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City i-Tick: The android based mobile application for students' attendance at a university

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ABSTRACT

This paper presents City i-Tick, the android based mobile application for students' attendance at a university. In this study, we developed mobile application for lecturers to take students' attendance in City University, Petaling Jaya. Managing students' attendance during lecture periods has become a difficult challenge. The research objectives for this study are to identify user requirement for City i-Tick, to design and develop City i-Tick, and to demonstrate the prototype of City i-Tick. The study is a narrative participatory design and exploits Design Thinking as the research methodology. City i-Tick was successfully validated by 14 lecturers and System Usability Scale (SUS) was used to determine the findings of the study. We found that City i-Tick is effective for lecturers in taking attendance because it is easy to use, easy to learn, and the users feel confident when using this application.

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1. INTRODUCTION

Currently, in City University, lecturers need to print out the attendance sheet from the city management system (CMS) portal, and take an attendance manually during the class session [1]. The attendance is very important to the lecturers and students. Based on Student Handbook, students are expected to attend a minimum 85% of all classes. Students must substantiate their absence with supporting documents, medical certificates or equivalent [2]. After class, lecturers will key in the attendance into the CMS portal. Certainly, this causes a redundancy in taking attendance. In this study, we propose a mobile application for taking attendance. Using this mobile application, it will help the lecturers in City University to perform their task efficiently as recently, the usage of cellular (mobile) phones are very much important [3].

The mobile application can be installed in lecturers' mobile devices. They can update students' attendances by connecting their mobile devices with the server through the internet [4]. The development of mobile application will be convenient and alternative to the lecturers in their process of learning new technology. This study will help lecturers to perform their tasks without using the computer. Technological advancements have contributed to the rising popularity of e-learning and mobile learning. With these learning methods, learners can access information anywhere and anytime, all at the touch of their fingertips [5].

The technology of mobile applications have already enabled various applications in our daily lives [6]. The development of information and communication technology is growing very rapidly in this era of globalization. Rapid development is also an impact on various aspects of life including

education. One way is to utilize mobile learning technology [7]. This will certainly reduce the workload of lecturers to control and continue updating the progress report of each and every student in their respective scheduled classes [8].

This paper presents City i-Tick, the android based mobile application for students' attendance at a University. In developing this mobile application, we use Design Thinking approach to employ the empathetic, creative, innovative and analytical skill [9]. The overall process was inspired by [10] five stages of design thinking which are empathize, define, ideation, prototype and test. In design challenge context, we must understand the people or users to implement the emphasized mode. The effort to understand the way they think, the needed of physical and emotional, how they think about the world and what matters was important to them [11]. Each of the phases encourages the use of tools for researchers to generate and present idea as well as to capture user feedback [12].

2. RESEARCH METHOD

In phase 1 empathize, contain the preliminary study, literature review and semi-structured interview. Preliminary study involves the journal, articles, proceedings and making observation between existing mobile applications. For semi-structured interview, we interviewed the registrar officer who is responsible to ensure all lecturers take students' attendance. In addition, we also interviewed three lecturers who are responsible to key-in the attendance.

In phase 2 define, we analyzed all the information about the student's attendance system in mobile applications. Define phase is to clarify the problem, to understand what needs to be solved [13]. Based on this study, the comparative study produces the outcomes of this phase like defined problem statement, the significance of the study and the functional requirement (FR) and non-functional requirement (NFR) [14, 15]. A use case diagram is used to describe requirements and desired functionality of the system. Figure 1 described steps that are used by actors when interacting with the system. Only one level of users who can access City i-Tick which is lecturers. While for non-functional requirement (NFR) the flowchart in Figure 2, displayed the map of the mobile application.

