Project Design Document

1. Introduction

1.1 Project Overview

Our project, CUHKSZ-Stack-Overflow mainly aims to provide a Q&A platform for CUHKSZ programmers who have technical questions about their Computer Science courses' projects or assignments in CUHK(SZ). It aslo offers a social channel where some of students, especially senior students, could share their programming and working experience, provide the guidance in CS learning, and give the specific suggestions to the other younger students who may encouter the same problem or situation. We hope to create an environment where students could bravely post their programming problems while other students or teachers would willingly to see and reply those questions. Hopefully this kind of communication will help students fully understand their homework, also improve their programming skill and accumulate programming experience. Those comunication and connection eventually could save much time for students learning CS also reduce the teaching load for TA at the same time, which definatle will enhance both learning and teaching quality in Computer Science courses.

1.2 Objective

Our System design comes from a famous Q&A application StackOverflow. It is a public platform building the definitive collection of coding Q&A for professional and enthusiast programmers. The system is divided into two parts, the fronted part which users could search, post and reply the questions, and the backend part, where developers and servers deal with the data transfer and management. Our goal is to provide a satisfied and perfect CUHKSZ-Stack-Overflow Q&A systetm particularly for programmers in CUHKSZ.

1.3 Expected Customers and Market

The target users of our system are programmers (all students take Computer Science course in our school, TAs, professors) of CUHKSZ. Every one who has an email account for registration would be welcomed to join the system as customers. Users could create their account password in system when they first sign up the website. They will create their nickname and other background information like the age, intersted research carrer, CS courses already taken, etc. They also need to sign up a contract to make sure they have the obligations to maintain Community harmony.

1.4 System Features

Our system is mainly composed of 6 parts, including registration and login, Searching relavent questions, Posting new questions, Answering and replying problems, Displying the highlight and hot questions or topic, ranking the excellent answers. Users could upload their questions online and also have the access to invite the people to answer their questions. They also could browse those hot questions that remain answered to see if they could help or join in the disscussion. Moreover, the searching function is also valid for users. They are allowed to search the questions by themselves with various filter type that could narrow down their searching range. More details of these features will be included in later sections.

2. Background

Our group observe that many student-programmers from CUHKSZ may encounter many familiar programming questions in their project or assignment. Their solutions mainly include: searching online, emailing TAs or professors, uploading questions in WeChat group, or assigning an office hour. Searching online sometimes may not be an efficient way, becasue the blog or some guidance information may not directly answer the assignment question. Even worse, programmers need to spend much time to filter the huge amount of information and it become hard for them to get answer when the homework question is not relavent to the results in website. Uploading question on Wechat group could get the detalied guidance and answer. But the new Wechat group will be created every semester for other students who may encounter the same problems. The connection between students already taken this course with the students taking this course right now is broken in this way. Rasing questions in office hour is not convenient for programmers to solve their question immediately since they need to make an appointment and wait until that day coming. Therefore, our group would like to take the first step to change the current situation.

Based on the inspiration of public Q&A platform Stack-Overflow, our group think it is necessary to design a similar Q&A platform for programmers in CUHKSZ. It could help them solve their technical questions in time which could save their much time in finishing homework. programmers could use this platform to browse their questions on website and they will get the relavent answer immediately since there are many students have already taken this course and they may encounter the similar problems. Also, the platform is more friendly. Programmers could use their nickname rather than true name and it is totally private for others. Therefore it would not make them shame about their questions. The platform also support many format of question, which means programmers could use code block to express their specific question rather than word. It is much efficient and clear to use code block to express their idea. So students could find the help on our website when they encounter some difficult bugs.

