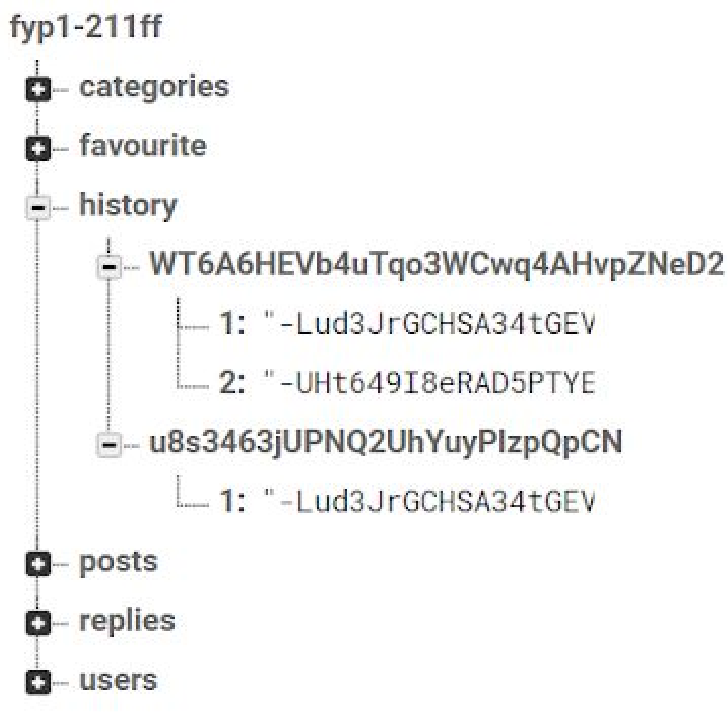


```
fyp1-211ff
  categories
  favourite
    WT6A6HEVb4uTqo3WCwq4AHvpZNeD2
      1: "-UHt649I8eRAD5PTYE
      2: "-KgR76_OEK848CkIFh
    u8s3463jUPNQ2UhYuyPlzpQpCNz1
      1: "-TH5fg4TfDHJ432FGA
  history
  posts
  replies
  users
```

Fig. 3.6.4.1 Favourite database schema

The favourite database is also quite simple. For the first entry, it stores the UID and the postID of his favourites posts. He has two favourite posts up till now according to the number of entries of the favourite post under this UID. The second entry is another UID and one postID, this user has one favourite post until now.

3.6.5 History database

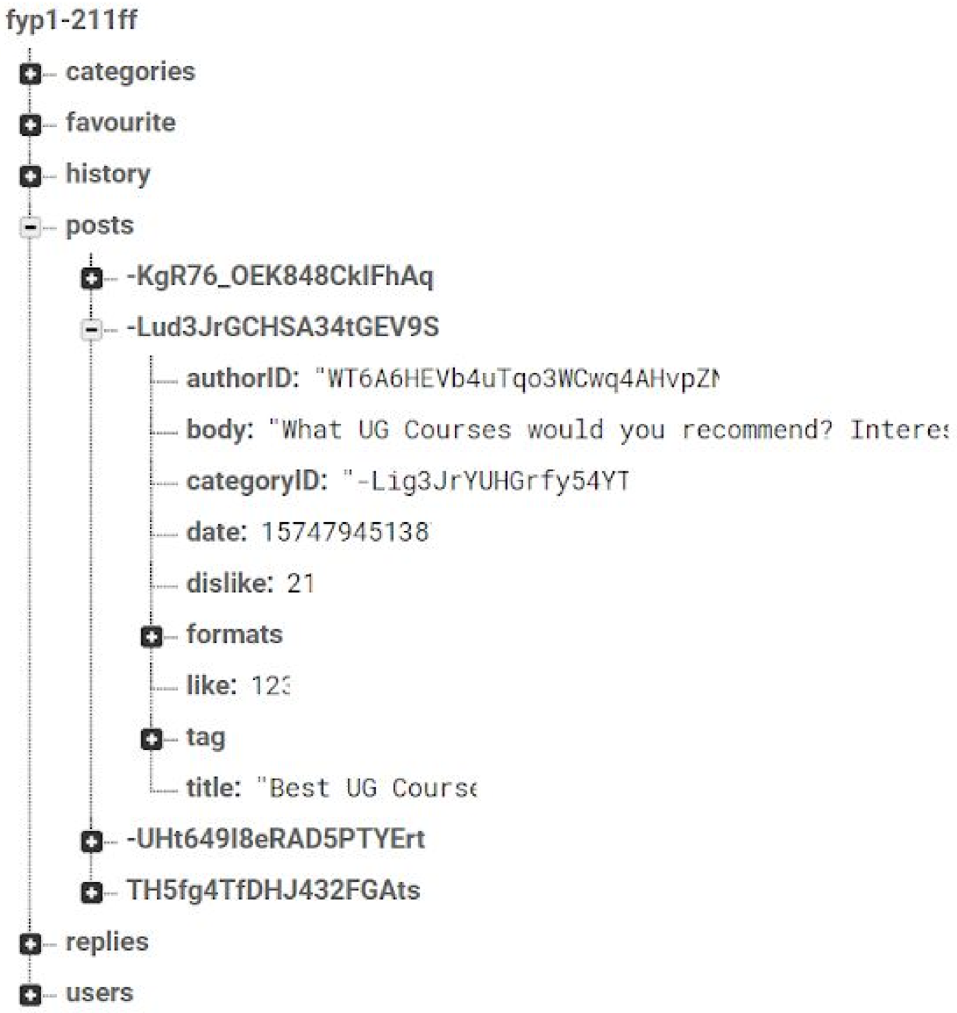


```
fyp1-211ff
  + categories
  + favourite
  - history
      - WT6A6HEVb4uTqo3WCwq4AHvpZNeD2
          1: "-Lud3JrGCHSA34tGEV
          2: "-UHt649I8eRAD5PTYE
      - u8s3463jUPNQ2UhYuyPlzpQpCN
          1: "-Lud3JrGCHSA34tGEV
  + posts
  + replies
  + users
```

Fig. 3.6.5.1 History database schema

The history database is similar to the favourite database. In this example, there are two entries. It first one also come with a UID first. Then there are two posts visited by this user according to the history. For the second entry, there is only one visit history under the second UID, meaning that this user has been to one post only.

3.6.6 Post database overview

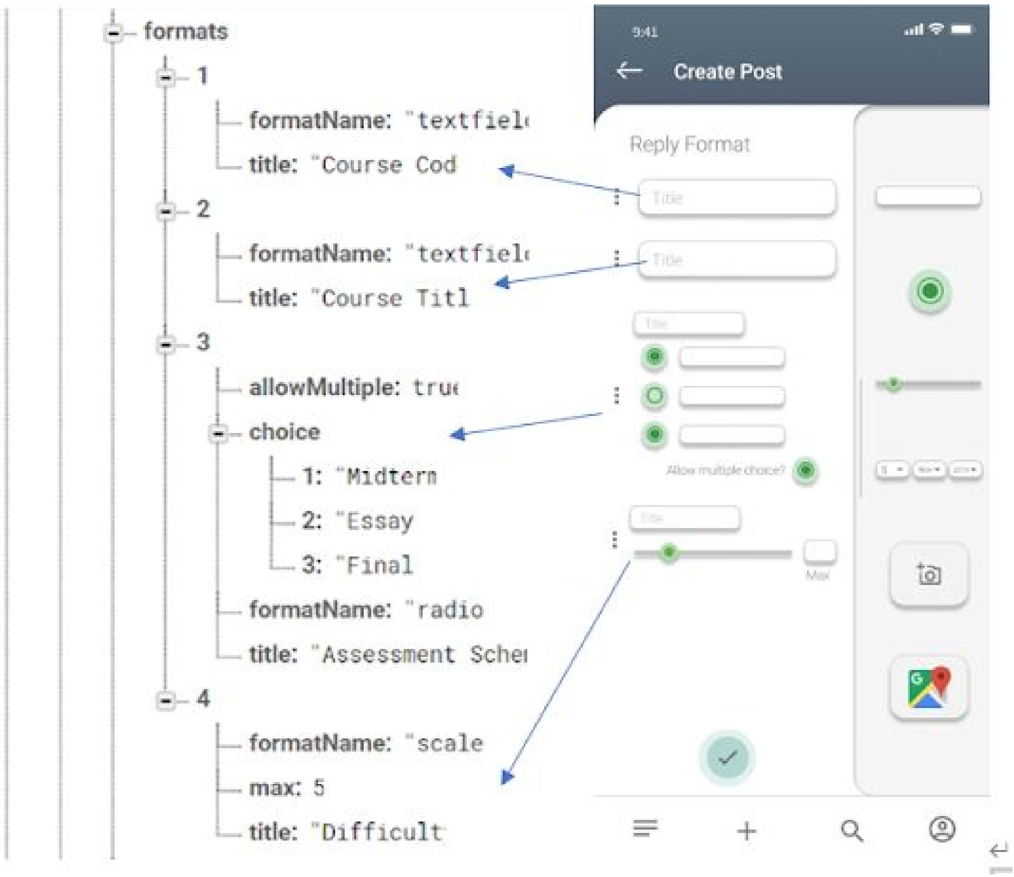


```
fyp1-211ff
├ categories
├ favourite
├ history
├ posts
│  ├ -KgR76_OEK848CklFhAq
│  ├ -Lud3JrGCHSA34tGEV9S
│  │  ├ authorID: "WT6A6HEVb4uTqo3WCwq4AHvpZ
│  │  ├ body: "What UG Courses would you recommend? Intere
│  │  ├ categoryID: "-Lig3JrYUHGrfy54YT
│  │  ├ date: 15747945138
│  │  ├ dislike: 21
│  │  ├ formats
│  │  ├ like: 12
│  │  ├ tag
│  │  └ title: "Best UG Cours
│  ├ -UHt649I8eRAD5PTYErt
│  └ TH5fg4TfDHJ432FGAts
├ replies
└ users
```

Fig. 3.6.6.1 Posts database schema

In the posts database, it is a rather complicated one. In this example, it shows 4 posts represented by 4 postID respectively. The structure of the second post is further expanded. Under the postID, authorID, body content, categoryID, date and time posted, the number of dislikes and likes, title, formats and tags are stored respectively. Formats and tags could be further expanded and they will be further explained thoroughly at the below.

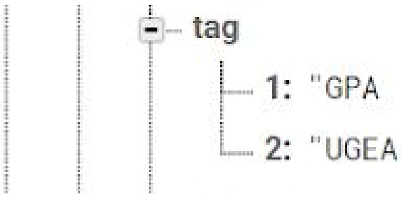
3.6.7 Structure of reply format and tag under posts database



```
formats
  1
    formatName: "textfiel
    title: "Course Cod
  2
    formatName: "textfiel
    title: "Course Titl
  3
    allowMultiple: tru
    choice
      1: "Midtern
      2: "Essay
      3: "Final
    formatName: "radio
    title: "Assessment Sche
  4
    formatName: "scale
    max: 5
    title: "Difficult
```

Fig. 3.6.7.1 Posts database schema - reply format

As user needs to specify a reply format when they are creating a new topic, user can arrange their customized reply format by selecting components such as text field, radio buttons, scale, date, image and location. The above reply format example demonstrates the data structure to store two text fields, followed by a multiple-choice radio button and a scale as the customized reply format for this topic. Different components have different data structure. For example, the text field is composed of formatName and title, while multiple-choice radio button is composed of formatName, title, allowMultiple and list of choices. And the ID for each component states its order in the reply format.