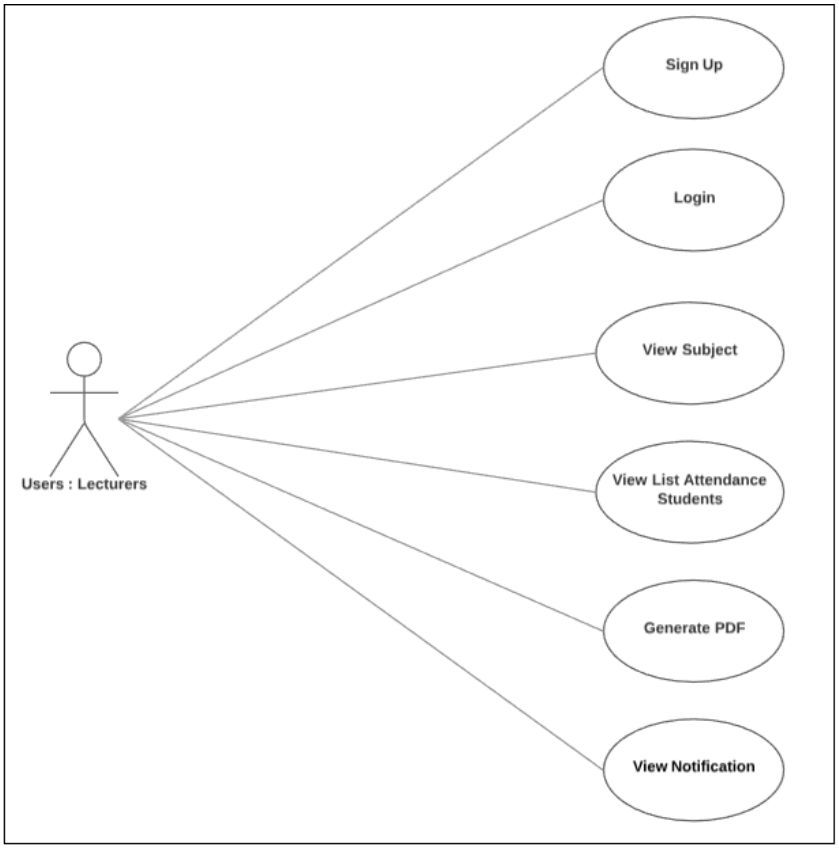

Figure 1. City i-Tick use case diagram

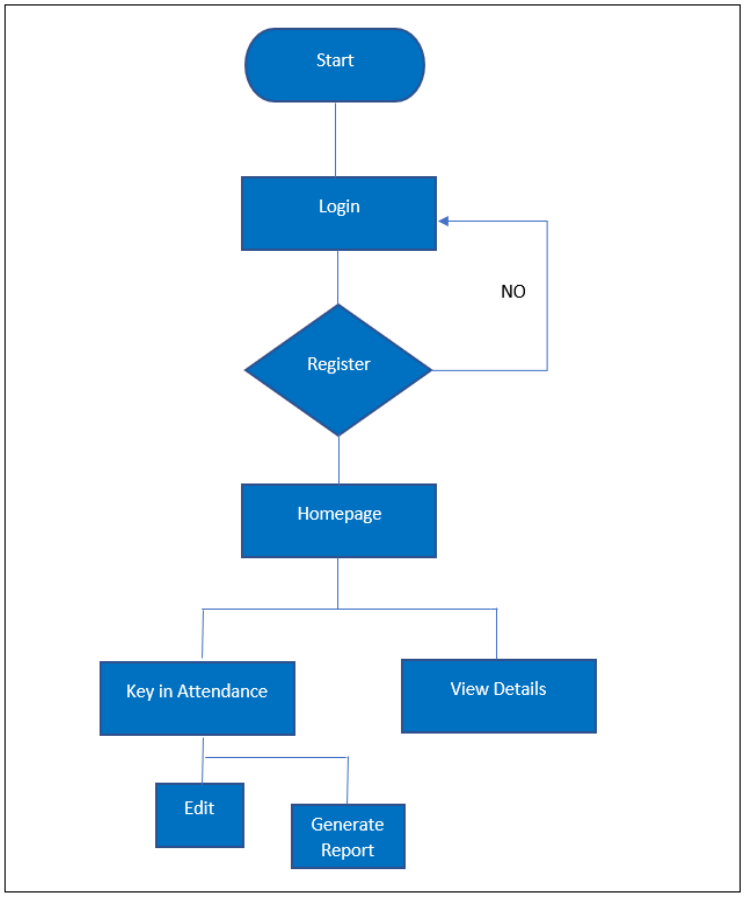

Figure 2. City i-Tick flowchart

In phase 3, we used the ideation techniques, brainstorming [16] may often be thought of as wild and unstructured, but it is actually a focused activity that involves a lot of discipline. Using this technique, we were able to clarify the user's goals and values, and to agree on the desired outcome of the study. We used affinity diagram as a tool that gathers large amounts of language data (ideas, opinions, issues) and organizes them into groupings based on their natural relationships [17]. Post it notes and whiteboards were used to visualize users' experiences and challenges. Brainstorming helps to get people unstuck by "jolting" them out of their normal ways of thinking [18].

In phase 4, a prototype was developed using android studio (android SDK and emulator). Prototypes enable us to share ideas with other people, get feedback, and learn how to further refine them. Besides, the prototype is about converting ideas into something that people can experience [19]. Table 1 showed t he summary of the software and hardware requirement.

Table 1. Software and hardware requirement

Software requirement	Hardware requirement
Software requirement (mobile development tools): - Android Studio (Android SDK & Emulator) - Java Development Kit (JDK) - Node.js - Apache Cordova - Sublime Text	Hardware requirement - laptop (Asus Zenbook UX305LA): - Processor (Intel Broadwell U Core i5-5200U) - RAM (8 GB LPDDR3) - Hard Disk Drive (256GB SSD) - Graphic Card (Integrated Intel 5500 HD) - Mouse (Optical Mouse) - Screen (13.3-inch IPS)
Software requirement (mobile database): - Firebase	Hardware requirement - phone (OnePlus 5T): - Android Version (Android OS 8.1.0 (Oreo)) - Chipset (Qualcomm Snapdragon 835) - Memory (8 GB RAM) - Storage (64 GB) - Screen (6.01 inches

Lastly, in phase 5, testing was conducted. This phase requires the participants to give feedback on the prototype developed in phase 4. A five point Likert scale was used [20]. We measured the usability of the prototype using System Usability Scale (SUS). Usability evaluation of any system is essential to ensure systems meet both design specifications and user requirement criteria [21]. Table 2 showed the SUS questionnaires. SUS is very short; it comprises only 10 items to be rated on a five point scale ranging from strongly disagree to strongly agree, among which five are positive statements and the rest are negatives [22]. SUS inquires users to evaluate their level of agreement or disagreement to the 10 statements [23].

