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## Enhancement of Undergraduate Time Management Through the Use of A Lab Schedule Reminder App

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**Abstract** - Engineering undergraduates have to attend a certain number of laboratory hours to obtain their degree. Undergraduates have to attend up to 10 laboratory sessions per semester. One problem that arises from this requirement is complicated lab schedule management. This leads to increased missing of lab sessions and also redundancy in laboratory replacement sessions, which decreases efficiency of student and staff. This paper provides a solution to this problem by creating a lab schedule mobile application based on android development. The LabSkedule application reminds students on lab sessions, reduces hassle for students in viewing lab schedules and also managing their various lab sessions. A post application launch survey verified by 92% of students shows an improvement in efficiency in managing lab schedules and improved attendance to laboratory sessions.

**Keywords**—Android studio, laboratory schedule, undergraduate time management, schedule viewer

### I. INTRODUCTION

Mobile application or in short, mobile app, is a computer program designed to run on mobile devices such as phones and tablets. Most of mobile devices are sold with some applications bundled as pre-installed software. Applications that are not pre-installed are usually available through distribution panels like Google Play, Apps Store and Windows Store. Applications can be installed manually by running android application package (APK) on android devices.

Mobile applications are generally used for general productivity and information retrieval such as emails, calculator, contacts and weather information [1]. Mobile applications are also often used as reminders.

A large number of studies have explored factors that influence human attitudes toward using and accepting new technologies. This includes the theory of reasoned action (TRA) in [2]; the technology acceptance model, which was

put forward by [3], Ajzen's theory of planned behaviour [4] and the unified theory of acceptance and use of technology, put forth by [5]. In [6], it is explained that the acceptance of m-learning and integrated technology acceptance model using perceived enjoyment from the motivational model, and perceived mobility value, as external variables of perceived usefulness. The study found that perceived usefulness and perceived ease of use positively influence students' attitudes toward m-learning.

Engineering undergraduate students are required to undergo a preordained number of laboratory hours to apply the theories learnt in classes in a hands-on manner. The hands-on is a requirement in the psychomotor domain on the Blooms' taxonomy of learning, which enhances the overall understanding experience of a theory or concept that is learnt in class.

Primitive lab scheduling practices that use manual schedules have caused much inefficiency in the implementation of these laboratory sessions in universities. These methods provide complex schedules that are difficult for students to read and follow, let alone have any means within these schedules to help students be reminded of the sessions. The primitive methods have reported cases of students attending different lab sessions, or attending lab sessions that are not in their syllabus. Hectic student-lecture schedules also cause a high probability of students missing their lab sessions. Forgotten lab sessions must be replaced, and replacement lab sessions may clash with other lectures, thus setting off a viscous cycle of unwanted mental stress for the undergraduates.

There are some research papers that focused on mobile applications that aid undergraduates and students to better manage their time.

The study done in [5] proposed a schedule system through a mobile application that aids students with their class timetable. The application is easy to be accessed by everyone,

more scalability and is efficient for resource sharing and reduces paper usage.

An educational iPhone, android and windows smartphone that cross platform applications to facilitate understanding of clinical genomics terminology was developed in [6]. The application was built to provide a concise bioinformatics dictionary for clinicians that is easily accessed and understood.

The Scheduler application made by [7] concentrates on event management and schedules. The application was also created to distribute information of an event to the user easily. The application uses a single-android platform.

Remind My Schedule is an android application invented by California State University, Sacramento [8]. The application uses Google calendar data to schedule on the application. The application also allows users to share location among friends. The application accesses the location of user, and alerts the time to travel and to reach the destination of the event.

An improved reminder application, Class Scheduler, was developed using Visual Basic as a front-end application which meets the class scheduling requirements including the functions of querying, generating reports and checking for constraints [9].

Google Keep (GK) is a note taking and reminder application by Google. The reminders are based on either time or location but not both. GK synchronises reminders with all the devices registered under the user's Google account and can share reminders with others. The drawback of GK is that it has no time restriction for location-based reminders and has no options to customize radius. In addition, unorganized user interface makes it difficult to use [10].

In this work, the LabSkedule mobile application is proposed as an efficient way forward to reduce absence to laboratory sessions due to student forgetfulness and schedule interpretation complications. The application was developed and tested based on information gathered from the students of the Faculty of Engineering, Cyberjaya. Section 2 details the research design and application development methodology. Section 3 shows survey results as well as post-application launch results. The conclusion and future work are discussed in Section 4.

## II. APPLICATION DESIGN STUDY

A preliminary survey was conducted among a sample of 19 student respondents of the Faculty of Engineering, Multimedia University Cyberjaya through Google Form. The objective of the preliminary design study was to understand the problems faced by the undergraduates as well as to gauge what undergraduates desire to be in the new application that will assist them with the laboratory schedule management.