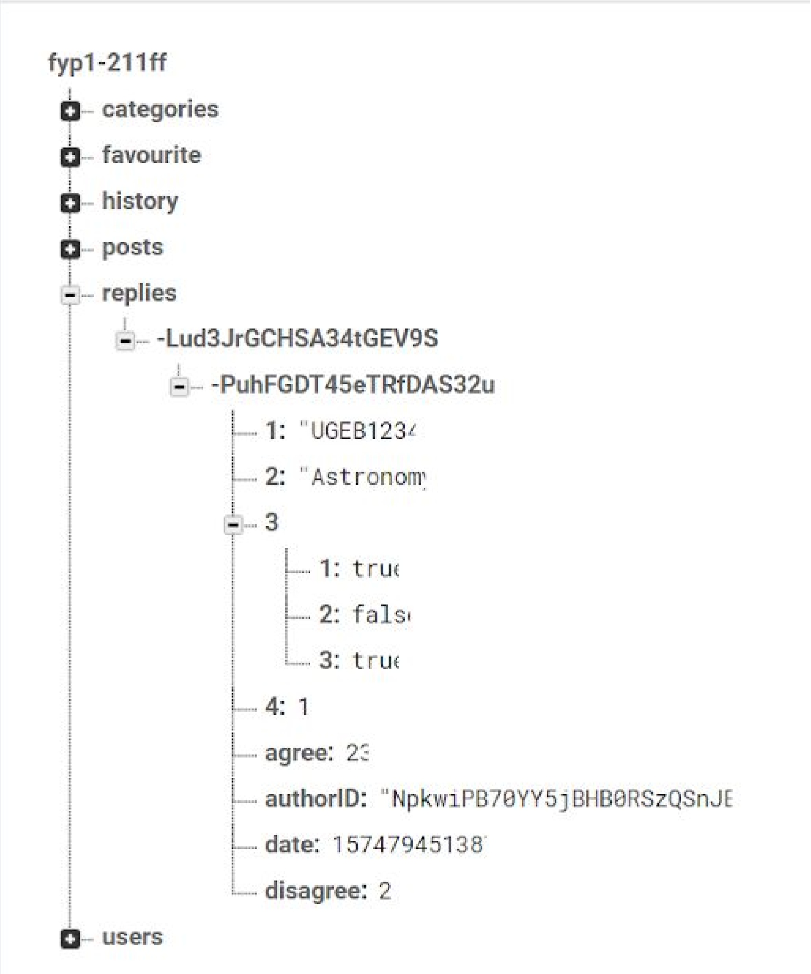


```
tag
  1: "GPA
  2: "UGEA
```

Fig. 3.6.7.2 Posts database schema - tag format

There may be multiple tags for each topic, these tags are stored in a list within each topic. In this case, GPA and UGEA are the two tags assigned for this topic. They are stored this way for the convenience of queries in the future.

3.6.8 Replies database

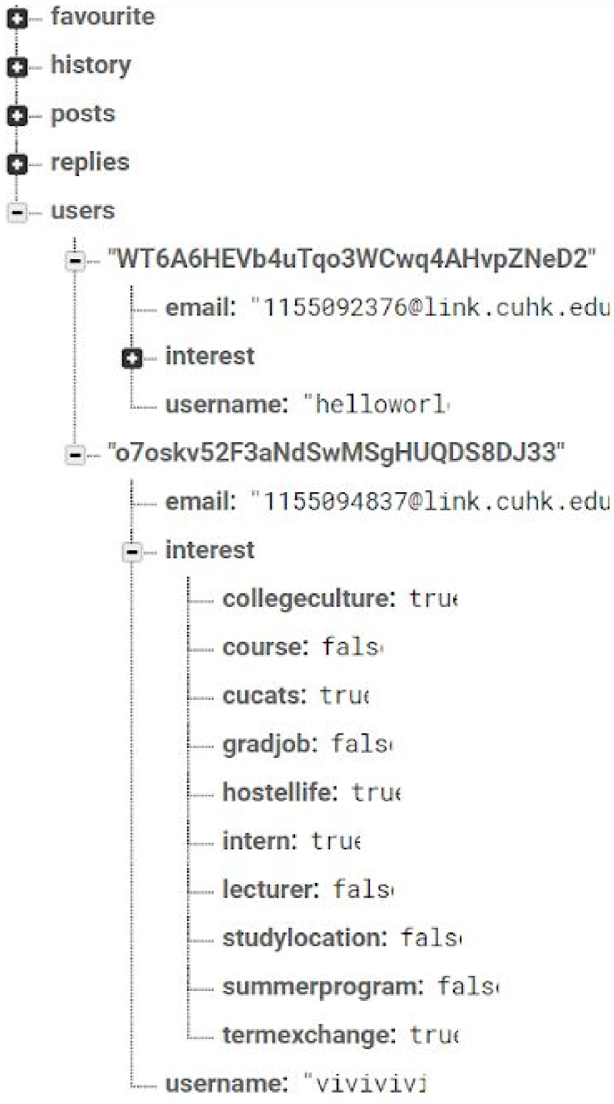


```
fyp1-211ff
  + categories
  + favourite
  + history
  + posts
  - replies
      - -Lud3JrGCHSA34tGEV9S
          - -PuhFGDT45eTRfDAS32u
              1: "UGEB1234
              2: "Astronomy
              - 3
                  1: true
                  2: false
                  3: true
              4: 1
              agree: 23
              authorID: "NpkwiPB70YY5jBHB0RSzQSnJE
              date: 15747945138
              disagree: 2
  + users
```

Fig. 3.6.8.1 Replies database schema

Replies of each topic are being stored in replies database. Each topic is represented by a postID, list of replies of that topic are being stored under the corresponding postID. Each reply has its own replyID. Inside each reply, it stores the formatted reply body as explained in the format section above, number of votes on agreeing and disagreeing, authorID and created date. Above diagram is an example of a reply with the format of two text fields followed by a multiple-choice with 3 options and a scale.

3.6.9 Users database

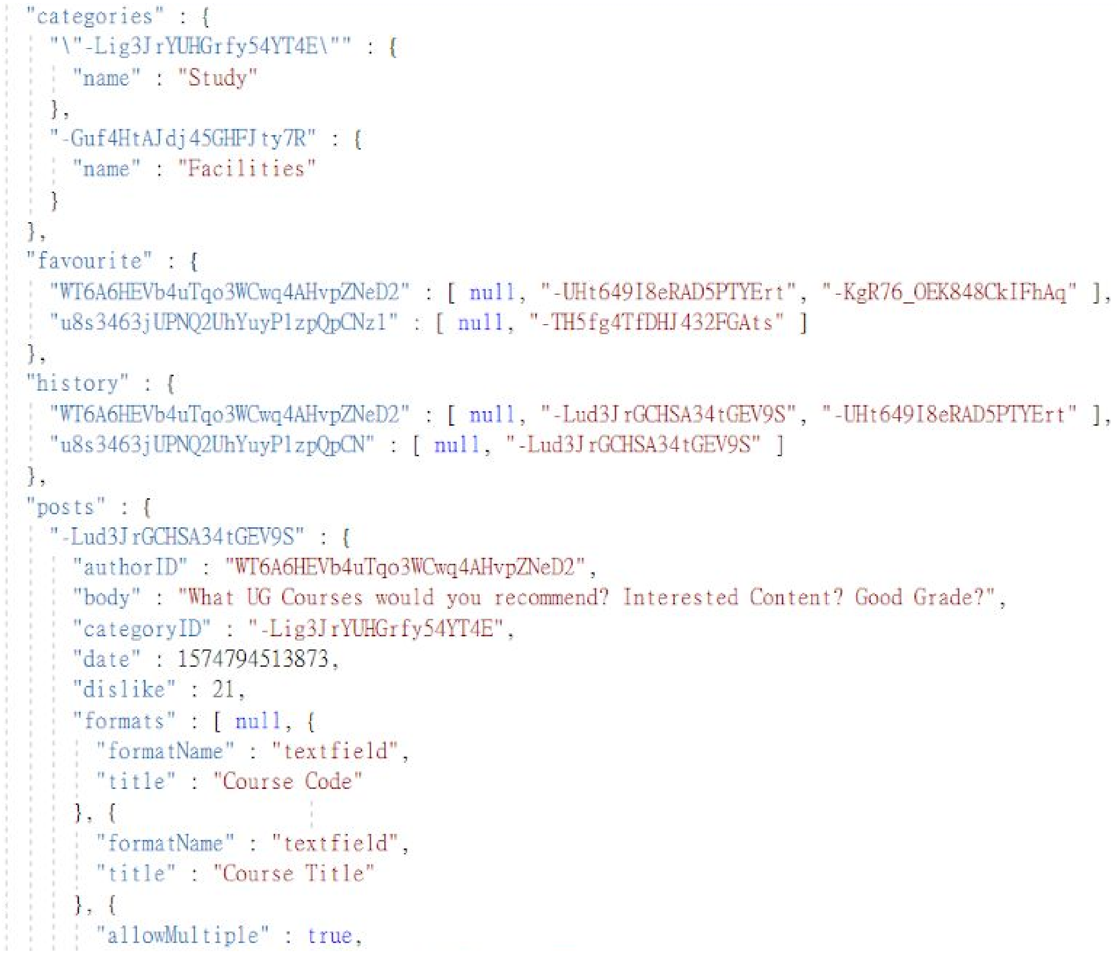


```
favourite
history
posts
replies
users
  "WT6A6HEVb4uTqo3WCwq4AHvpZNeD2"
    email: "1155092376@link.cuhk.edu
    interest
    username: "helloworl
  "o7oskv52F3aNdSwMSgHUQDS8DJ33"
    email: "1155094837@link.cuhk.edu
    interest
      collegeculture: tru
      course: fals
      cucats: tru
      gradjob: fals
      hostellife: tru
      intern: tru
      lecturer: fals
      studylocation: fals
      summerprogram: fals
      termexchange: tru
    username: "vivivi
```

Fig.3.6.9.1 Users database schema

The users database stores user details for each user. In the database, each user is represented by a UID. Within each UID, user details such as email, interest and username are stored. Note that a boolean list is used to store user interest.

3.6.10 JSON



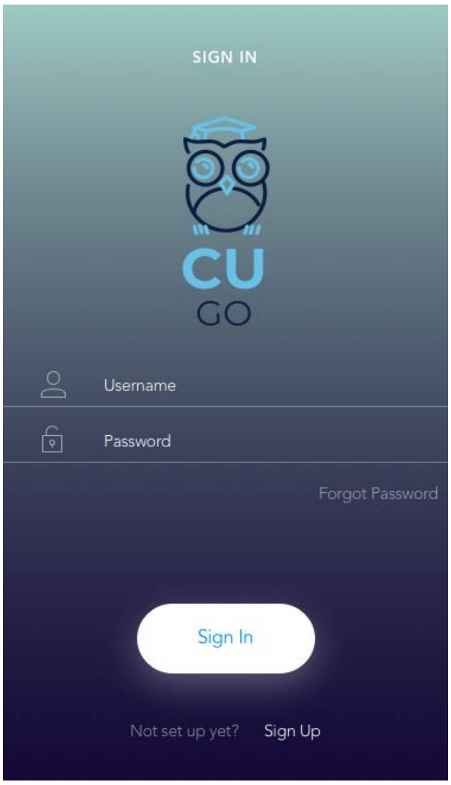
```
"categories" : {
  "\"-Lig3JrYUHGrfy54YT4E\"" : {
    "name" : "Study"
  },
  "-Guf4HtAJdj45GHFJty7R" : {
    "name" : "Facilities"
  }
},
"favourite" : {
  "WT6A6HEVb4uTqo3WCwq4AHvpZNeD2" : [ null, "-UHt649I8eRAD5PTYErt", "-KgR76_OEK848CkIFhAq" ],
  "u8s3463jUPNQ2UhYuyP1zpQpCNz1" : [ null, "-TH5fg4TfDHJ432FGAts" ]
},
"history" : {
  "WT6A6HEVb4uTqo3WCwq4AHvpZNeD2" : [ null, "-Lud3JrGCHSA34tGEV9S", "-UHt649I8eRAD5PTYErt" ],
  "u8s3463jUPNQ2UhYuyP1zpQpCN" : [ null, "-Lud3JrGCHSA34tGEV9S" ]
},
"posts" : {
  "-Lud3JrGCHSA34tGEV9S" : {
    "authorID" : "WT6A6HEVb4uTqo3WCwq4AHvpZNeD2",
    "body" : "What UG Courses would you recommend? Interested Content? Good Grade?",
    "categoryID" : "-Lig3JrYUHGrfy54YT4E",
    "date" : 1574794513873,
    "dislike" : 21,
    "formats" : [ null, {
      "formatName" : "textfield",
      "title" : "Course Code"
    }, {
      "formatName" : "textfield",
      "title" : "Course Title"
    }, {
      "allowMultiple" : true,
```

Fig. 3.6.10.1 JSON structure

As a NoSQL database, Firebase realtime database structures data in a JSON tree. All data stored in the database are treated as a node in the JSON tree [14]. It facilitates flexible schema and arbitrary data structure which is required in the customized reply format feature in CUgo.