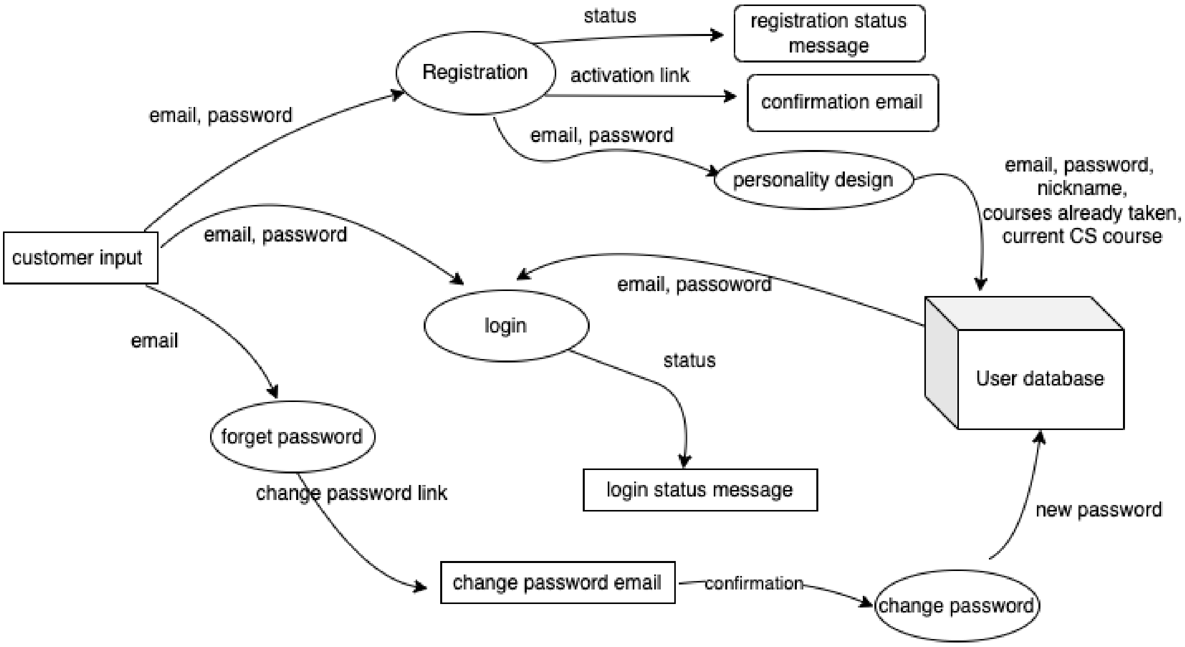
Our group also want to build it as an social community for those programmmers who want to raise some intersting topic to discuss with others. programmers will have a platform to share their learnning experience and their own suggtestions to those younger students. And this friendly environment will also encourage more programmers to learn skills and be more creative and productive.

In the view of above, our groups borrow the ideas from famous used app called Stack-Overflow in CS community, and we hope create a CUHKSZ version for programmers in our school. This website can be used to uploaded the questions relavent to their course homework, support user use code block to express their problem and specific need. The website also will ranking the high-quality answer and recommonded every member in this community to read in their homepage, which rasie interest for every community member to learn. By knowing the drawback of current Q&A mode, hopefully this system can boost the motivation for programmers to rasie question and sovle question immediately in CUHKSZ. Thus, empower every CUHKSZer programming skill.

3. Specification

We have divided our system into four main parts to show the data flow: User Login and Registration, User Search and match results, User upload questions, and Ranking System. This part of reports shows the data flow diagram and the description on the design specification of data flow and behaviour of thses four parts.

3.1 User Login and Registration



Users will have to go over a user registration process before they could use our system. The user registration function is mainly for the programmer to personalized. To create an account, we require users to enter their email and password. A format validation check will be applied to ensure that the email format is like“xxx@xxx.xxx”. There would also be a data verification process that asks users to confirm their password by retyping in their desired password in another field. An email will be sent to the email account of the user afterwards and they are required to activate their account by clicking on the link provided in the confirmation email.
Users who did not login to the system could also view the contents of the pages. For those users who would like to post comments of menus, they will have to login by typing their email as username and their own password. If users have any login problems, our system provides a function for users to change their password. These users will be asked to type in their email for

receiving an email, and in the email, they can click into a link to change password. By submitting the new password in the link, our database will update the user's data in the password field.

After creating the account, we will provide various type for user to personalized their information. They are able to have a nickname and some basic information like courses already takne and courses taking right now, language preference, etc. This basic information is public, and other user have the access to see these information. This funciton mainly help user to recognize many friends who have the same preference, and it also will be used to invite people to deal with some specific problem.

