Enhancing Students' Technopreneurship Projects with Mobile Collaboration and Communication Application

Stephanus Eko Wahyudi, Kartika Gianina Tileng, Ian Budi Kurniawan
Universitas Ciputra Surabaya, Indonesia
stephanus.eko@ciputra.ac.id

***Abstract*—Technopreneurship subjects are a series of 3-semester subjects at Universitas Ciputra. Students usually take these subjects during their final years, which invoke problems, such as less frequent campus visit, motivation lost, miss milestones deadline, and many more. Information and Communication Technologies application can be used to promote the bond between lecturers/supervisors with students and among the students. Mobile collaboration and communication application allow the students to get notifications, relevant resources, communicate and collaborate. The mobile apps discussed in this paper is part of an integrated system which also includes a website. It was developed using SDLC methodology. Firebase cloud service developed by Google is used as the backend, including Firebase Real-time Database, Firebase Storage, and Firebase Cloud Functions. The result is that the application is easy to use and useful as a mean of support that helps the students to complete the subject series.**

***Index Terms*—Collaboration; Communication; Technology Entrepreneur; Mobile Application.**

I. INTRODUCTION

Universitas Ciputra Surabaya, Indonesia, has committed to create world-class entrepreneur. In the Informatics study program, there are a series of subjects that study about Technology Entrepreneur called Technopreneurship. The 3-semester subjects are a continuation of Entrepreneurship 1-5 subjects, compulsory subjects for all of the university students.

In Technopreneurship 1, students develop Information and Communication Technology (ICT) ventures. The business should be based on real-world problems. The solutions offered must meet the need of a great number of prospective users and have the potential to grow the number of users rapidly in a short time. To support the development of both products and services, students take internship program on Technopreneurship 2. Through the internship, they gain insights and experiences from the industry. This kind of real-world world experience is very useful to future challenges they will face. Finally, in Technopreneurship 3, students focus themselves to develop the products planned. Under the supervision of one or two supervisors, they will complete their final projects as one of the requirements to obtain a bachelor's degree in Informatics.

The long series of courses that must be taken within 3 semesters requires not only student's concentration and dedication, but also support from mentors. In the last few semesters of their study, the frequency of student visits to campus decrease as they completed most of the subjects in previous semesters. This raises a problem where the frequency of face-to-face meetings between students and supervisors or lecturers and tutors are less frequent. Students need to be reminded of milestones and deadlines they have to follow. Supervisors have to provide continuous encouragement and support, both technically and motivation.

By utilizing Information and Communication Technology, there are several things that can be developed to reduce the aforementioned problems. Various coaching and mentoring processes that usually have to be done through face-to-face meetings can be enhanced by web or mobile technology applications [1]. Mobile technologies introduce possibilities of new learning experiences [2].

This study is based on the previous study which investigated the problems and students' perspective of social media features they needed to support them in taking the series of Technopreneurship subjects [1]. The study found that students need a number of features to support them to find information related to their projects, to communicate each other with their peers, as well as to collaborate. Based on the requirements, a website and a mobile application that offer a different set of tools then developed. This paper focuses on the development of the mobile application.

II. ONLINE COMMUNICATION AND COLLABORATION

Information and communication technology can be developed to provide a number of features to support students in their efforts to complete various tasks they have to complete. The popularity of the Internet and Mobile technologies provide an opportunity to use the technologies not only for entertainment purposes but in education as well. This technology can be used to communicate, collaborate, and to develop unique learning experiences [2].

Mobile communication technology can be used as an effective tool to improve the bonding between students and instructors [3]. The bond between supervisors and students is needed to encourage more frequent communications between instructors and students. This also allows both parties to collaborate more actively [2].

However, it should be considered that the more features provided, the more it will indirectly make it difficult for students to find the features they really need. Some features might be best provided on mobile apps, while others might be better off to a website. Mobile application is suitable to exchange brief information and as social communication tools, while for a large amount of data transferring needs, a website is more suitable in this regard [3]. Some features

might be needed to be provided on both tools, as some students prefer using laptop or personal computers to study, while some others prefer to use mobile devices [2].

III. Adaptive System Development Lifecycle

Software development processes should follow a certain procedure in order to produce high-quality software that are fit to the users need, easy to use, robust, and reliable. One of the fundamental concepts of a successful information system projects development is System Development Life Cycle (SDLC) [4].

There are many different approaches to SDLC, from adaptive to predictive approaches [4]. SDLC with predictive approaches can be used where the requirement is already clear and probably not going to change within a certain period. In contrast, adaptive approaches SDLC can be used where the requirements might change in the very near future, so the developer should be able to change and adapt to change.