4. Application Implementation

4.1 Login and User Profile System



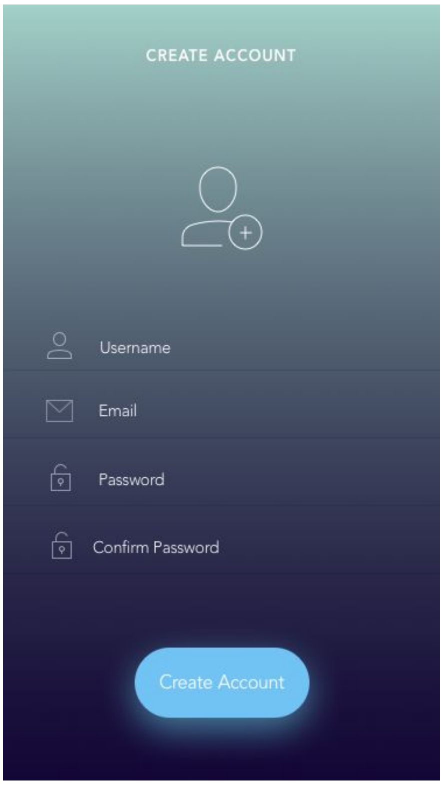
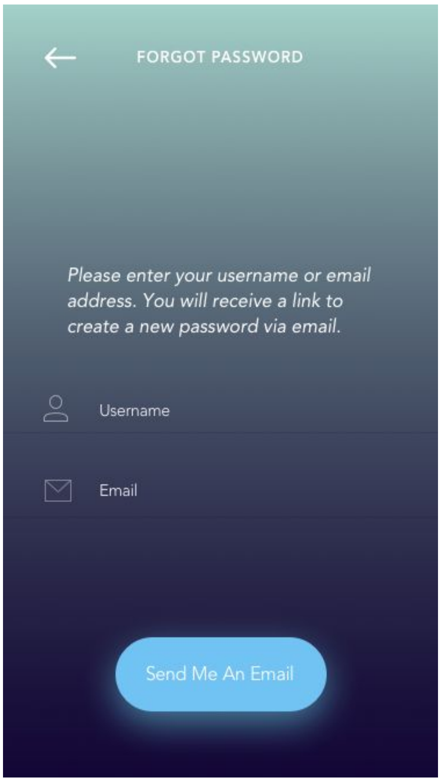


Fig. 4.1.1 Sign-in page of CUgo

Fig. 4.1.2 Create New Account



Please enter your username or email address. You will receive a link to create a new password via email.

Fig. 4.1.3 Forgot Password Page

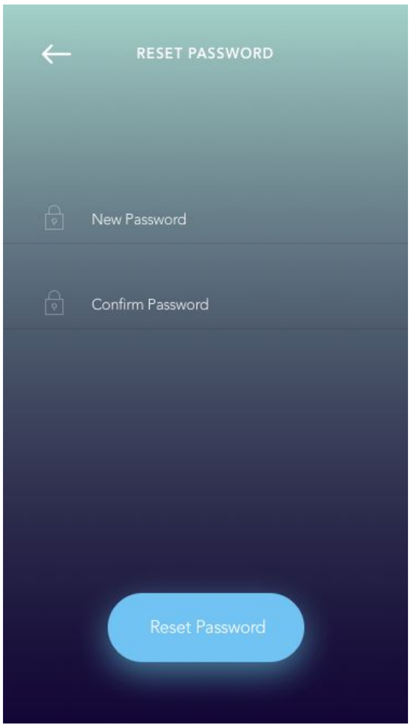


Fig. 4.1.4 Reset and confirm new password

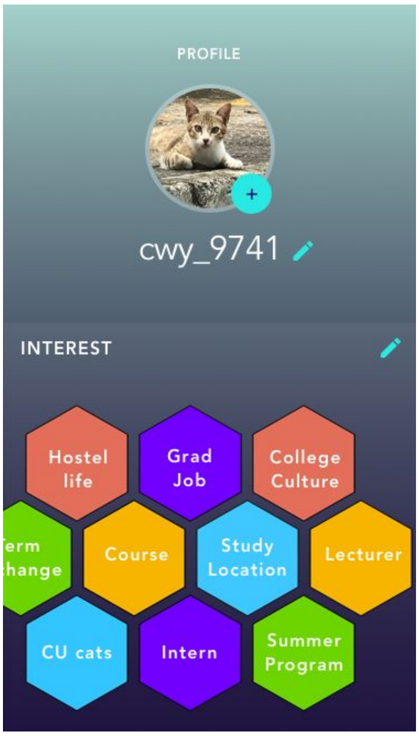


Fig. 4.1.5 Profile of a user

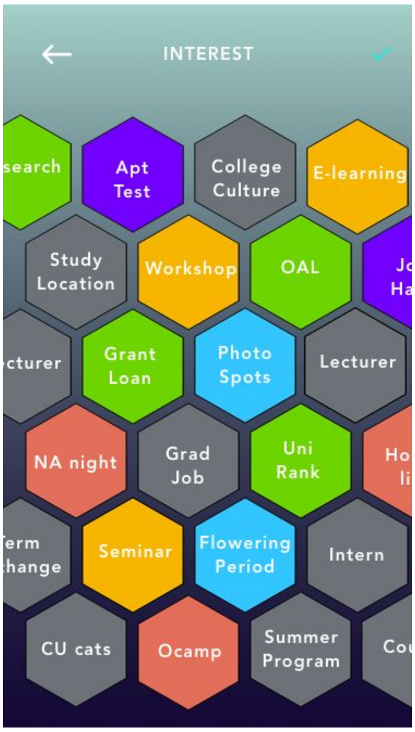
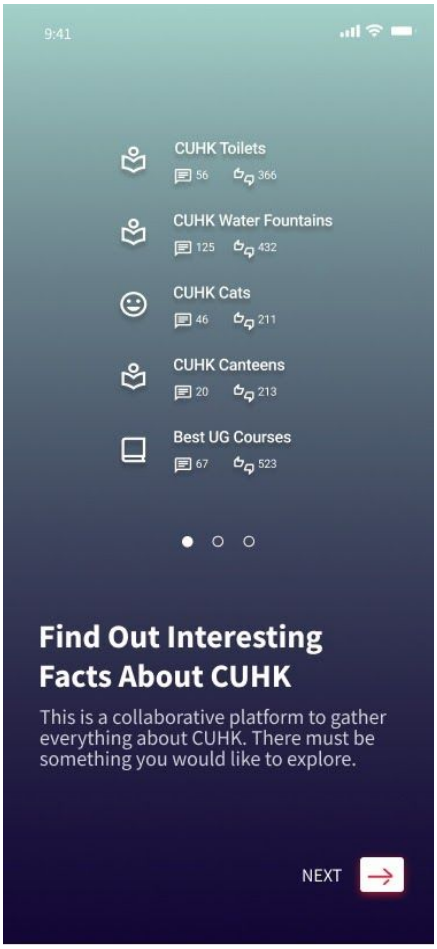


Fig. 4.1.6 Select/ Change indicated interests



CUHK Toilets 56 366

CUHK Water Fountains 125 432

CUHK Cats 46 211

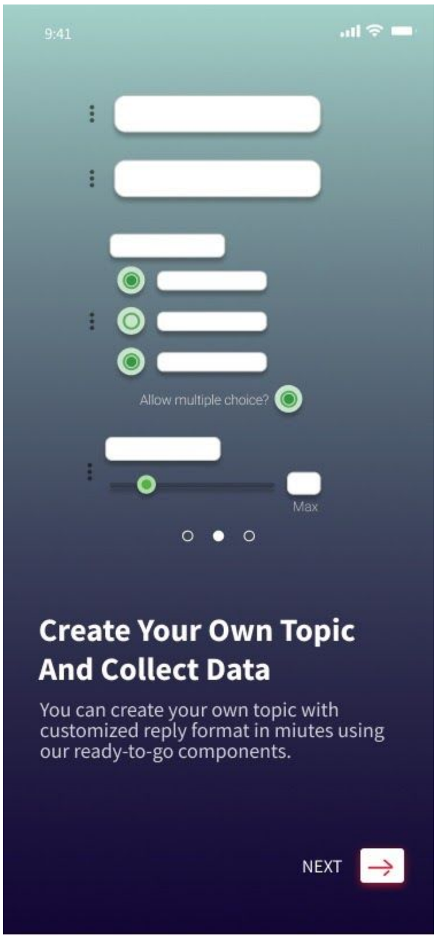
CUHK Canteens 20 213

Best UG Courses 67 523

Find Out Interesting Facts About CUHK

This is a collaborative platform to gather everything about CUHK. There must be something you would like to explore.

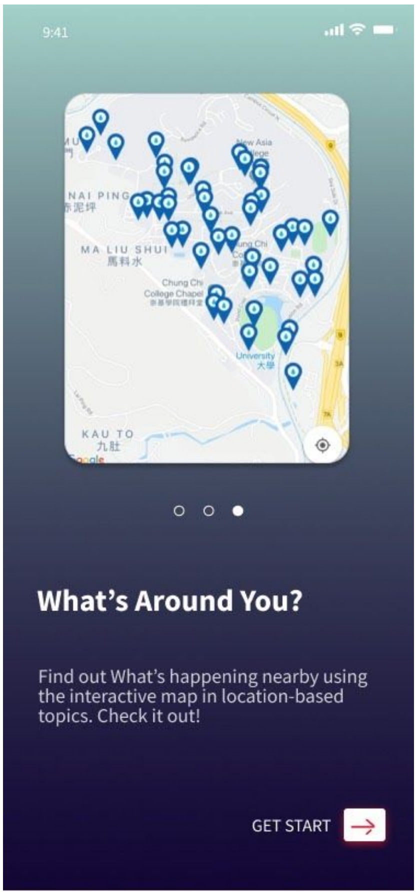
Fig. 4.1.7 User guide part 1



Create Your Own Topic And Collect Data

You can create your own topic with customized reply format in miutes using our ready-to-go components.

Fig. 4.1.8 User guide part 1

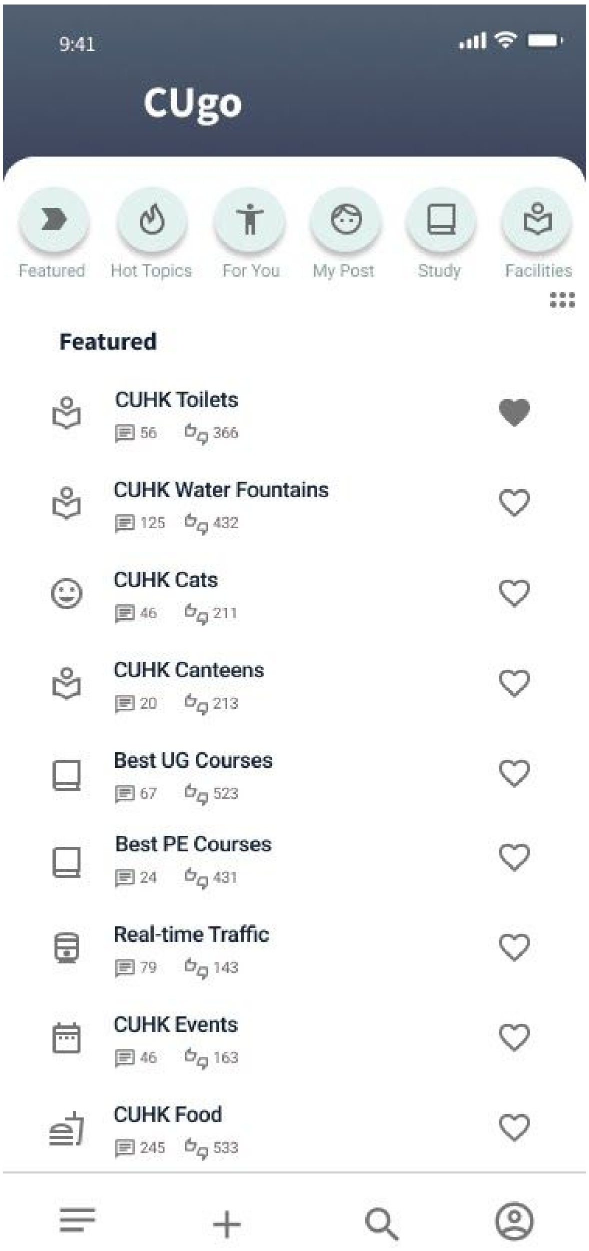


What's Around You?

Find out What's happening nearby using the interactive map in location-based topics. Check it out!