Results from this survey as shown in Fig. 1 and Fig. 2 indicate that 63% of undergraduates have missed or replaced laboratory. 38% of undergraduates who missed laboratory cited forgetfulness as a reason while 31% of the students cited misread of complex laboratory schedule. Figure 3 reveals that 79% from sample of students feel an application for personal

lab schedule management will help them in their time management.

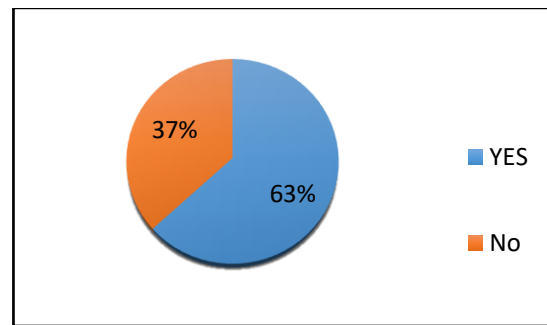


Fig. 1. Percentage of students who have missed laboratory sessions.

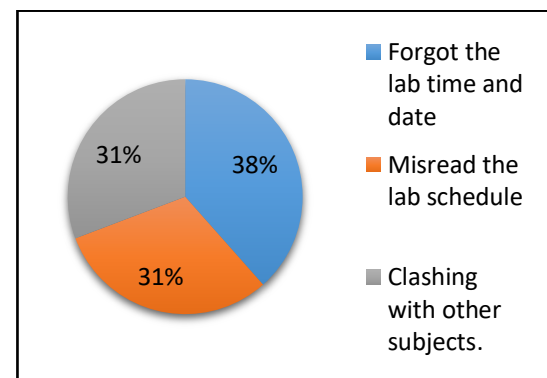


Fig. 2. Student reasons for missed laboratory sessions.

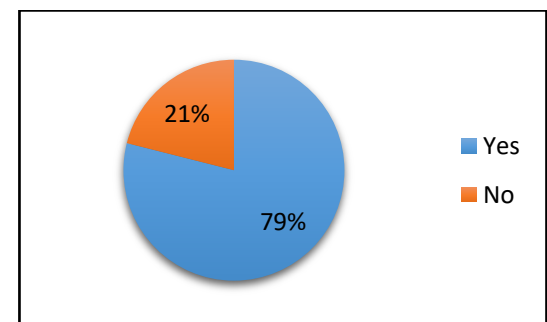


Fig. 3. Percentage of students who desire a lab application for personal schedule management.

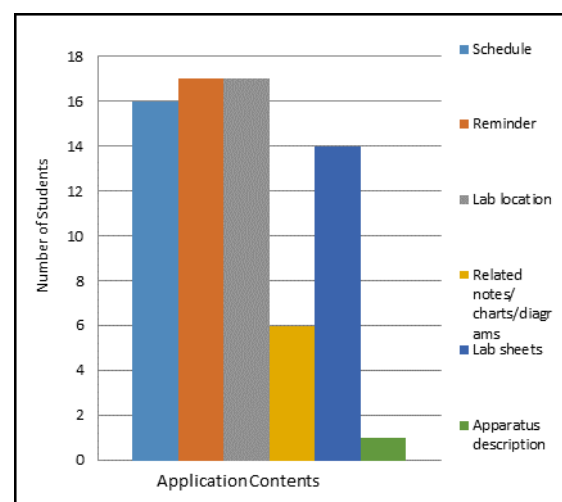


Fig. 4. Number of students and application content they want.

To gauge the features that are desired by users, some possible design features were listed in the survey for selection by respondents. Figure 4 shows that 16 students out of the total students want a reminder in their app. The other features highly desired by respondents are lab location and the availability of a quick link to the laboratory instruction sheets. Only 6 students wanted related notes/charts/ diagrams in the application.

### III. APPLICATION DEVELOPMENT

#### A. Development Methodology

The mobile application was developed based on Android Studio. Thus, the application is an Android platform application and may be used on Android devices only.

MySQL was not used as a database management tool due to security concerns. Student information in the SQL server is vulnerable to exposure via the internet. Mobile application users would have direct access to the server and chances to reverse engineer can lead to data phishing. Even though encryption can be installed, the hackers can launch a DOS/DDOS attack to the database directly.

Google Drive was therefore chosen as it is free and can be used to store spreadsheet. Google Drive can also be configured for data security via the limited user access configuration. The student information was obtained in a spreadsheet format from the university database. The spreadsheet was then parsed to JSON format to be viewed in the application. Figure 5 shows the phases in the development of the LabSkedule application.