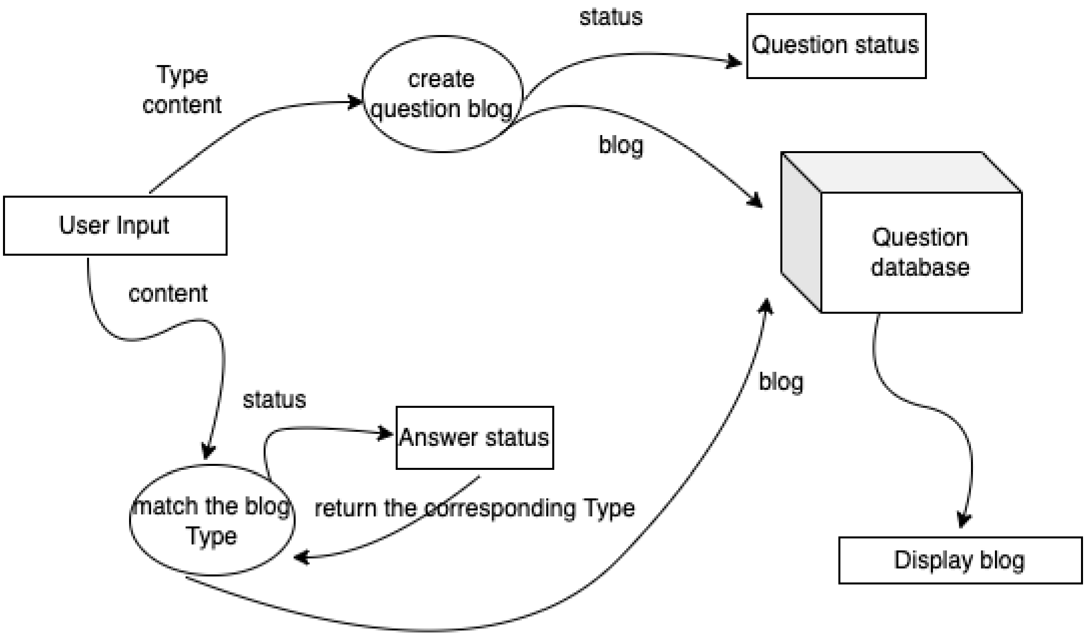
3.2 User search and match result

When user try to Search some relevant information with its problem. The System will ask them to input the question content and the question type. The question type is defined by the system admin. The question type mainly include CSC3100, CSC3050, etc. The filter is composed of two parts. The first filter is course number like CSC3100, user could only pick one of those course number. The second filter is aboout the homework number, eg. project 1. By this filter, the user can search the content in detailed like CSC3100 project 1.

The user are aslo could to upload the question content. The system will cut the word into different chunks. And the database system will search some of those chunks by some algorithm and present the most relevant blogs to user. user can search information by either the question content or question type.

The database will use the input word chunk or course type to match the corresponding blog. During the the match process, we will develop a matching algorithm to match the source information and target blogs. The first blog that is found will be present on the top, which will be regard as most relevant blog. The system will show all the relevant blogs. And user can filter those blogs by upload time, by most approved, etc.