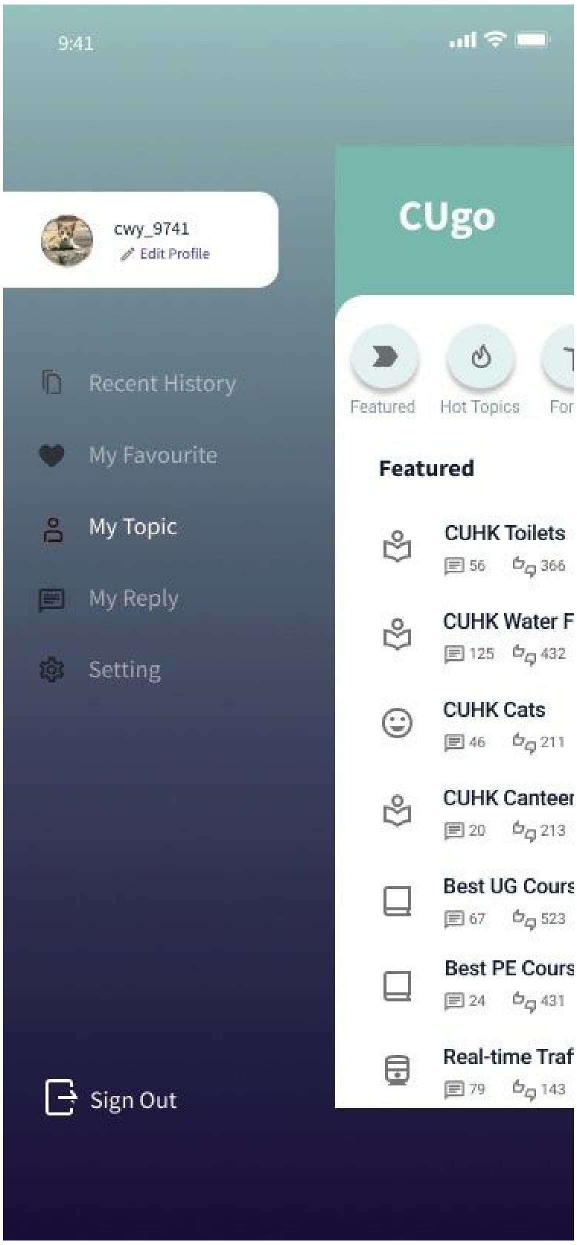
Fig. 4.1.9 User guide part 3

4.2 Homepage, Menu and Category



Featured

CUHK Toilets 56 366
CUHK Water Fountains 125 432
CUHK Cats 46 211
CUHK Canteens 20 213
Best UG Courses 67 523
Best PE Courses 24 431
Real-time Traffic 79 143
CUHK Events 46 163
CUHK Food 245 533

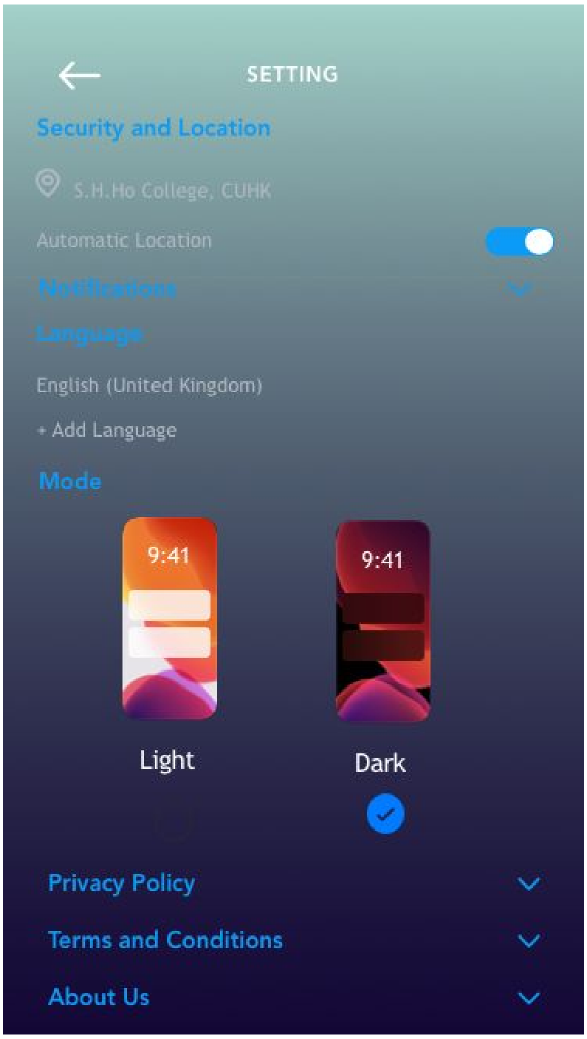


Featured

CUHK Toilets 56 366
CUHK Water F 125 432
CUHK Cats 46 211
CUHK Canteer 20 213
Best UG Cours 67 523
Best PE Cours 24 431
Real-time Traf 79 143

Fig. 4.2.1 Homepage and category

Fig. 4.2.2 Sidebar Menu



SETTING

Security and Location

S.H.Ho College, CUHK

Automatic Location

Notifications

Language

English (United Kingdom)

+ Add Language

Mode

Light ○

Dark ✓

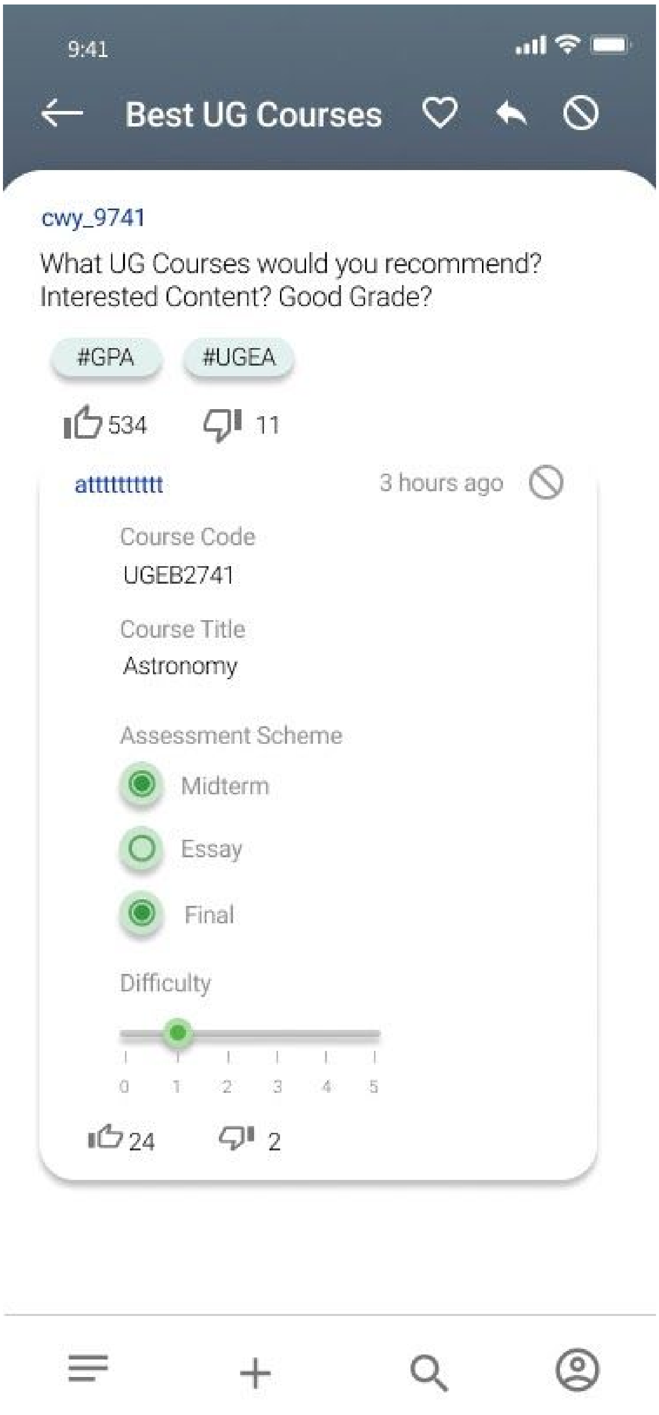
Privacy Policy

Terms and Conditions

About Us

Fig. 4.2.3 Setting Page

4.3 Browse Topic



Best UG Courses

cwy_9741

What UG Courses would you recommend?
Interested Content? Good Grade?

#GPA #UGEA

534 11

atttttttttt 3 hours ago

Course Code
UGEB2741

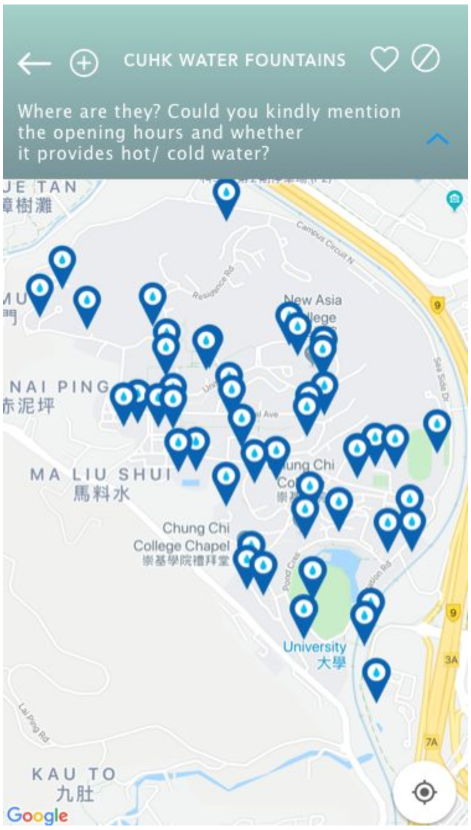
Course Title
Astronomy

Assessment Scheme
● Midterm
○ Essay
● Final

Difficulty

24 2

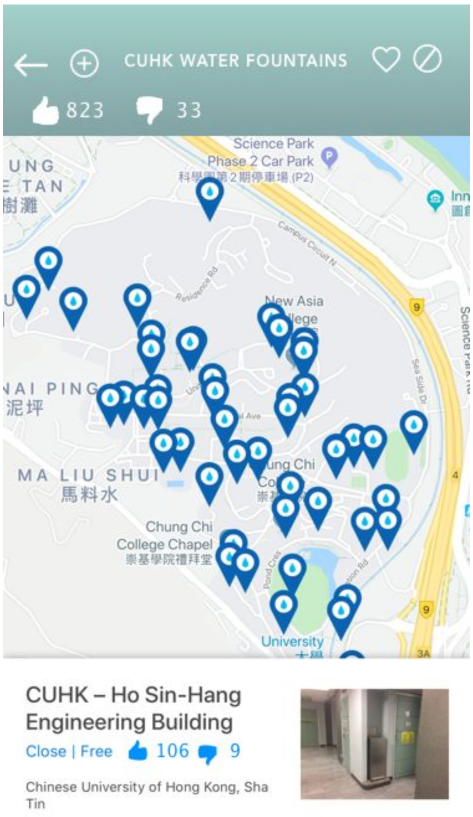
Fig. 4.3.1 Browse a non-location-based topic



CUHK WATER FOUNTAINS

Where are they? Could you kindly mention the opening hours and whether it provides hot/ cold water?