One of the oldest and basic predictive approaches of SDLC is waterfall model. In this approach, the phases are carried out one after another. There is no going back after the phased move to the next phase. For most developers, this approach can be difficult to be implemented, as usually something should be added on along the process. depicted the Waterfall Model SDLC. Figure 1 depicted an example of Waterfall Model SDLC [5].

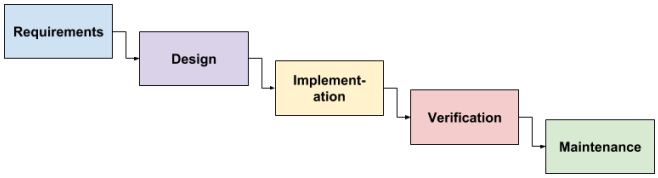

Figure 1: Waterfall model SDLC

There are many other approaches that fall into adaptive categories [4], which includes spiral model, iterative, incremental, walking skeleton, and many more. On iterative approach (Figure 2), the SDLC phases are conducted several times, and in every iteration, modifications can be made that allows the development to adapt to requirements change. Incremental is based on interactive where small additions are included in the system development on every iteration.

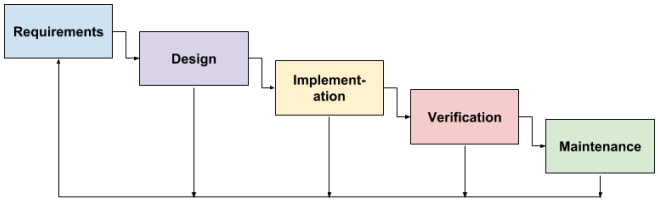

Figure 2: Iterative Waterfall model SDLC

IV. Methodology

The study uses Iterative Waterfall System Development Life Cycle. The mobile apps developed with the most useful features. Additional features will be added later.

The first phase is requirement analysis to identify the apps requirements. Following that is design phase that transforms the requirements into system architecture, database, and user interface. The design then implemented into code in the following phase. Finally, the application tested on some users to verify and validate its ease of use and usefulness before published to the application store. The maintenance phase is an ongoing process and will not be discussed in this paper.

V. Requirements Analysis

A. Features Based on Previous Study

Previous study by Tileng and Wahyudi [1] found that there were some important software features needed to improve the process of coaching and mentoring. Notification was one of the most important ones. The students also needed to be reminded of what to do next, what documents or administration that must be completed, as well as various other things [1].

Other must-have features needed are related to announcement and guidelines, including department announcements, related references information, writing and research guidance, tutorial videos, plagiarism checker tools, reference testing, and progress monitoring. Accessible online announcements, such as seminars or workshops dates related to their final assignments, will be very useful.

Students also needed a list of topics offered by the supervisors. During writing reports, students are also having difficulties in several ways in report format and template, as well as tips and tricks to write official reports. Information on how to quote or citation format specified by the university will be beneficial.

Software features that allow them to store references or sources they found and allow them to find references based on previous students' projects or studies also considered very helpful. However, this feature should consider the danger of plagiarism.

B. Benchmark

There are some information and communication technology solutions that are available in the market today, that might be able to contribute as a solution to the problems. There are eLearning platforms, social media and chat platforms, as well as collaboration tools on the desktop or mobile applications.

Two examples of popular e-learning platforms are Moodle and Edmodo. These platforms are very popular and used around the world. Both platforms are also available on the website as well as mobile apps. Edmodo and Moodle are very rich features that are enough to support teachers or lecturers to organize a class and to support students' self-study. However, in some cases very specific feature that is required might not be available. University interlinked data for example, is not possible to integrate on these platforms [6].

On one side, these platforms are feature rich to support eLearning. On the other side, many of these features are not needed in the context of the problems discussed in this study. While the features provided are specific need might not be supported.

In the past several years, a number of chat platforms are emerging and becoming one of the most used and downloaded apps on application stores. WhatsApp, Line, and BBM are among the popular chat platforms in the market. These platforms are matured enough and simple to use. WhatsApp is a very powerful tool to support blended learning activities [7]. The platforms allow its users to easily share documents, videos, or images. However, some users find it difficult to find older videos, images, or documents from the

archive. The chat sessions also tend to be very long and often not organized into a specific chat topic, especially if there are many people join the same chat room.

Social media such as Facebook can also be used to support teaching and learning processes. These social media platforms provide a number of features that can support teaching and learning processes, such as groups, file sharing, chats, and many more. However, students are easily distracted by other posts that are not related to their study.