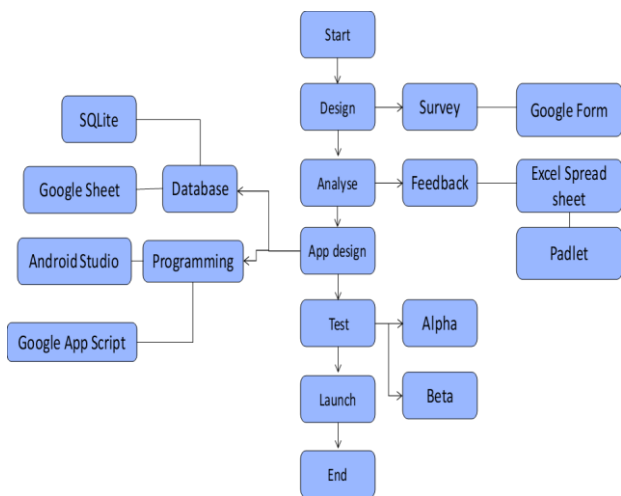


Fig. 5. Development of mobile application.

#### B. Application Design Progress

The application design process was separated into two parts. The first part is the programming process for the mobile application while the other part is the creating of the database for the mobile application.

The mobile application coding is done in Java language. The Android platform was chosen because it is an open source platform and Android Studio was used to program the application. The maximum Android version chosen was Oreo (API level 27) while minimum Android version was Marshmallow (API level 23). By targeting API level 23 and

later, the application is estimated to be able to run on approximately 62.6% of android devices.

The layout design of each activity in the android application was created on a layout editor and an XML layout file was created for the activities and lists. A Java class was created to create interfaces and classes to work.

Manifests were created to describe essential information about the application. The components of the application, the permission given to the application the package name and icons were then listed in the manifest.

The laboratory schedule and student details for the mobile application were stored on Google Drive in Google spreadsheet format. The schedule was recreated from the existing schedule uploaded by the laboratory administrator. Two separate excel spreadsheets, one containing the undergraduates' lab group list and the other the schedule with laboratory groups, were cited as the main source of confusion for lab schedules by respondents. A new spreadsheet combining all this information is generated, and details of the lab location, lab room numbers and lab titles were included as well.

The new spreadsheet was then uploaded into a Google Drive folder. Google App Script was created for every undergraduate year and for every lab location to parse the spreadsheet data into JavaScript Object Notation (JSON) format. The Google App Script was programmed to view the student identity number, name and individual schedules. The link with the JSON format was created and then copied in android studio java script to access the JSON format lab schedule.

The new spreadsheet also created an automatic feedback spreadsheet to collect feedback from students. The feedback will be used to collect bug reports, usage feedbacks and future upgrade suggestions.

#### C. Reminder Notification

An SQLite database was created in Android Studio and embedded into the android application. This database is used for reminder management. The reminder title, date and time is saved in SQLite as undergraduates' key in the details. The data saved is used to call the alarm manager.

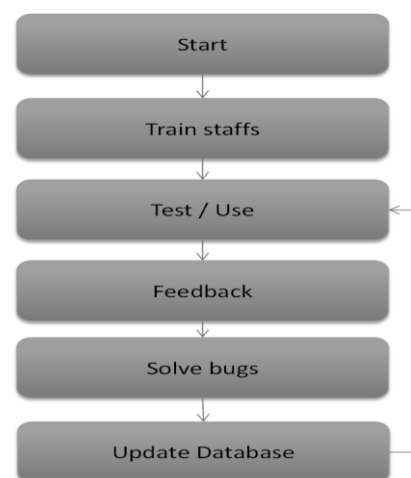


Fig. 6. Maintenance methodology flow chart.

*D. Maintenance Methodology*

The Maintenance Methodology depicts how the mobile application should be maintained post release. As shown in Fig. 6 shows laboratory assistant staff were trained to update the database.

As shown in Fig. 6 also, post-release, the mobile application was tested by students and feedback on satisfaction and bugs were collected. Bugs in mobile application can be solved and included in each session of the academic years.

*E. Final Application Launch*

The LabSkedule Android mobile application was created to have a no-frills design with easy to access laboratory schedule. Figure 7 shows that the main menu of the application. Beta, Gamma, Delta and Epsilon are the undergraduate years.

The Add Reminder Menu allows students to set reminders for lab sessions. The schedule list view shows the names and identity numbers of the undergraduates as well as the schedule and group number. The page with these details are not shown in this paper due to confidentiality reasons of preserving the privacy of names and identity numbers of undergraduates. The feedback activity shows that students are allowed to give feedback about the application. Students are required to type in their feedback and send it. The data are be then stored in an excel file which will be retrieved by the application owner or the lab assistant, who may check on the feedback list and check if the application has any bugs or error that needs to be fixed.



Fig. 7. The main menu of application.