Fig. 4.3.2 Browse location-based topic



CUHK WATER FOUNTAINS

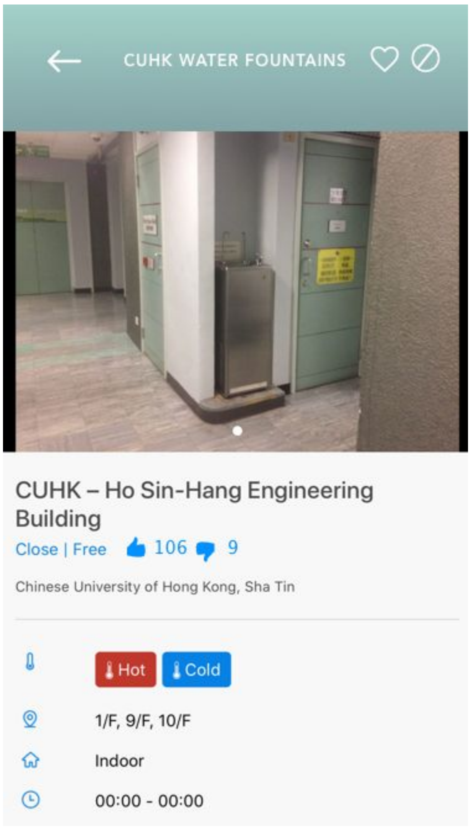
823 33

CUHK – Ho Sin-Hang Engineering Building

Close | Free 106 9

Chinese University of Hong Kong, Sha Tin

Fig. 4.3.3 View information window after clicking the marker



CUHK WATER FOUNTAINS

CUHK – Ho Sin-Hang Engineering Building

Close | Free 106 9

Chinese University of Hong Kong, Sha Tin

Hot Cold

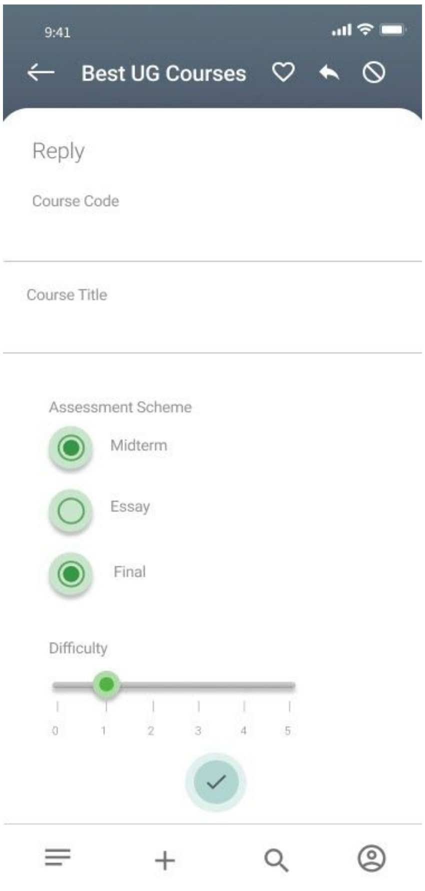
1/F, 9/F, 10/F

Indoor

00:00 - 00:00

Fig. 4.3.4 Browse further details of the spot

4.4 Reply Topic



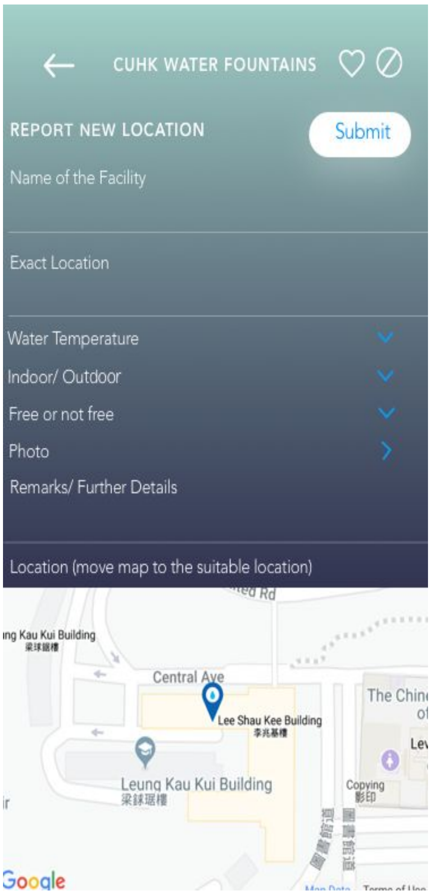
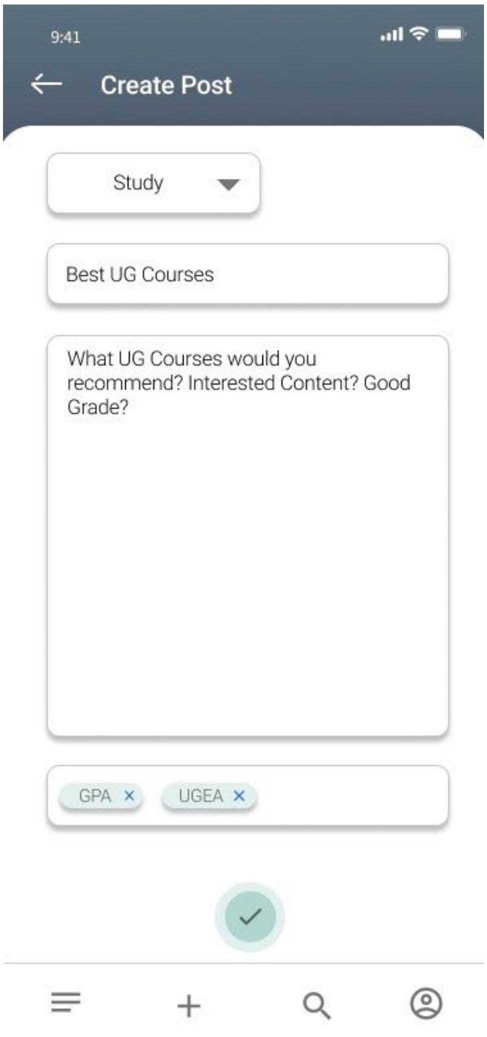


Fig. 4.4.1 Add a new reply in non post

Fig. 4.4.2 Add a new location in location-based location-based post

4.5 Create Topic



Study

Best UG Courses

What UG Courses would you recommend? Interested Content? Good Grade?

GPA ×

UGEA ×

Fig. 4.5.1 Create new post

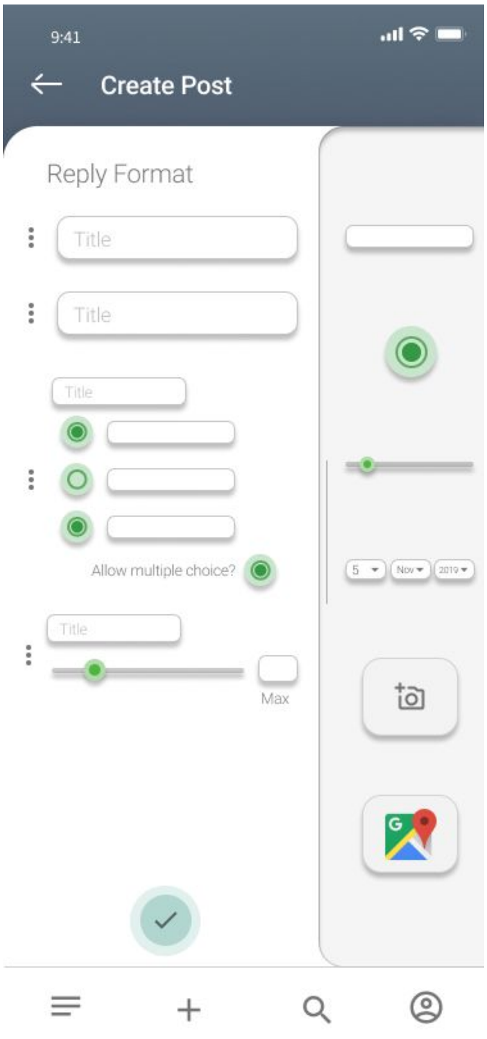


Fig. 4.5.2 Drag-and-drop components for constructing reply format

5. Procedure Flow

5.1 Flow Chart

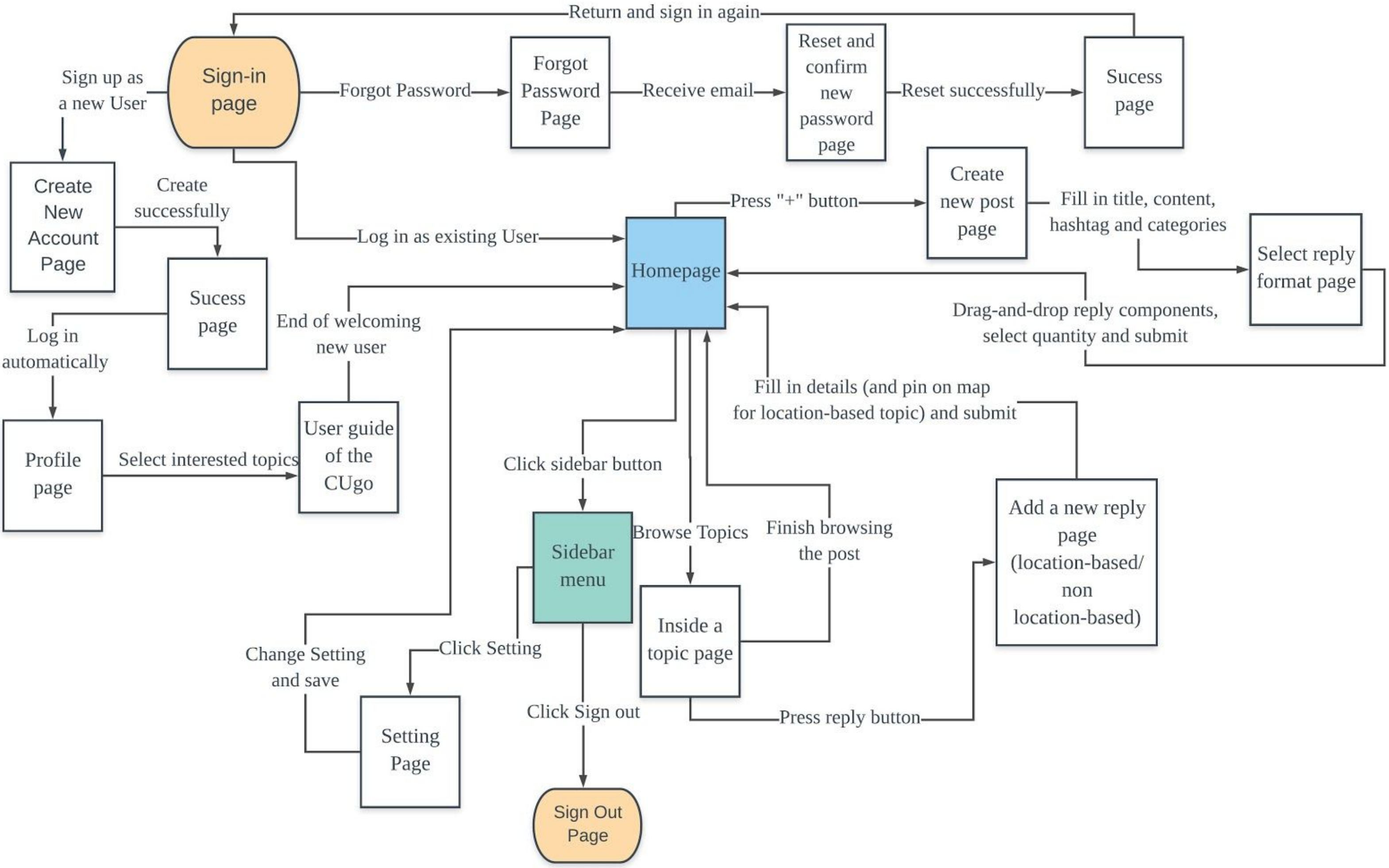


Fig. 5.1.1 Page flow of CUgo

The complete flow of pages start from our sign-in page and end with sign-out page. Upon executing the action named on the arrow, the user will be directed to the pages pointed by the corresponding arrows. The homepage is coloured as blue as it is the main page of our application. Most of the paths in this chart contain the homepage. Also, the page of sidebar menu is coloured in green since there are many buttons in the menu. Users can be redirected to different pages such as Recent history and My topic apart from setting page and sign out page mentioned in the chart. The details of the sidebar menu are omitted here.

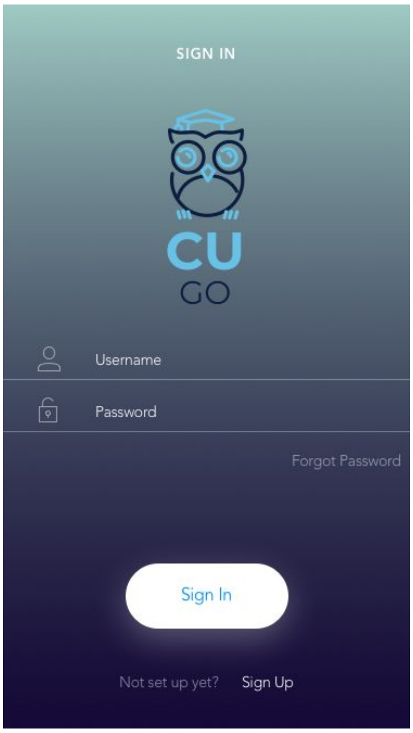
5.2 Scenario

5.2.1 Scenario A

In this scenario, user Tom registers as a new user. Upon successful registration, he browses his profile first. He then creates a post to ask for information about the UG course suggestion.