Table 2. System usability scale (SUS) questionnaire

No	Questions	Strongly disagree				Strongly agree
1	I think that I would like to use this system frequently	1	2	3	4	5
2	I found the system unnecessarily complex	1	2	3	4	5
3	I thought the system was easy to use	1	2	3	4	5
4	I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5	I found the various functions in this system were well integrated	1	2	3	4	5
6	I thought there was too much inconsistency in this system	1	2	3	4	5
7	I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8	I found the system very cumbersome to use	1	2	3	4	5
9	I felt very confident using the system	1	2	3	4	5
10	I needed to learn a lot of things before I could get going with this system	1	2	3	4	5

Note: Adapted from [24]

3. RESULTS AND ANALYSIS

Table 3 showed City i-Tick compared to four (4) other systems namely iTime [25], Andro Attendance [26], e-Attendance [8] and Coyote-Attendance [27]. By using the mobile apps user would be able to mark attendance and generate the report. For first-time login, user needs to register into the system. Unlike other system, City i-Tick could also send notification to the users after marking the attendance.

Table 3. Review of related work on an adapted conceptual framework compared to City i-Tick

No	App. Name	Mark attendace	Registration	Cross platform	Generate report	Notification	Time consuming task
1	iTime	⁄	×	⁄	⁄	×	×
2	Andro Attendance	⁄	×	×	⁄	×	×
3	e-Attendance	⁄	⁄	×	⁄	×	×
4	Coyote-Attendance	⁄	⁄	⁄	⁄	×	×
5	City i-Tick	⁄	⁄	×	⁄	⁄	×

Users must log in their email and password whenever they use the mobile apps. Figure 3 showed the screenshots of the login page, list of subjects, and take attendance page. Table 4 showed the demographics of 14 participants obtained from the user background questionnaire. They consist of 11 women and three men. Their ages ranges from mid 20's to 50's. The lecturers in this study are mostly graduate Master Holders from different universities in Malaysia with two to 20 years working experience.

