Detailed Interim Report

Title: A Smart Phone Application to support Peer Learning

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Abstract

Colleagues always encounter assessments from different courses. It is quite common that the students do not perform well in the conceptual topics and feel nervous about inadequate concept understanding. The students, therefore, may inquire classmates, surf the internet and have consultation with tutor for help. In this report, the smartphone application is designed for supporting peer learning, like sharing experience and having a discussion on difficult topics, namely Artificial Intelligence, Advanced Algorithm and so forth. The application is constructed by three main components, frontend User Interface, backend storage and business logic. The application is cross-platform, it will be available for Android users and iOS users, all colleagues, who major in Computer Science, can download and use the application. Due to the time limitation and insufficient manpower, supporting language, account security and the chance of maintenance updates will be the expected difficulties for the application. Currently, the preliminary designs of database configuration and User Interface are finished. The elementary design will be implemented and realized in December. Last, the schedule of project development will be shown.
Acknowledgement

I would like to give my greatest appreciation to the people who supported me through the project development. Dr. Chim, who is my project supervisor, guided me the requirement of the project and provide valuable suggestions on my project architecture, including the frontend and backend design. Moreover, Dr. Chim discussed the details and improvements of the mobile application with me, I believe the suggestions would enhance the user experience in my application.
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1. Introduction

1.1 Background

The university of Hong Kong offers hundreds of courses under different departments, like Computer Science, Philosophy, Statistics and so forth. Students take their interested major or elective courses and enhance the knowledge. However, the assessments from several courses and examination preparation are always the most difficult obstacles in front of colleagues. For instance, Principle of Operation System course requires the students to write a multi-threading program while Modern Technology on World Wide Web requires the students to write a interactive website. Attributed to the irrelevance between knowledge acquired from courses, CS colleagues may not catch up with or fully understand the information or skills required in every course.

1.2 Current situation

Seeking for appropriate help has become easier now. Many forum websites purposed to principles or difficulties encountered sharing, tutorials for different coding languages and template sharing (e.g. GeeksforGeeks [3], StackOverflow [4] and Quora [5]). Colleagues, moreover, can contact lecturers and tutor through email or phone number posted in moodle. User can seek for the addition materials, having a consultation or inquiring any conceptual questions. Lecturers and tutors, however, have many things to do, they would not be always available to give suggestions. In addition, the solutions found from online website may be not suitable with reference to coding skills and programming language required. The application is designed as a communication platform for the Computer Science students, exploring courses not related to CS, studying the academic topics and sharing funny things happened are also welcomed.
1.3 Motivation

This project hypothesizes that designing a mobile application can be valuable in exchanging experience, inquiring and learning as well as facilitating colleagues’ communication. Moreover, lecturers and tutors can relieve the pressure on answering massive students’ questions. Supervisor believed that the colleagues, who have studied the corresponding course, give more precise and concise suggestions compared to online forum, because they experienced the assessments and theories required in the course. The project aims to enhance the students’ overall performance in CS related courses.

This paper proceeds as follows. First, the report introduces the main objectives and flow about how students utilize the application to motivate the applications architecture choices. Next, the scope of the application will be described. Then the implementation on architecture as well as evaluation on the choices will be introduced. After that, three expected difficulties and limitation in the development will be offered.
2. Objectives

The main purpose of this project is to design a cross-platform smartphone application that help HKU CS students tackle their academic obstacles, facilitate the interaction between colleagues and relieve the tutors’ burden.

Since Computer Science gains popularity in recent years, more and more students choose computer science as major or minor subject. This application provides an easy to use tool for students to learn related knowledge. The application will be like a forum. Through smartphone, students can browse the posts everywhere and every time. No matter the questions related to academy or daily life, colleagues can post what they want on the suitable category and wait for other students’ responses.

This project aims to help the students effectively enhance their concept related to CS or coding skills by inquiring and answering. Furthermore, the colleagues can share the anecdotes in campus. The application, moreover, will be a potential way to make friends, users may assemble the classmates and attend the lecture together. Using smartphone application can avoid face to face talking and reduce the feeling of awkward when students are asking to other unfamiliar classmates.