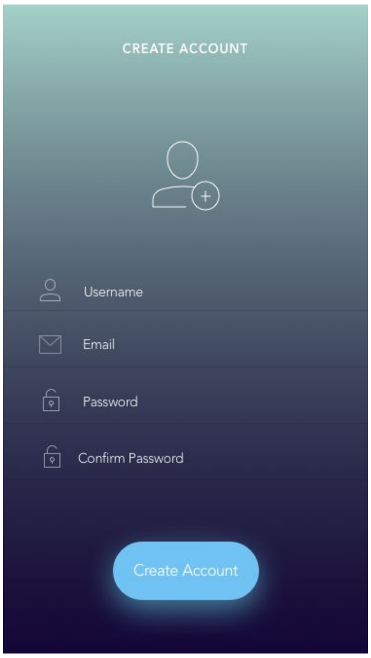
Step 1

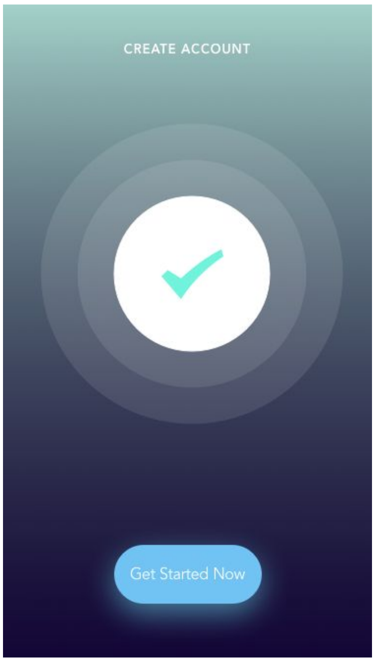
On the Sign In page of CUgo, Tom presses the "Sign Up" button at the bottom to create an account.



Step 2

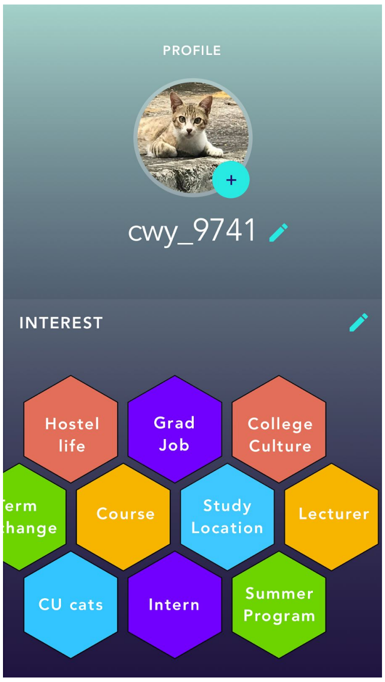
After uploading a profile picture and inputting the required information, Tom creates an account successfully.

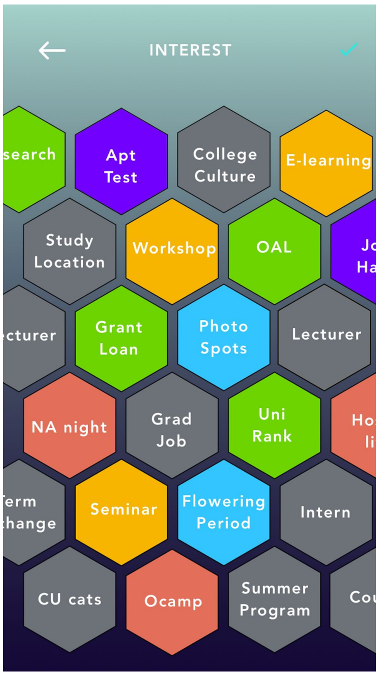




Step 3

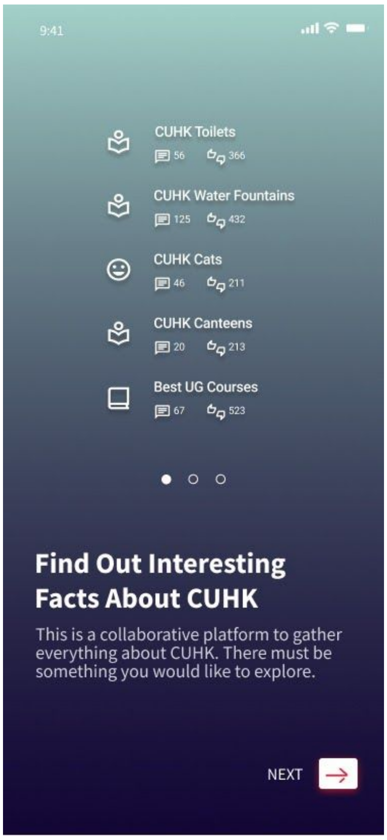
Tom selects the topics he is interested in, the chosen ones are in grey colour. After confirming his interests, Tom's profile is set up.





Step 4

Tom goes through a set of user guide in order to familiarize himself with the functions of CUgo.


9:41

CUHK Toilets 56 366

CUHK Water Fountains 125 432

CUHK Cats 46 211

CUHK Canteens 20 213

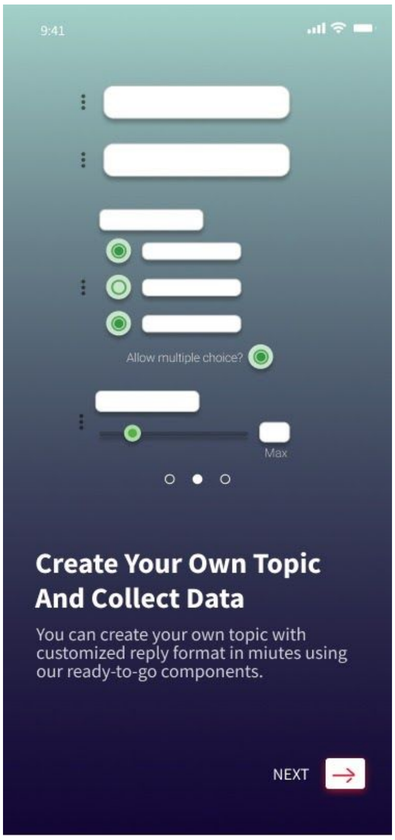
Best UG Courses 67 523

● ○ ○

Find Out Interesting Facts About CUHK

This is a collaborative platform to gather everything about CUHK. There must be something you would like to explore.

NEXT →


9:41

Allow multiple choice?

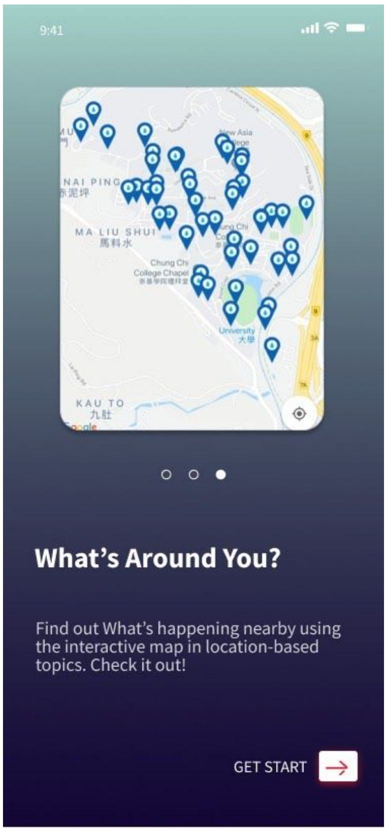
Max

○ ● ○

Create Your Own Topic And Collect Data

You can create your own topic with customized reply format in miutes using our ready-to-go components.

NEXT →



9:41

○ ○ ●

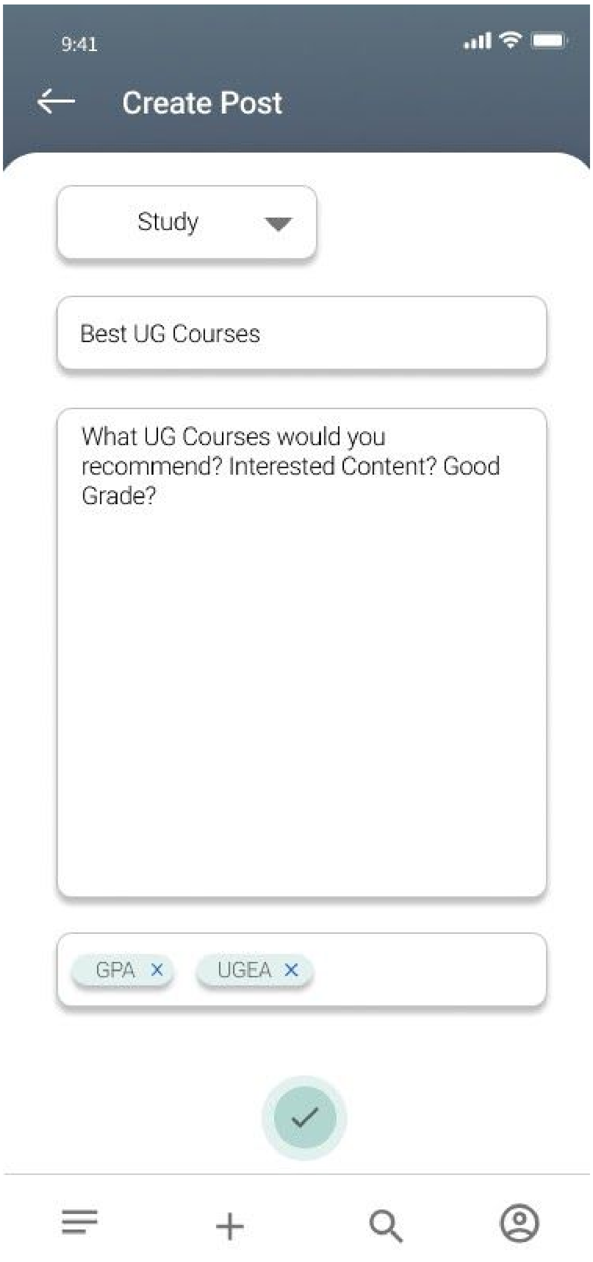
What's Around You?

Find out What's happening nearby using the interactive map in location-based topics. Check it out!

GET START →

Step 5

Tom goes to the home page then press the "+" button on the bottom bar to create a post. He wants to ask about "The Best UG Courses". After inputting the description and the hashtags, Tom can go to the next step.



Study

Best UG Courses

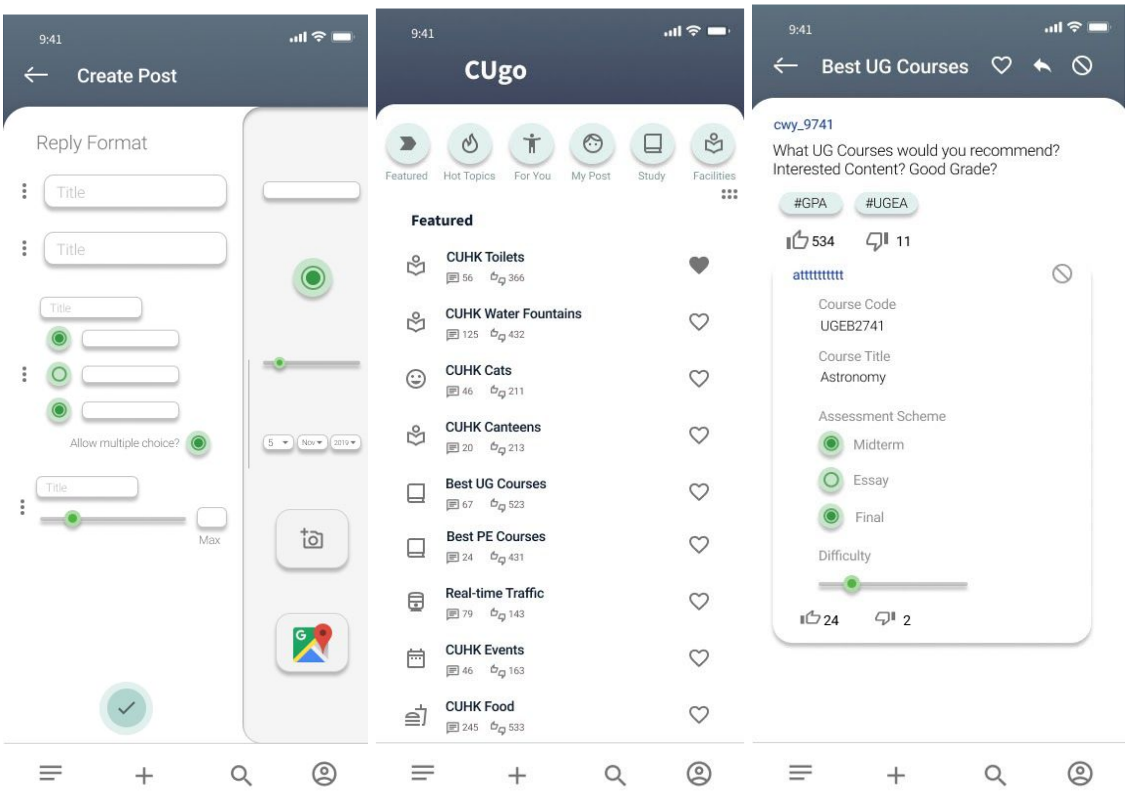
What UG Courses would you recommend? Interested Content? Good Grade?