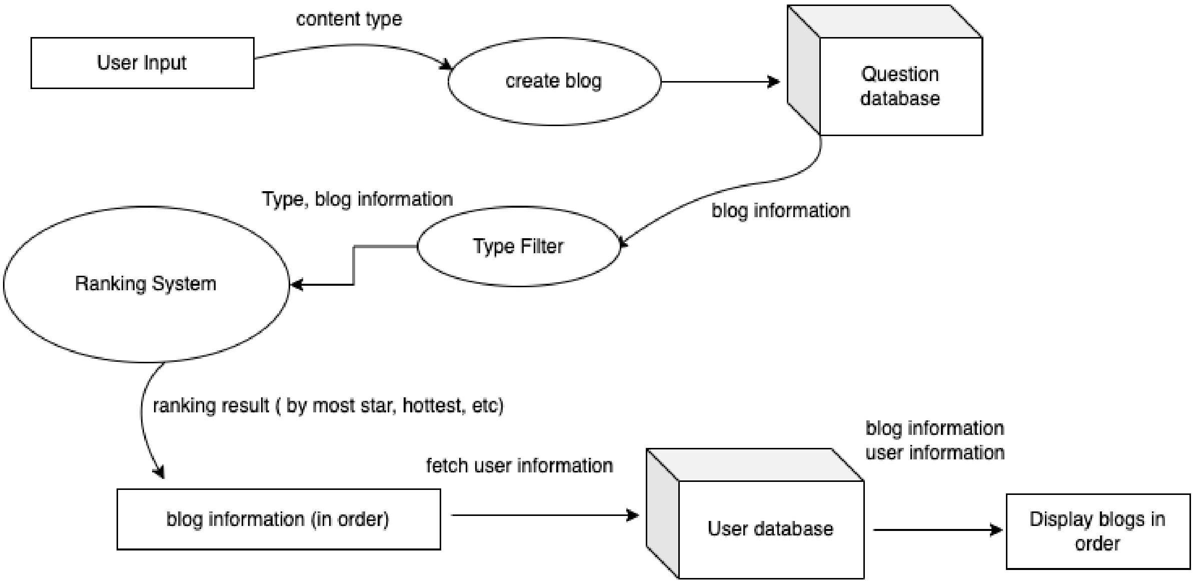
3.3 User upload questions or answer



When user try to rasie a question in the system, User have to determine which type the question is. The type include the course number like CSC3150. After user choose the type, they are required to type their question content. the content support many format such as markdown, word, text, code block, emoj, etc. Users feel free to type any question they want to ask within the type. The users will create the blog when user after finish the content, and the blog will be sent to the question databse system with users information.

When user want to answer somebody's question. Their answer will just be put under the original question blog. And the informaiton will be stored into teh database system, the course type of the answer will be the same as the question blog. The blog information will be displayed on the website for every user to see.

3.4 Ranking System



The ranking system is used when there are many blogs in database system. All the blog information will be classified into many class by their type. In each type, the the ranking system will take some particular algorithm to rank all the blog information. The system will rank blogs by created time, most approved, most necessary question needed to be answer, etc. The system will display the result to the user and recommend them to read or answer question based on their background information.

4. System Architecture

This part mainly provides an overall ideas how our system architecture design. In the first subsection of this section, an architecure diagram will be used to inllustate the structure of design in client sides, application server, and database server. In the second subsection, basic system components as well as the functions we plan to deploy in these components will be introduced. In the third subsection, we will describe the relationship of our major system components using UML diagrams.

4.1 Architecture Diagram

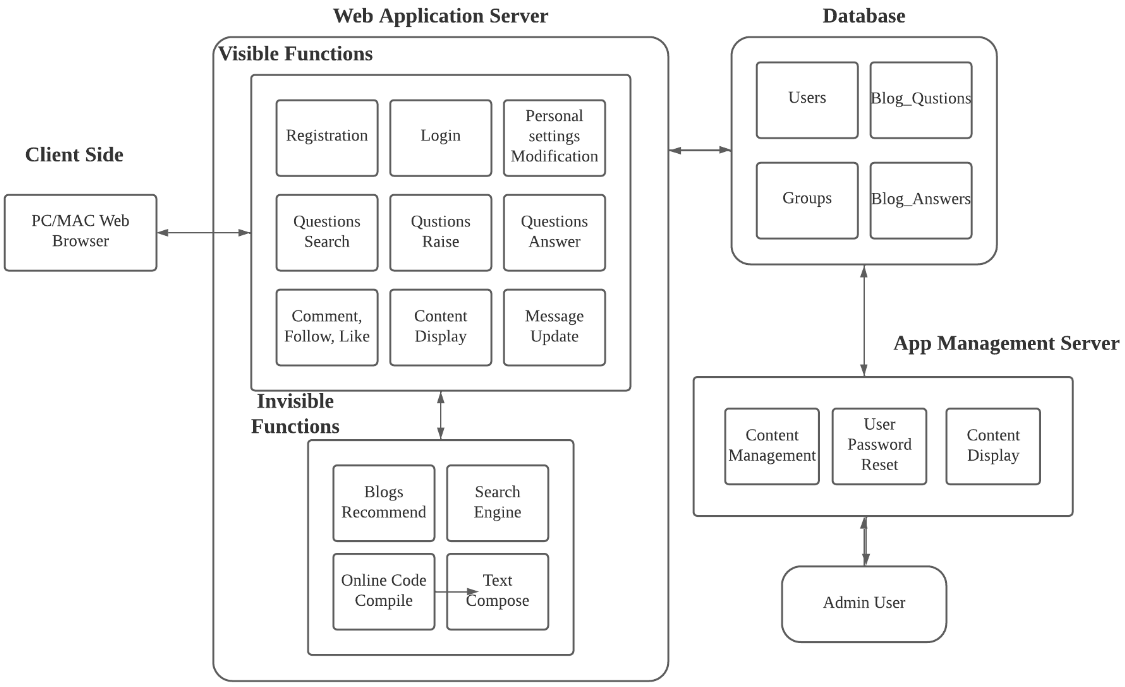


Figure above provides an understanding of the overall design of our system. Totally, our system can be divided into 5 parts, where 2 parts are regarding users, 2 parts for admin user, and 1 part regards database.