To complete this application, three components are needed. First, backend database storage is the place the application stores the data. To maintain the short running time, database design must be concise and precise. Secondly, frontend User Interface (UI) is anything the clients can perceive when the clients run the application, UI is designed to represent the data stored in server side, like the posts or comments in this project. A user-friendly UI design is crucial, user can get started to utilize the application within 15 minutes. Finally, a backend logic is
needed to provide application programming interfaces (APIs). In simple words, API is dedicated to connecting frontend UI and backend storage. User can input comments or questions thought UI to trigger APIs, APIs send a request to backend server for update, store or delete, and vice versa.
3. Scope

This project aims to study how to design a UI, backend storage and the logic between them to comprehensively develop a mobile application. In addition, more social functionalities, like evaluation system, private message system as well as friend list system will be considered to develop. The interim goal of the project is to design a user interface prototype application and fulfilling the basic test cases requirement.

The final goal of the project will develop more functions on the application and deliver a executable smartphone application for peer learning. For example, user can give rating to others’ comments, high rating for useful sharing and low rating for offensive comments.

When a user perceives an answer from high-rating user, he can believe that this answer is more reliable. High-rating user, moreover, will have priority to put their posts on top of post list. This feedback effect will encourage all users to share useful experience or tricks, questions raised by high-rating user will be noticed by other colleagues easier. It is considerable that allowing users post audio or gif file to discuss their questions will make the application to be more interactive, it would be implemented too if time allows.

Private message system as well as friend list system are focusing on peer communication. User can convene the like-minded people within discussion. They, for instance, can be very interested in specific field, namely Web development, database management or system operation. The users may be interested to add each other into friend list to keep contact and do further discussion.
4. Methodologies

In this chapter the approaches and architectures of the project will be introduced. The backend design is possible to have modification since the backend parts are not implemented yet. Any modification may occur if other software can provide better performance.

The main components of this project are the Frontend User interface and the backend storage. User Interface gives basic idea to the user how to utilize the application and backend storage stores the posts and comments in the application.

4.1 Backend database storage: MySQL

MySQL is fast and easy-to-use Relational DataBase Management System. It is suggested that MySQL has the advantages of being well established, stable and reliable [6]. Figure 3 shows that developers can implement their database in the form of tables, columns and ordered by indexes.

![Figure 2. MySQL Table Structure](image)

MySQL provides comprehensive referential integrity to ensure the relationship must be formed by existing row. Referential integrity acts as foreign key to establish linkage between two tables and prevent from pointer error occurs.

Since the university has provided the phpMyAdmin account, which is also one of MySQL administration tools, it is free to use for HKU students. Compare to MongoDB, MySQL uses
SQL language to implement update, search and delete operation. SQL language is easy to learn and easy to implement. To conclude, MySQL will be an easy-to-implement and convenient database storage.

4.2 Frontend Design: React Native

As a part of user may use android smartphone while others may use iOS smartphone. To consider both kinds of user’s interest, cross-platform application will be more favourable in this situation.

React Native is a JavaScript-based framework for designing mobile application. React Native is based on React, however, it mainly focuses on mobile application platform [2]. Since the coding used in developing either platform can be shared to other platform, developers can easily develop both platforms concurrently. Figure 1 shows the User Interface designed by React Native, colorful button can be easily created to have better interaction with user. For example, users can identify the functionalities of buttons based on different color.

![Figure 3. The UI designed by React Native](image-url)
Moreover, React Native will report the error and help user accommodate the error intelligently. Therefore, React Native will be a good choice for designing User Interface without complicated animation in cross-platform application.

4.3 Backend Server Logic: PHP

PHP: Hypertext Preprocessor is a server-side scripting language for Web Development originally. Since PHP is easy to use to access the backend database (phpMyAdmin in this project) for selecting, inserting and deleting actions, it can quickly build the server logic for testing. Furthermore, PHP has been in existence for a long time, lots of bugs are discovered and solved so this programming language is currently very stable. The mobile application product calls the responding URL to receive json format data if the device can access the Internet. Reliable server decreases the chance of denial of service problem.

4.4 Project Features

Rating Mechanism:

Rating is purposed to increase the reliability of certain users’ response. For example, the user always raises contributive solutions, he will obtain high rating and identifiable signature. All users recognize the signature and rest assured that this high-rating user is reliable. All users contain a rating which is 1.0 initially. The highest rating is 10.0. A star signature will be given to the username if the user obtained 8.0 rating or higher. Moreover, the rating information can only be retrieved by the user himself. This prevents the opposite effect from low-rating user, such as the reliability or reputation of low-rating user.
Email Notification:

Email notification will be sent to the user’s email automatically when the user’s post or comment has new replies. Every user does not need to browse their posts frequently for the most updated comments.

Customizing Browse:

A post can be searched by the topic keyword or Course code. It is trouble that the user searches the course codes he has studied one by one. Therefore, the application supports customization of browsing. The student can select all course codes he wants to search in the user setting. A “Customized Page” will show the searching result. The user can just browse the “Customized Page” for all posts with the focused course codes.