GPA ×
UGEA ×

✓

Step 6

Tom has to choose the format of the reply to this post. There are different elements on the right-hand side. Tom drags and drops the elements he wants to the left-hand side. He sets the standardized format of the reply includes two text fields, one multiple-choice section and a scroll bar. Next, he can see his topic being posted. After some time, Tom has received a reply, he can click into his post to view.



9:41

Create Post

Reply Format

Title

Title

Title

Allow multiple choice?

Title

Max

5 ▾ Nov ▾ 2019 ▾

9:41

CUgo

Featured | Hot Topics | For You | My Post | Study | Facilities

Featured

CUHK Toilets	56	366
CUHK Water Fountains	125	432
CUHK Cats	46	211
CUHK Canteens	20	213
Best UG Courses	67	523
Best PE Courses	24	431
Real-time Traffic	79	143
CUHK Events	46	163
CUHK Food	245	533

9:41

Best UG Courses

cwy_9741

What UG Courses would you recommend? Interested Content? Good Grade?

#GPA #UGEA

534 11

atttttttttt

Course Code
UGEB2741

Course Title
Astronomy

Assessment Scheme
● Midterm
○ Essay
● Final

Difficulty

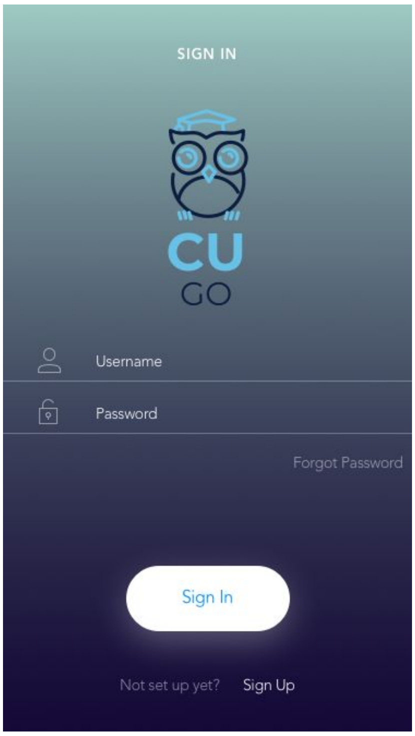
24 2

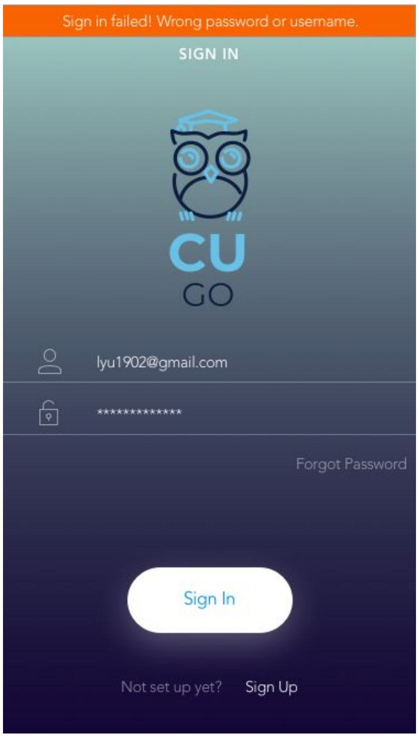
5.2.2 Scenario B

In this scenario, Kate is an existing user of CuGo. She remembers her password incorrectly so she reset her password. Then, she goes to Setting to turn on automatic location function. After that, she browses a topic called "CUHK Water Fountains". She reports that there is a new location of the water fountain in CUHK.

Step 1

On the Sign In page of CUgo, Kate inputs her username and password. However, she remembers her password incorrectly. She presses "Forgot Password".



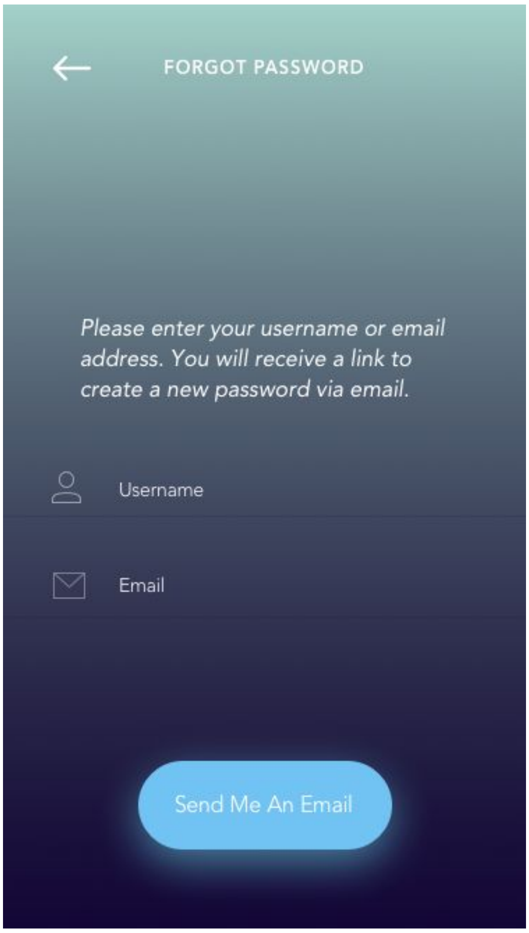

Sign in failed! Wrong password or username.

lyu1902@gmail.com

****

Step 2

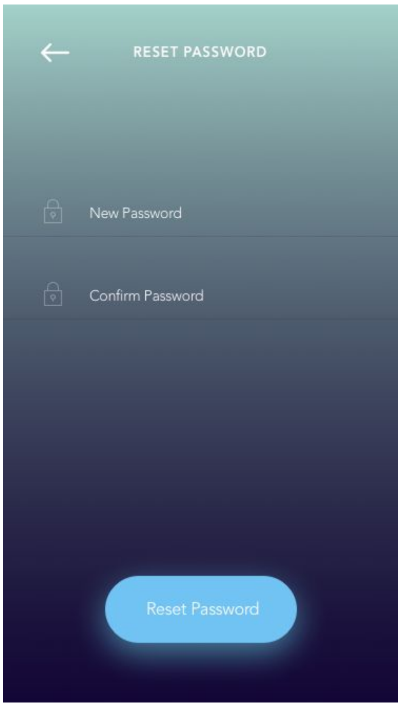
Kate has to enter either her username or the email that she has used to register her CUgo account. A reset password email will be sent from the system to her mailbox.

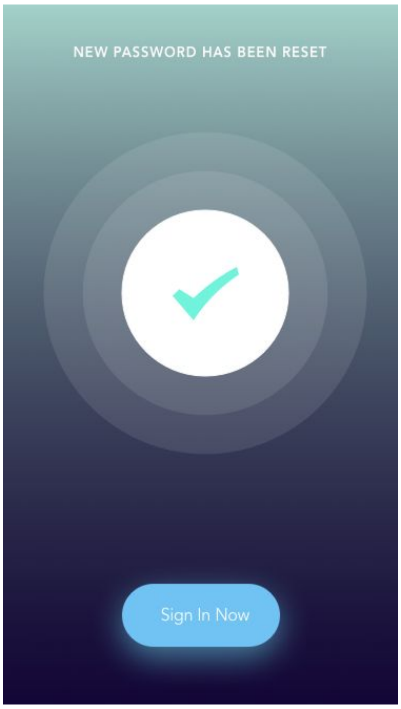


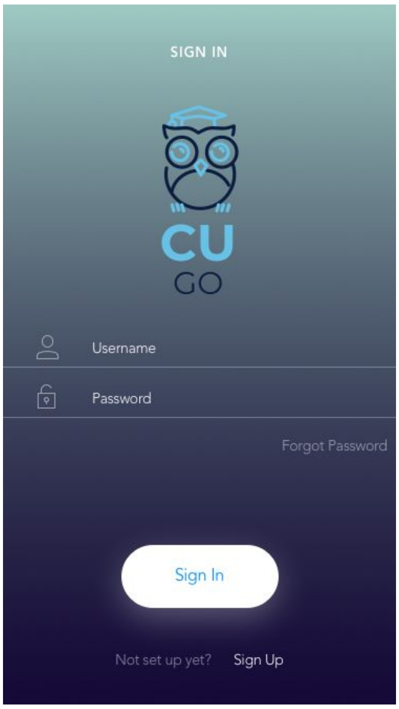
Please enter your username or email address. You will receive a link to create a new password via email.

Step 3

After clicking the link on the mail, Kate comes to the reset password page. She has to set a new password and confirm the password by retyping it again. A new password has been reset successfully. Kate has to sign in once again using her new password.

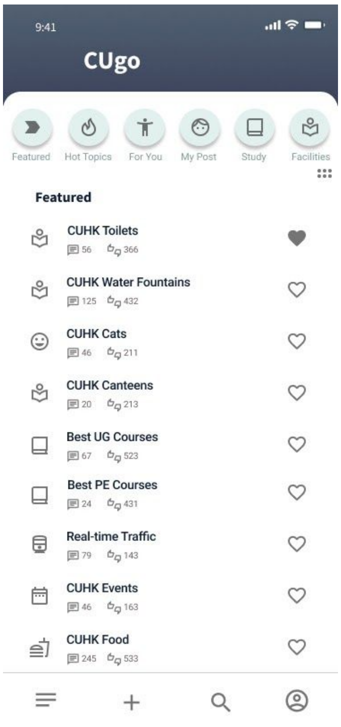


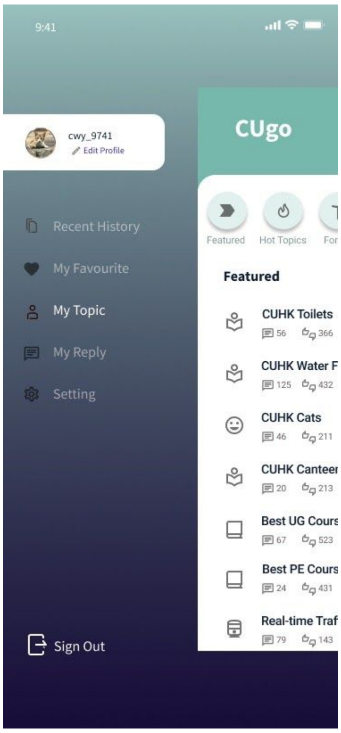


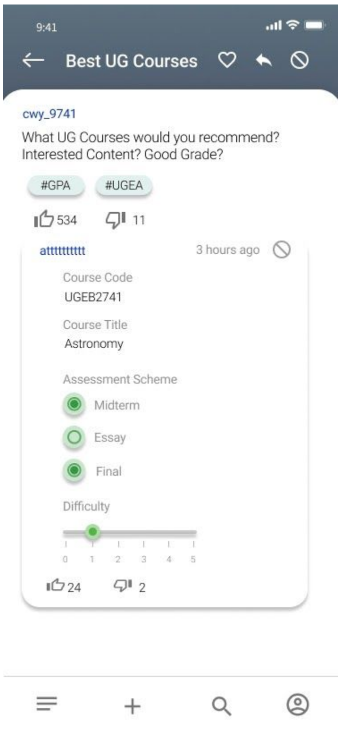


Step 4

After signing in successfully, Kate sees the list of topics and different categories on the homepage of CUgo. She clicks on the leftmost button on the bottom bar, a sidebar menu is shown. Kate goes to the Setting.







cwy_9741

What UG Courses would you recommend? Interested Content? Good Grade?

atttttttttt

Course Code
UGEB2741

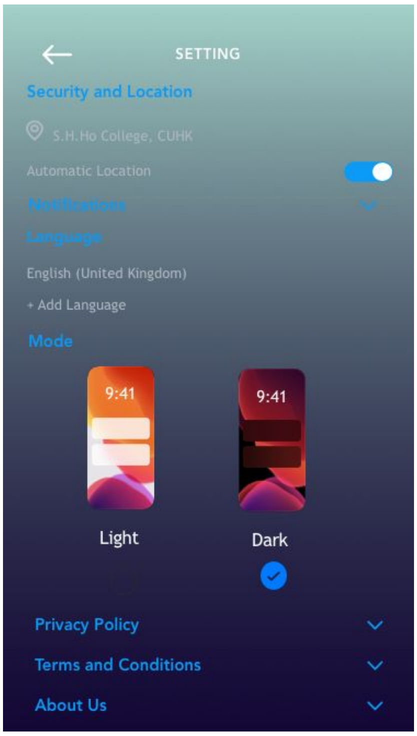
Course Title
Astronomy

Assessment Scheme
● Midterm
○ Essay
● Final

Difficulty
0 1 2 3 4 5

Step 5

Kate turns on the automatic location function which allows CuGo to track and use her location activities.