The lab schedule list will also display the laboratory location list and the laboratory code. A notification will pop

out with a custom vibration when the reminder is set. It will show the reminder title with an alarm icon and the notification will provide a yellow LED light to blink.

IV. POST APPLICATION RELEASE EFFECTIVENESS STUDY

A second survey was conducted to get feedback from students after using the LabSkedule application. The sample size for post application launch survey was 24 undergraduates.

Figure 8 shows that the satisfaction rate from the use of the LabSkedule application was more than 80%. Figure 9 shows that after the use of the application, 8% of the respondents still prefer to obtain the laboratory schedules from the faculty website.

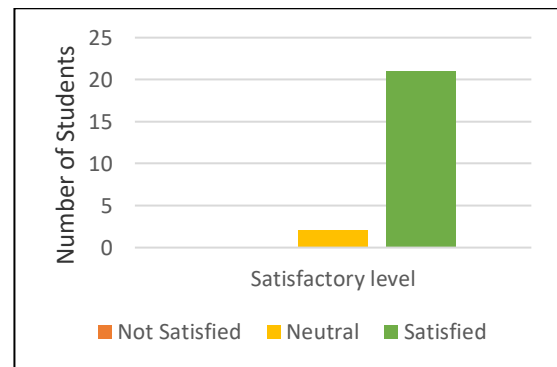


Fig. 8. LabSkedule usage satisfaction level.

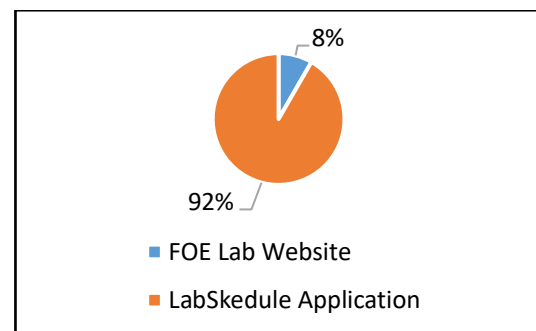


Fig. 9. LabSkedule usage preference by undergraduates.

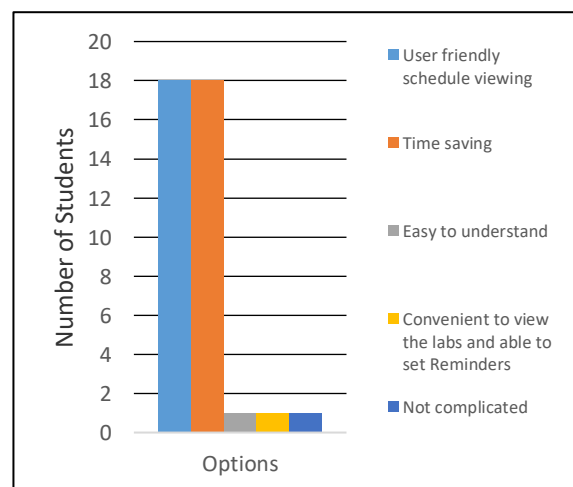


Fig. 10. Superiority of LabSkedule application compared to faculty lab website.

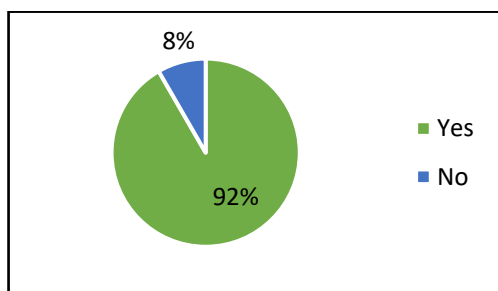


Fig. 11. Perception of possible improvement in laboratory attendance via the use of LabSkedule.

Figure 10 shows that undergraduates find the LabSkedule application user friendly and time saving in their overall laboratory management experience. Figure 11 shows that 92% of the respondents perceive that the continued use of LabSkedule as an alternative to the conventional lab schedules can improve laboratory attendance amongst undergraduates.

Feedback gathered from the 24 respondents for application future enhancement included requests for the laboratory reminder to be set-off 1 hour before the laboratory session. Some respondents wished for the LabSkedule to be able to synchronize with the main Multimedia University student portal. Other respondents wished for the groupmate names to be part of the listing.

#### V. CONCLUSION

A laboratory schedule management application called LabSkedule is created using an Android platform to effectively assist students find, be reminded and manage their laboratory sessions. The main aim of the application is to improve the attendance of undergraduates to the laboratories by reducing human-error mistakes. A post application launch survey indicated that undergraduates prefer to use the LabSkedule Android application as compared to the faculty's laboratory website. This is because the LabSkedule Android

application has a user friendly schedule viewing and is time saving. Most students are confident that the use of the LabSkedule Android mobile application will improve future laboratory attendance.

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