In the front-end part, users can access our application via browser. Users interact with our application with the fancy user interface we provide and is able to use the visible functions below:

- Registry via email verification
- Login\logout
- Set personal information includes modifying password and uploading profile photo
- View the contents recommended by our system
- Search questions
- Edit and raise questions
- Answer questions raised by others
- Compile and run codes online
- Follow and like others' questions
- Comment on others's answers
- View the updated massage that relates to users

To empower the visible functions provided to users, we have some invisble functions that invisible to users while embeded in our system. These functions benefit the QoE by delivering contents users might be interested in, increasing the speed of searching, providing a pretty text composition, and enabling user to compile and run codes on website so that questions and answers about coding could be inllustrated in a vivid way. The invisible functions we provide to users are listed below:

- Blog recommendation: in charge of delivering the recently hot blogs to users.
- Search Engine: in charge of analyze the questions user type in and return the correlated results in an efficent way.
- Online code compiling, running: allow user to compile and run their codes writen in blogs online.
- Text composer: compose what users type and display it in pretty style.

For the part of data base, our database server maintains mainly four tables to store the infromation about users, groups, blog questions, blog answers.

To allow the handy management of our application, we provide another user interface for the admin user. The admin user is allowed to access and manipulate on all the data in database via the functions we provide in app management server.

4.2 System Components

4.2.1 Frontend Development

Our produce would be presented as a website composed of html, CSS, Javascripts. For the development of frontend, we plans to adopt the framework Vue. Additionally, we plan to make our user interface to be user-freindly and fancy by designing pretty UI.

4.2.2 Functions

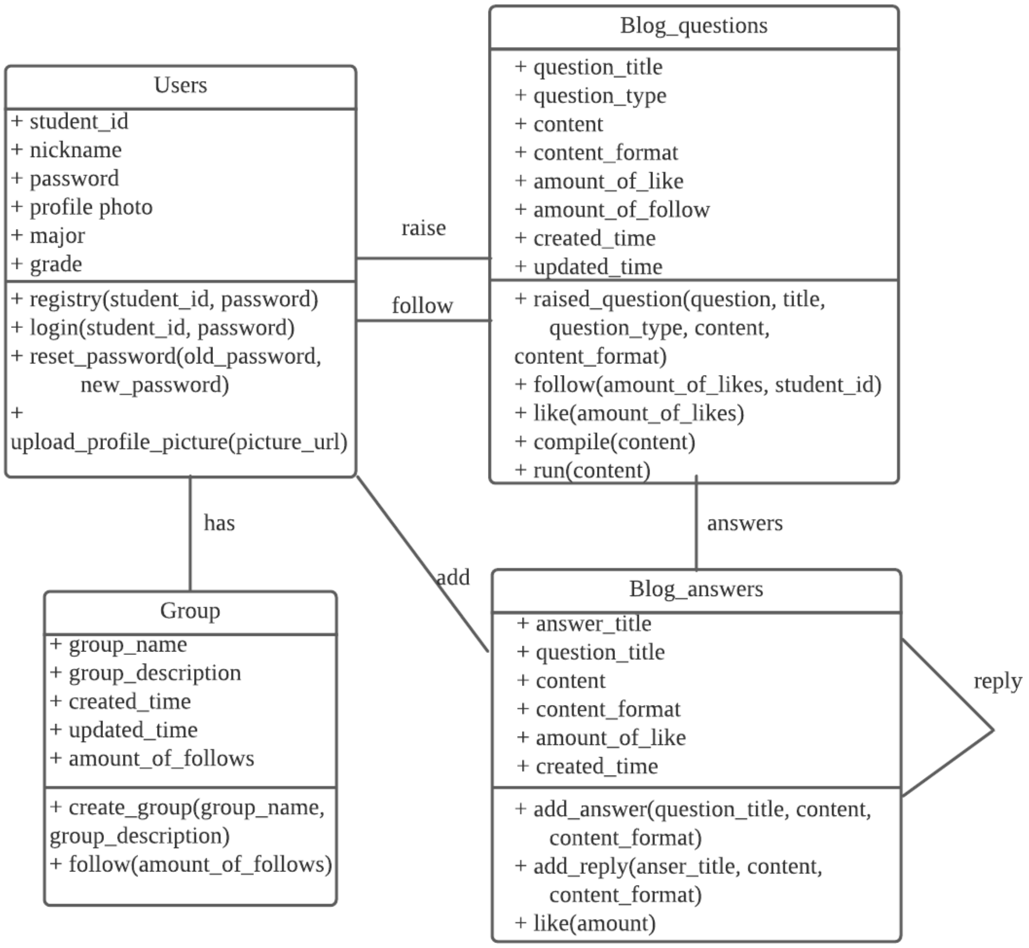
In previous part, 4 major functions are mentioned:

- User Login and Registration
    - This function requires the backend to verify whether the user's input of email is whether the email account of CUHKSZ and send the verification code to users via email. After user type in the verification code, it should check whether it is matched and store the user's information into database.
- User Search and Match Result
    - User should be able to search for the questions and get the relavant results via this function. This function is empowed by the search engine we plan to implement in our system. Our system should chunk the questions users type in, also get the question types selected by user. Then it should use the algorithm we would design to find the relavent blogs in database and present it to users. The search engines to be robust enough to deal with various questions from user, as well as efficient enough to return the search results within a time users can accept.
- User upload questions or answer
    - For this part, our system should allow users to type in the subject of quesitons, types of questions, and content of questions. What's more, the system should provides diffrent format of content like markdown, word, text, code block and so on. Our text composer should be robust enough to compose the various raw content user type in prettly. Our online compiling and running function should enable the users to execute the code written in code block.
- Ranking system
    - This function should rank the hot blogs according to the amount of follows, likes, and views, of the blocks. It should keep updating the ranking of blogs in a reasonal period of time(every 30 minutes) according to the data stored in database and recommend them to users.

Middleware and Communication

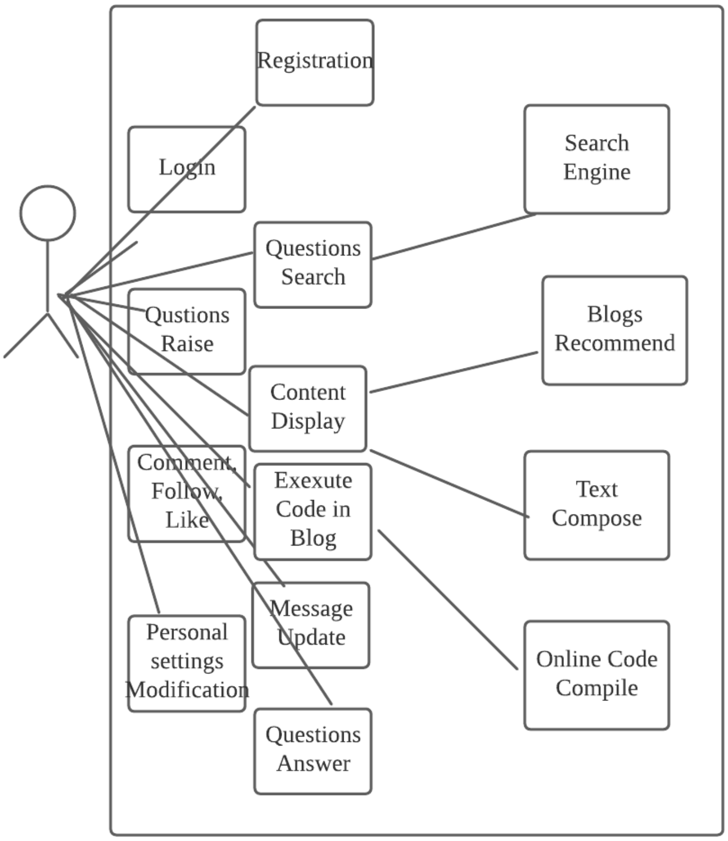
For the middlewares we plan to adopted in our product is some middlewares assiting text composition, code block's online compiling and running. These middlewares would be together installed on the cloud server, and where our application on cloud server could directly use them. For the communication between frontend and backend, we plan to use POST and GET request to get the data from end. Then, the backend would deliver the data back with data formated in JSON. For the requent manipulating data in database, we plan to direclty use the API implemented in Django for some simple manipulations, and write some SQL statements for the complex manipulations.