SETTING

Security and Location

S.H.Ho College, CUHK

Automatic Location ●

Notifications

Language

English (United Kingdom)

+ Add Language

Mode

Light [✓ Dark]

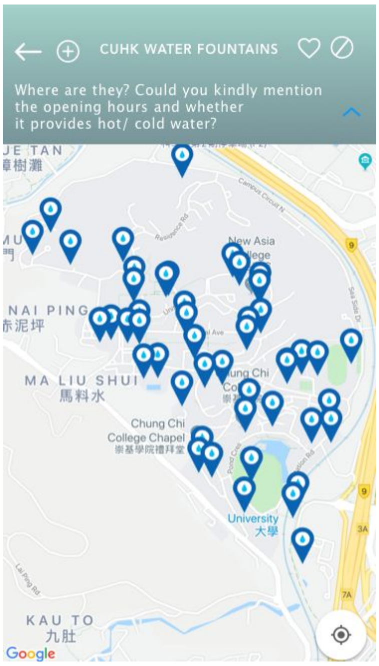
Privacy Policy

Terms and Conditions

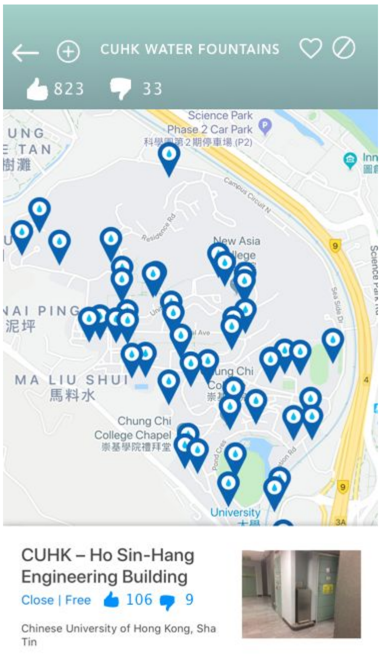
About Us

Step 6

Kate goes back to the homepage and clicks into a post called "CUHK Water Fountain", it is a located-based topic so the replies are shown on the google map as different markers. She clicks on one of the markers and the information window pops up.



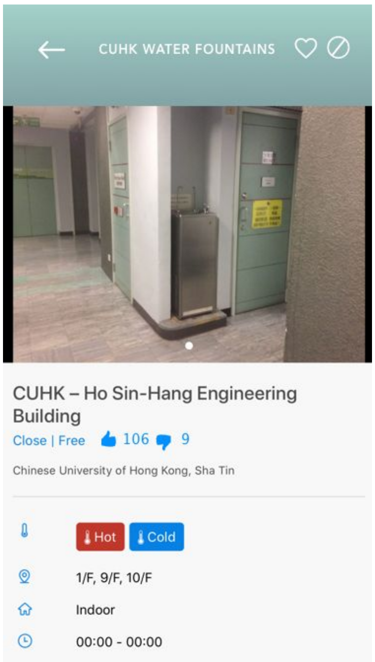
Where are they? Could you kindly mention the opening hours and whether it provides hot/ cold water?



CUHK – Ho Sin-Hang Engineering Building

Close | Free 106 9

Chinese University of Hong Kong, Sha Tin



CUHK – Ho Sin-Hang Engineering Building

Close | Free 106 9

Chinese University of Hong Kong, Sha Tin

Hot Cold

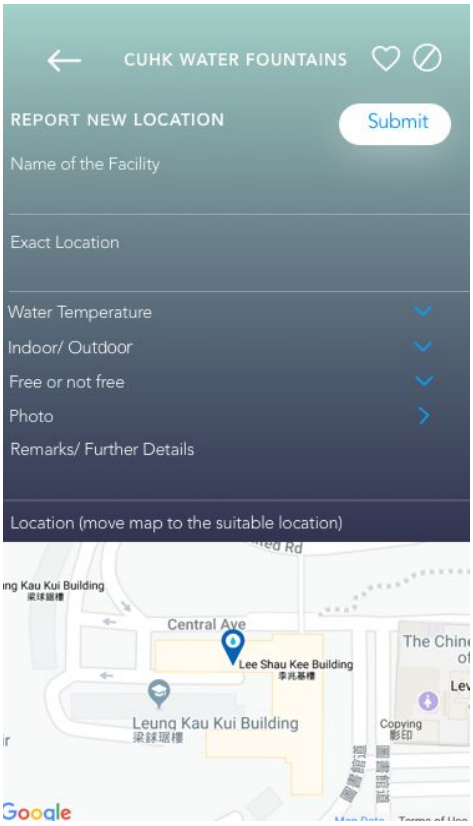
1/F, 9/F, 10/F

Indoor

00:00 - 00:00

Step 7

Kate wants to add an unreported water fountains locations, she presses the "+" add button on the top bar of the post, then she fills in the details and moves the map so that it can pin on the correct location. Finally, she can submit her reply.



REPORT NEW LOCATION

Name of the Facility

Exact Location

Water Temperature

Indoor/ Outdoor

Free or not free

Photo

Remarks/ Further Details

Location (move map to the suitable location)

6. Future Development

6.1 Fact Check

As there are many claims on the Internet everyday. By looking at the number of votes on agree and disagree in each post or comment, other users can estimate the reliability of that piece of information.

In the second term, we expect there will be more posts which require a collaborative effort. For example, if there is a user wants to know whether he has to go for another route to get to the lecture hall when there is a temporary road reconstruction in CUHK. He can create a post to ask for the current situation of his planned route. If there are some users who happen to be near the construction site, they can reply to that author of the post and provide a solution. Those users could make a reply and attach a photo of the road. Taking a photo of that location is considered as a reliable source of proof in terms of fact-checking.

This fact-checking function may be different from other methods. There are other several fact-checking techniques which could be applied but they need time to process. The fact-checking technique can identify the fake news in real-time by the facts gathered.

Hopefully, in the second term, we can make use of collaborative intelligence to deal with the spreading of fake news. Photo of a particular location could be retrieved in real-time and we can have fact-checking in a faster manner.

6.2 Recommendation Algorithm

We are going to provide a category called "For you" in the second term. Inside this category list some post which recommends to the user by the system.

We analyze the history and interest of the user for enhancing the user experience. Each post is marked with several hashtags. If the user is interested in the nice study location in CUHK, we will first search for the hashtags which as similar meaning with "study location" and "nice location". Then we suggest posts that contained these hashtags. Apart from suggesting posts which their hashtags match with users' interests, we are going to use algorithms to analyze users' interests and behaviours so that we can provide the optimal user experience by suggesting the posts that users might be interested in.

Also, we can further facilitate the experience by rearranging the layout and page access by analyzing the frequencies of visiting each page. For pages which have high access frequencies, they will be placed in a more accessible area of the interface, for example, the button linked to that page will be placed at the centre of the interface. This requires the analysis from the users' history as well.

6.3 Censor, Abuse and Report

As we aim at providing a platform which gathers reliable information. If there are some users who abuse the system or spam other users with unrelated contents, other users could report them by clicking the report button inside the post or reply. The report cases will be examined manually.

We foresee that there may be possible abuse of the system. Currently, when a user submits a reply to a post, be it location-based or non-location based, user's reply will be shown to the designated area immediately. If there are some malicious users who submit repeated replies, In the second term, we aim at censor different posts and replies on a frequent basis in order to avoid abusing usage.

6.4 Keyword Search

We are going to implement a search function in CUgo. By clicking the search button, users can type multiple keywords they want. The keywords entered will be taken to match with the title of every topic and the hashtags marked in every topic. Either part of the title or one of the hashtag match with the keyword, that particular post will be shown in the search results. This function can allow the user to get his desired post among numerous posts.

6.5 User motivation

Maintaining a collaborative platform of rapid contribution form user is not an easy job, user motivation is one of the important factors that we have to take care of.

In order to encourage users to post their queries and submit their facts to CUgo continuously, we aim at implementing a reward scheme for users to enhance their motivation to contribute to this collaborative platform. Just like the membership scheme of different forum and games, users are divided into different levels. The level of each user takes into account the number of posts and replies he made and also the credibility of his posts and replies on average.

Every effort counts, we value each contribution. The higher the credibility earned by the user and the higher the level he can achieve.

6.6 Testing

In the second term, we have to verify CUgo by testing it. During the first term we are mainly using emulation-based testing [15]. The emulator acts as a mobile device and it provides a virtual machine version. As we are going to deploy CUgo on both iOS and Android platforms, we have two different emulators as each of them can only cope with one designated platform. There are several downsides of using this approach, an emulator only allows part of the gestures as a result that we cannot test our application fully. Worse still, we cannot test the quality of service of our application due to the limitation of the emulator.

Therefore, in the second term, we are going to follow a stepwise testing scheme. We will have component and function testing first, they including white-box testing, black-box testing, testing on several gestures and functions. After that, we will offer the quality of service testing which we are going to put emphasis on performance, compatibility, reliability, security and interoperability across different platforms. Lastly, we are going to have service testing which will look into the service of CUgo such as download and installation procedures.

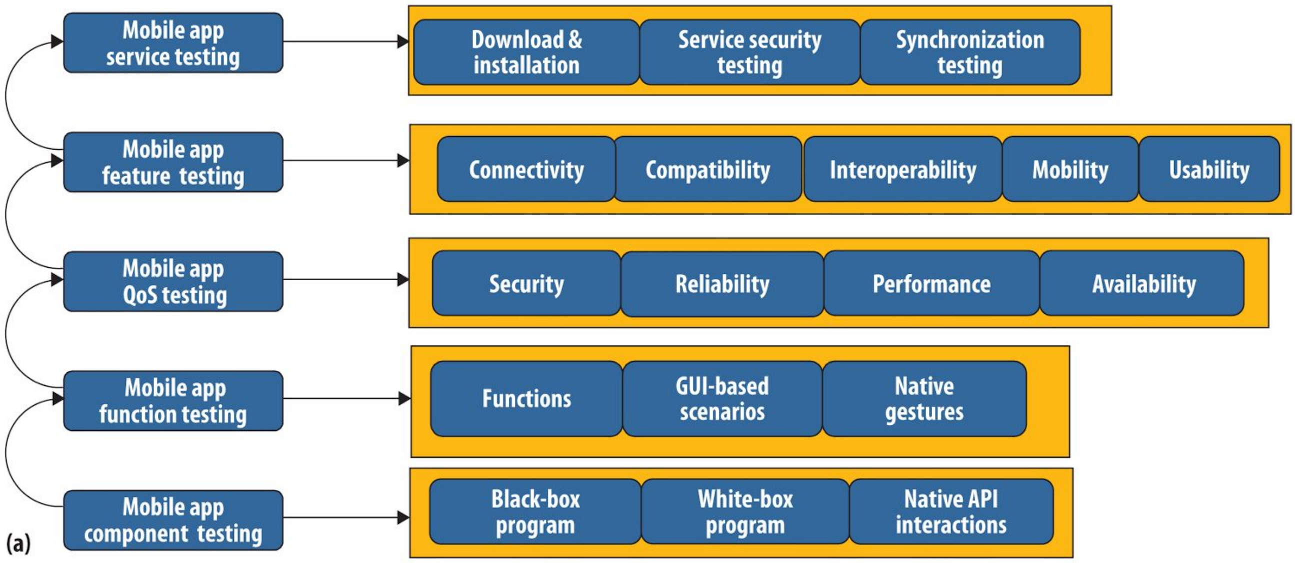


Fig. 6.6.1 Procedures of testing

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