VI. Design and Implementation

A. *System Architecture Design*

Firebase is a cloud service provided by Google. A number of features provided allow developers to focus on web or application development without having to worry about the infrastructure [8]. Realtime Database is similar to that of the traditional database stored in a reliable cloud service [9].

The mobile application was developed for Android mobile operating system using Firebase as the backend. Firebase features used in the development: Firebase Real-time Database, Firebase Storage, and Firebase Cloud Functions. Firebase provides several API that allows communication between the application and Firebase server. Firebase Auth API used to authenticate the users before using the application, Firebase Database API allows the application to store data in the database, and Firebase Cloud Storage to store media.

Figure 3 depicted the system architecture design for the mobile application development, as well as the website development. The website will also have access to the Firebase database, website database, and university database through web service.

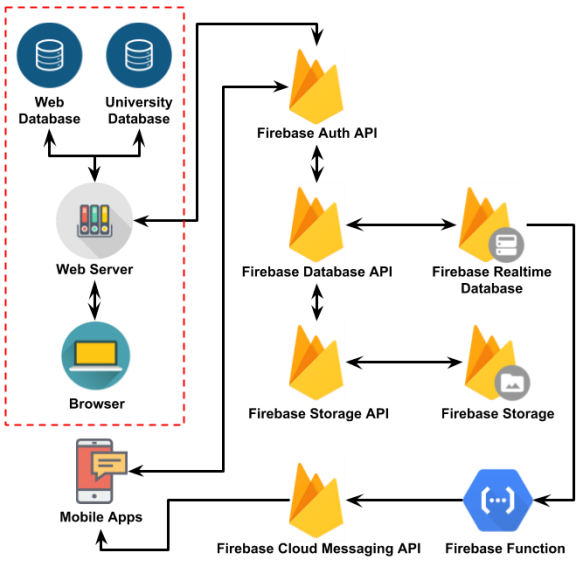

Figure 3: System Architecture Design

B. *Features Design*

The mobile apps are designed as light as possible. As mentioned before, the main function of the mobile apps is to allow the students to communicate to each other, as well as with their respective supervisors or lecturers. A number of collaboration features also provided in the apps. Following are the main features of the mobile apps:

- Push Notifications
- Announcement
- Notes
- Progress Monitoring
- Chat: Group Chat and Personal Chat
- Group Event
- Group Timeline

C. *Database Design*

Firebase Realtime Database is used as the database server for this application. Firebase uses NoSQL cloud database type, which is stored as JSON objects. Following are the structure of the database structure used in this application:

- class
  - [class_key]
    - name : string
    - term : long => semester (1 or 2)
    - year : long => class year (yyyy)
- class_milestone
  - [class_key]
    - [class_milestone_key]
      - amount : long => *marks*
      - description : string
      - due : timestamp => due date
      - posted : timestamp => posted date
      - title : string
- group_chat
  - [group_key or class_key]
    - [group_chat_key]
      - message : string
      - senderUid : string
      - timestamp : long => post date and time
- group_chat_hashtag
  - [group_key or class_key] : string[] => hashtag
- group_event
  - [group_key or class_key]
    - [group_event_key]
      - address : string
      - description : string
      - groupKey : [group_key or class_key]
      - joinUser
        - [uid] : boolean
      - latlng : string
      - location : string => location name
      - timestampEnd : long
      - timestampStart : long
      - title : string
- group_post
  - [group_key or class_key]
    - [group_post_key]
      - content : string
      - likes
        - [uid] : boolean
      - pinned : boolean => pinned post
      - shares
        - [uid] : boolean
      - timestamp : long
      - uid : string
- groups
  - [group_key]
    - code : string

- createdTimestamp : long => created time
- creatorID : string
- description :string
- joinUser
  - [uid] : boolean
- name : string

- lecturer
  - [uid]
    - identityNumber : string =>
    - title : string
- push_notif
  - [push_notif_key]
    - message : string
    - target : string => users_token
    - title : string
- student
  - [uid]
    - identityNumber : string => student's number
    - major : string
    - yearEnroll : long => class year (yyyy)
- user_chat
  - [user_chatroom_key]
    - [user_chat_key]
      - message : string
      - senderUid : string
      - timestamp : long => posted time
- user_chat_hashtag
  - [user_chatroom_key] : string[] => hashtag
- user_chatroom
  - [user_chatroom_key]
    - recipientUid : string
    - senderUid : string
    - timestamp : long
- users
  - [user_key]
    - currentClass : string
    - email : string
    - joinClass
      - [class_key] : boolean => all class
    - joinEvent
      - [group_event_key] : boolean
    - joinGroup
      - [group_key] : boolean
    - name : string
    - phoneNumber: string
- users_token
  - [uid] : string => android app token