File / Image Upload:

The application allows the users upload their questions or codes in the discussion. It will be more attractive than just text discussion. The colleagues will understand thoroughly from the uploaded file instead of text description.
5. Discussion of results

This chapter is going to introduce the progress of the project done currently. Basic functionalities have already finished in the current stage.

Backend server consists of php files. The logic has been examined from the simple frontend User Interface calls. React Native supports fetch() function to send http request to the php through URL and get the data in json format. Now the application supports browsing the posts, searching the posts with criteria, creating the new posts, login account and register new account.

For the purpose of security, the token-based authentication is studying and implementing. Preliminary authentication has been made for testing login. When the user logged in the account, a random hashing value will be generated. The userid and hashing value will form a key-value pair and store in the database table. The hashing value is stored in the user’s device temporary storage. When the user launches the application again, hashing value is used to verify the user’s identity and logging in automatically in the application. It prevents the attackers from directly changing temporary storage variable and attempt to spoof others’ identity.
6. Future Plan

This chapter is going to introduce what will be done in the second semester. The current prototype is simple and contains few functionalities only.

At the end of January, the project will focus on the appearance of user interface since the current user interface prototypes are too simple for testing backend logic. It is expected that a basic functional demo with attractive appearance will be finished at the end of January. For instance, the post and comments will be displayed in a dialog form. The content of post and comment will be included in a cloud-like container.

First user acceptance test will be carried out by inviting Dr. Chim and the colleagues. Users’ experience and suggestions are appreciated to improve the application. It is expected that the test can discover the more convenient and detail operation method.

Furthermore, extra functionalities will be designed or integrating into the application For example, customizing weekly schedule are taken into consideration now. Since the weekly schedule from HKUportal only shows the lectures time. Students can include the tutorials or private events to have better time management.
7. Limitations and difficulties

7.1 Constant update according to the platform
Sometimes when iOS/Android OS updates their internal APIs, the developers may need to work around the latest update to be available in latest OS version. Although a bug happened in either version, developers need to update the whole applications for Android users and iOS users. The application is cross-platform. Either iOS or Android OS updates their internal APIs, the application needs to update too. The probability of updating will be increased or doubled. A supporter may be need for constant checking and debugging if the application can be put into practical use.

7.2 Account Security
If there is no encryption method to protect user account information, attackers can modify the cookies or environment variables to perceive the password and usernames easily. Authentication can ensure only the account owner can access to their account information. With time limitation, it may be quite difficult to implement two-factor authentication or token authentication.

7.3 Supporting Language
Since there are students from different countries in HKU, providing various language version will be more user-friendly, such as Chinese, English and Japanese. However, developing the application to offer various language must consume more time. With time limitation and individual project, this application will only use English. English should be the most common language between colleagues. Translation will be considered after the user interface, functionalities and backend logic of the application are maturely developed and executable.
## 8. Project Schedule

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<tr>
<th>Month</th>
<th>Activities</th>
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| September | Initial project planning on frontend/backend design.  
             | Constructing the detailed project plan  
             | The project website. |
| October   | Study the programming on frontend software  
             | Study on related work and drawing the interface prototype |
| November  | Implementing the User Interface design and have a user acceptance test. |
| December  | Collect the participants’ feedback and improve the UI.  
             | Implementing the backend design and basic function of the application. |
| January   | Interim report and deliver a demo version prototype.  
             | Combining frontend/backend design. |
| February  | Compiling the final product.  
             | Do Second User acceptance test. |
| March     | Collect the participants’ feedback and improve the products’ functions.  
             | Debugging and final adjustment. |
| April     | Final implementation and detailed final report submission and presentation. |
| May       | Final year project exhibition |
9. Conclusion

This report first introduces the motivation and background information of the project. Then the frontend and backend designs are discussed and justified. Followed by illustrating entity relationship diagram and paper prototype to realize the preliminary implementation currently. Due to time and manpower constraints, the application may be limited in supporting languages and required constant updates. The interim prototype will be used to test the functionalities in the user acceptance test, which will be tested by supervisor. Next, the feedback collected helps improve the mobile application. After the modifications, the final products will be finished by April 2019.

This cross-platform mobile application encourages colleagues to ask questions and help others. By discussion among students, they can have better understanding in the concepts or better performance in the courses related to Computer Science. Students will be attracted because the application provides opportunity to practice their knowledge in previous courses and the application is easy to use in smart phone.
10. References


[Accessed 28 September 2018].


[4] StackOverflow

[5] Quora