Detailed below are the test results of the system usability scale (SUS) questionnaires. Table 5 showed the frequency distribution by percentage. The results are summarized in the frequency distribution graph as depicted in Figure 4. Most of the participants have the knowledge about the mobile usage. Participants agreed to use City I-tick frequently because of its ease of use. The mobile application is also very quick to be learned and users feel very confident when using it.

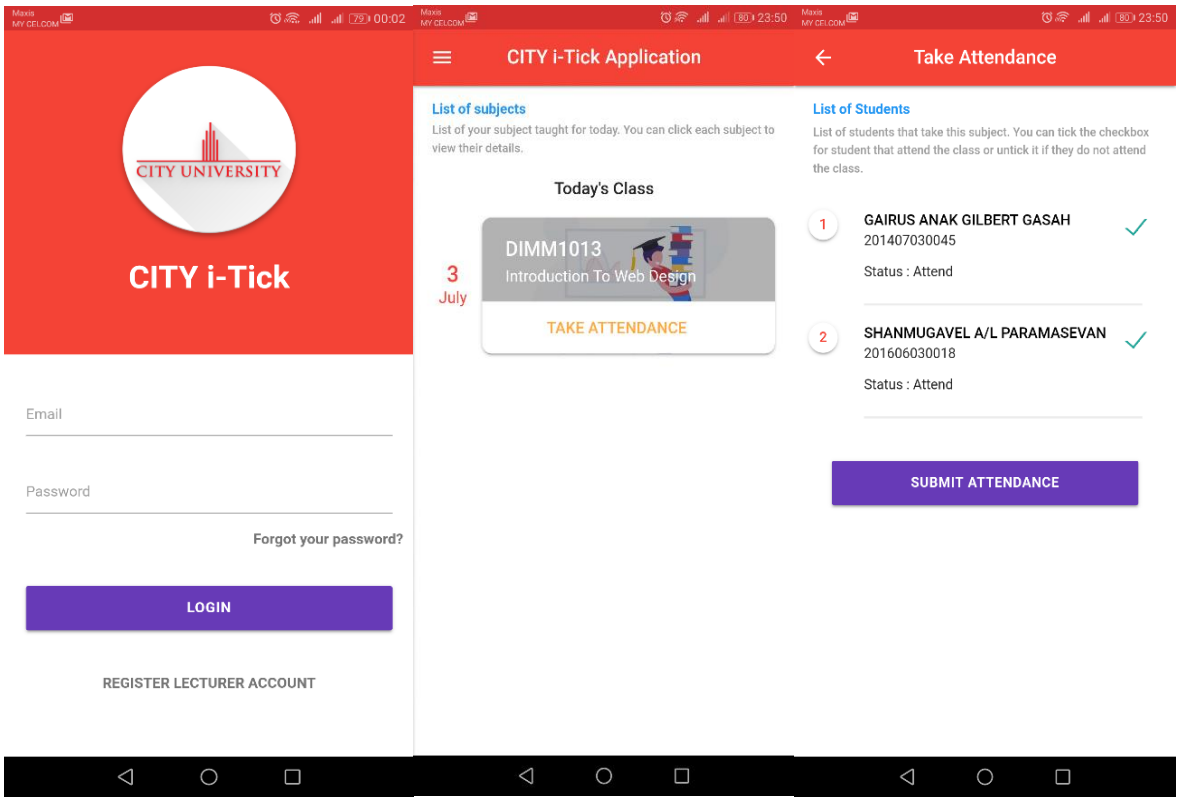

Figure 3. Login, list of subjects and take attendance screenshot

Table 4. Demographic of test participants

Participants	Gender	Age	Position	Education level	Work experience (year)	Frequency use smartphone	Apps in smartphone use frequently
P1	F	30	Lecturer	Postgraduate	6	Yes	Camera, Facebook, Instagaram
P2	F	45	Lecturer	Postgraduate	10	Yes	Camera, Facebook
P3	F	56	Lecturer	Postgraduate	20	Yes	Camera, Facebook
P4	F	35	Lecturer	Postgraduate	7	Yes	Camera, Facebook, Instagaram
P5	F	35	Lecturer	Postgraduate	8	Yes	Camera, Facebook, Instagaram
P6	M	29	Lecturer	Postgraduate	3 to 5	Yes	Camera, Facebook, Instagaram
P7	M	27	Lecturer	University Degree	3 to 5	Yes	Camera, Facebook, Instagaram
P8	F	39	Lecturer	Postgraduate	14	Yes	Camera, Facebook, Instagaram
P9	F	32	Lecturer	Postgraduate	7	Yes	Camera, Facebook, Instagaram
P10	F	30	Lecturer	Postgraduate	3 to 5	Yes	Camera, Facebook, Instagaram
P11	F	38	Lecturer	Postgraduate	12	Yes	Camera, Facebook, Instagaram
P12	F	35	Lecturer	Postgraduate	9	Yes	Camera, Facebook, Instagaram
P13	M	34	Lecturer	Postgraduate	7	Yes	Camera, Facebook, Instagaram