D. User Interface Design

Figure 4 depicted some of the user interface design for the mobile application. The top left mock-up was designed for Login screen. Top right mock-up was for Calendar features, Timeline for the bottom left, and Chat Screen for the bottom right. On the Login screen, user should choose to log in as student or lecturer before typing the username and password. Optionally, they can also Login using their Google account. Calendar feature enables the student to see upcoming events related to their project. On the timeline screen, students can see other student's post and hit the Like or Share button if they find that the information might be useful to other students. The chat screen is similar to other chat applications.

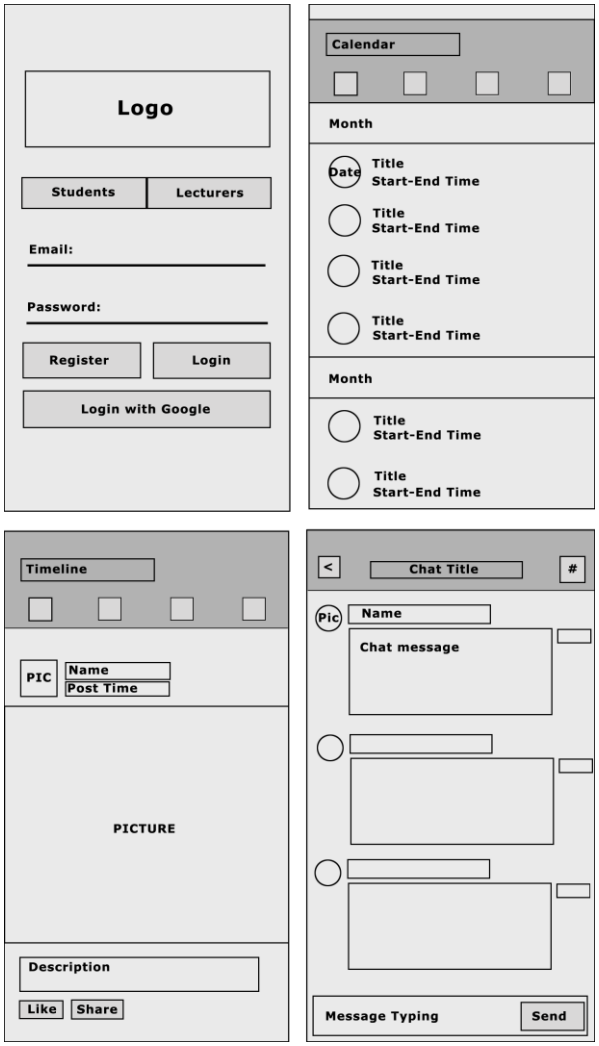

Figure 4: Mock Up

E. User Interface Implementation

The User Interface on the application was designed based on the Material Design Guidelines developed by Google. Material Design is a set of theory, tools, and resources that support developers to create the best user experience [10]. Figure 5 depicted some of the User Interface Implementation (UI) screenshots based on the mock-up.

VII. VERIFICATION

After the prototype was ready, a survey was distributed to 15 final year students. These students currently undertaking Technopreneurship 3 final projects or have completed the final project last semester.

The questionnaire is designed with the following questions:

1. Easy-of-Use: The Technopreneurs application is easy to use?
2. Effectiveness: The Technopreneurs application make you more productive in the completion of your project?

The options for each of the questions are using Likert scale as follow:

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

Hypotheses are made for One-Sample T-Test.