4.3 Description of Major System Components by UML

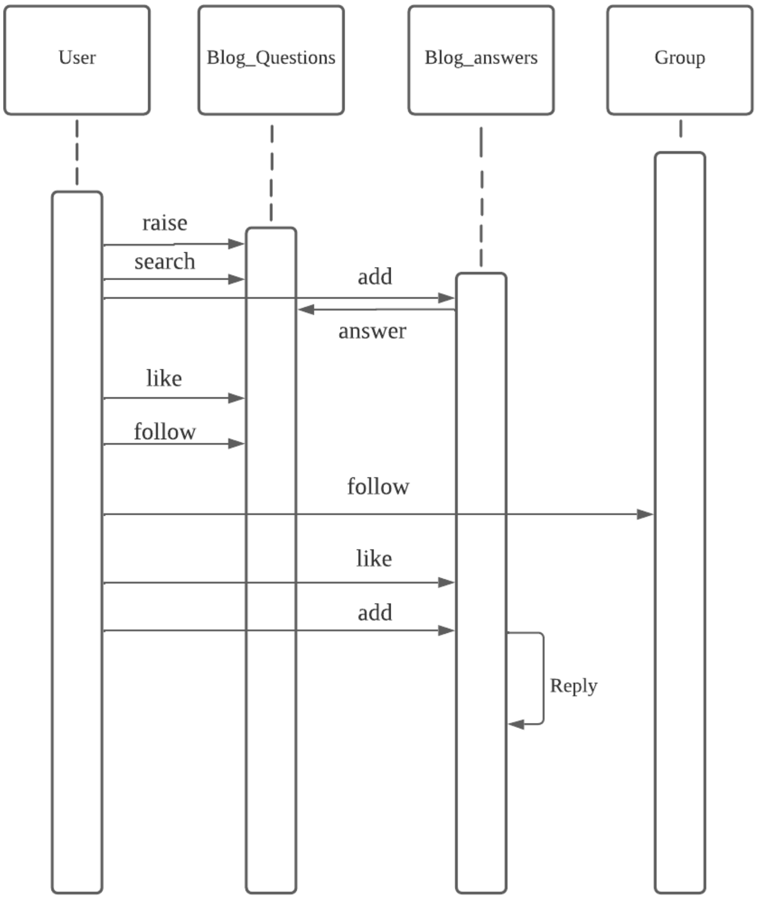


The above diagram shows the classes we plan to include in the development process and database. For each class, it has several functions which helps to manipulate the information in each class and implement other functions we provided to the client. Class `Users` stores the use student id as the main key and contains other basic infromation of users. Class `Blog_questions` represents each blog of question, it get title as the main key and contains other feature decribe the contents of this question. Class `Blog_answers` represents the answer answering to the question, which use answer_title as its main key. As it shows, it contains question_title which is the foreign key of class `Blog_questions`. For the class `Group`, it stores basic information of a certian group, which use group_name as main key.

Regarding the relationships between each class, `Users` and `Group` has a multi-to-multi relationship, means one group contains several users and in users can follow several groups. For `Users` and `Blog_question` as well as `Users` and `Blog_answers`, one user can raise several questions and gives several answers. Another relationship between `Users` and `Blog_questions` is follow, which means one user could follow one question he/she is intereted in. For the relationship between `Users` and `Blog_questions` is that one users can add several answers. In addition, one special point is that `Blog_answers` can have relationship with itself, which means the one answer could be the reply to another answer but not limited to questions.



The relationship between between the user and functions we plan to implement is shown in the above figure. The functions directly connected to the user are the ones user can directly use with clicking the icon or typing something. The functions not connected to users are the invisible functions which empower the functions that is visible to users.



The above figure is the sequence diagram whch discribe how does the process of QA works. First, user raise a blog question and the question would be stored in the database. It allow other users to search then find out the question in by the search engine. Then the user who wanna add the answers regarding this question can add an answer, and the answer would be automatically displays under the corresponding blog of question. The users can like and follow the questions, where the information would be added into the table of blog questions in database. The user could also follow a group and like a answer. Also, the user can add an answer to reply another answer, and this would also be stored in database and be queried from database when display.