P14	F	27	Lecturer	University Degree	0 to 2	Yes	Camera, Facebook, Instagaram

Table 5. Frequency distribution by percentage

Question	Strongly disagree (%)	Slightly disagree (%)	Neither agree nor disagree (%)	Agree (%)	Strongly agree (%)	Total (%)	No of participants
Q1	0	0	0	86	14	100	14
Q2	7	7	36	21	29	100	14
Q3	0	0	29	50	21	100	14
Q4	36	21	21	14	7	100	14
Q5	0	7	64	29	0	100	14
Q6	21	14	36	7	21	100	14
Q7	0	0	7	79	14	100	14
Q8	93	0	0	0	7	100	14
Q9	0	0	36	50	14	100	14
Q10	43	7	50	0	0	100	14

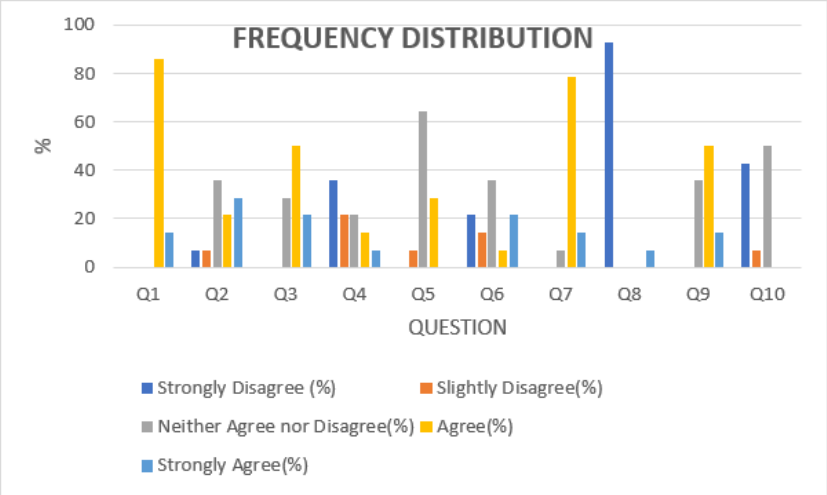

Figure 4. Frequency distribution of the SUS questionnaires

4. CONCLUSION

This paper presents City i-Tick, the android based mobile application for students' attendance at a university. In this study we developed a mobile application for lecturers taking students' attendance in City University, Petaling Jaya. City i-tick has been proven to solve the problem of manually taking attendance and keying in the attendance in the CMS portal after each class. There are several improvements that can be suggested in enhancing the mobile apps. City i-Tick can be improved by providing the notification from the lecturers to the administrator. This could be implemented upon further research development of the system for the administrator. City i-Tick can also be improved by the graphical user interface by incorporating more icons, colours and menus. Furthermore, City i-Tick can be improved by adding the function to alert the lecturers like notification in a smartphone status bar or setting alarm sound if the lecturer forgot to key in students' attendance.

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