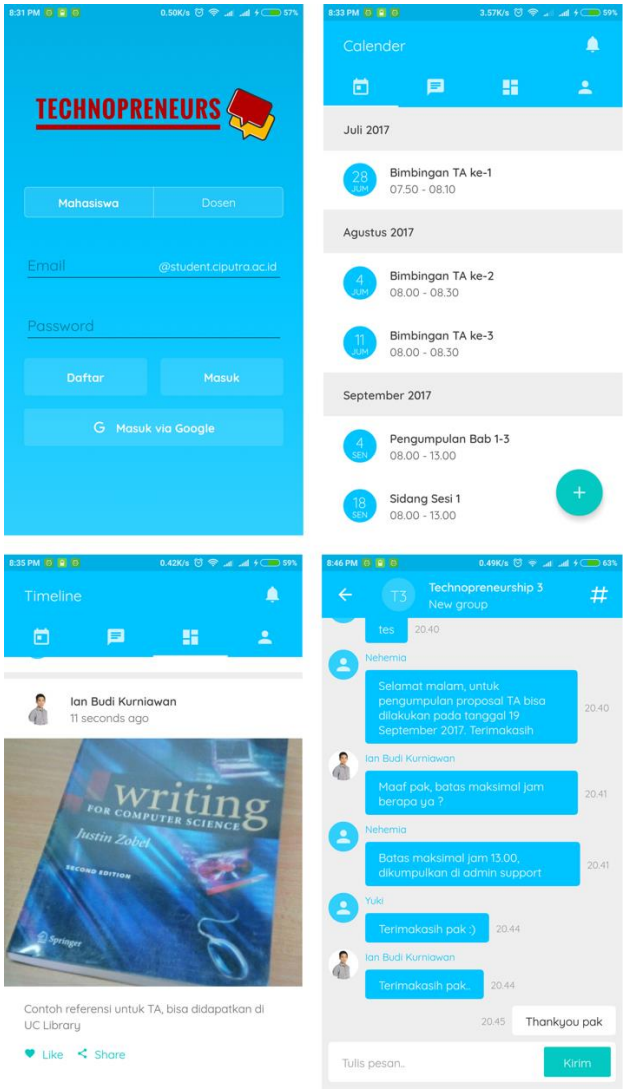

Figure 5: Some of the Apps Screenshots

A. *Ease-of-Use Variable*

Hypothesis 1.1: Average responses of respondents choose Agree (4) as the answer that Technopreneurs Application is easy to use.

Hypothesis 1.2: Average responses of respondents do not choose Agree (4) as the answer that Technopreneurs Application is easy to use.

B. *Effectiveness Variable*

Hypothesis 2.1: Average responses of respondents choose Agree (4) as the answer that Technopreneurs Application make them more productive in the completion of their final project.

Hypothesis 2.2: Average responses of respondents do not choose Agree (4) that the Technopreneurs Application make them more productive in the completion of their projects.

Before the data analyzed using One Sample T-Test, it should normally be distributed. Kolmogorov-Smirnov test was used to check if the data. The result of the test can be seen in Table 1.

Table 1 depicted that for Ease of Use variable, the results showed that the number of asymp Sig. (2-tailed) is 0.300. As the number is greater than the limit of 0.05, it can be assumed that the data is normally distributed. For Effectiveness variable, the results showed that the number of asymp Sig. (2-tailed) is 0.100, which is greater than 0.05, hence the data are normally distributed.

Table 1
One-Sample Kolmogorov-Smirnov Test

		VAR_Easy_of_Use	VAR_Effectiveness
N		15	15
Normal Parameters[a,b]	Mean	4.2667	3.8667
	Std. Deviation	.70373	.63994
Most Extreme Differences	Absolute	.251	.316
	Positive	.248	.284
	Negative	-.251	-.316
Kolmogorov-Smirnov Z		.973	1.223
Asymp. Sig. (2-tailed)		**.300**	**.100**

a. Test distribution is Normal.

b. Calculated from data.

Table 2
One Sample Test

	Test Value = 4					
	t	df	**Sig. (2-tailed)**	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
VAR_Easy_of_Use	1.468	14	**.164**	.26667	-.1230	.6564
VAR_Effectiveness	-.807	14	**.433**	-.13333	-.4877	.2211

Since the result of Sig. (2-tailed) of the two variables is greater than (>) 0.05 as displayed in Table 2, it can be assumed that hypothesis 1.1 and hypothesis 2.1 are accepted, whereas hypothesis 1.2 and hypothesis 2.2 are rejected. This means that the average respondent agreed that using Technopreneurs Application they will be more productive in their final task completion and this application is easy to use.

VIII. CONCLUSION

Advances in Information and Communication Technology, especially on mobile technologies, introduces possibilities of using it in the education sector. A mobile application can be developed to support collaboration and communication among students and between students and their supervisors. The application can complement the traditional face-to-face meetings. While a number of applications or social media, such as Edmodo, Moodle, Facebook, WhatsApp, or BBM, were already available in the market, students still find the application, which is integrated with the university database system, is useful to support them during their study. The availability of cloud computing services such as Firebase from Google enable developers to focus on developing the application instead of split the attention to develop and maintain the infrastructure.

IX. FUTURE WORK

The mobile apps provide features that allow the students to communicate and collaborate among themselves or with their supervisors. A web-based application or system information

should be developed to cater other purposes, such as students reports post, resources library, milestone details, and many more. Both the mobile apps and the website should communicate each other in order to avoid data redundancy.

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