Fygo: An automated dormitory leave pass mobile application for Philippine Science High School - Western Visayas dormitories using Thunkable

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Abstract

The dormitory leave pass system, used in Philippine Science High School - Western Visayas Campus (PSHS-WVC), uses a traditional pen and paper method of filing. It has various limitations due to it being a cumbersome, multi-step, and unconventional method. This study aimed to automate such system locally through developing a *mobile application* that is capable of filing and approving leave pass, viewing records, and logging in or out interns based on the type of user. The application was created using *Thunkable* and *Firebase.* The developed application, Fygo, is composed of five different subsystems: login, registration, intern, dorm manager, and guard subsystem. Fygo was able to perform its intended purpose of being able to file and check status of leave pass (intern subsystem), approve leave pass and view log records of interns (dorm manager subsystem), log in or out interns (guard subsystem). Fygo could be further developed to accommodate offline capabilities and be customized base on the structure of the institution.

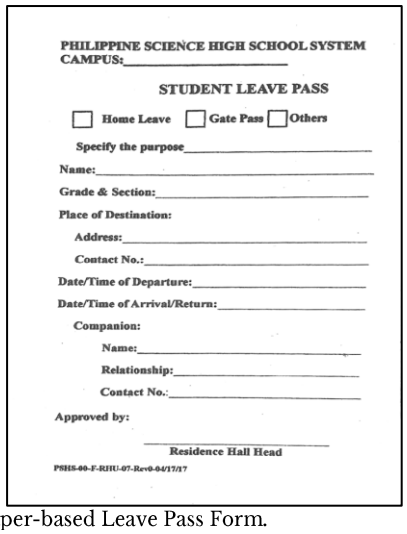
Keywords: *mobile application, Thunkable, Firebase, Android, app development*

Introduction. Currently in Philippine Science High School - Western Visayas (PSHS-WV) dormitories is imposing a leave pass system which requires the interns to file a leave pass, have it approved by the dorm manager and fill up all the necessary details (name, time of departure/arrival, signature) in the guard logbook. A leave pass is a form that when approved allows the interns to leave the campus. The current method used could allow impersonation and log records being lost.

Smartphones and mobile applications have become popular over the last couple of years. Mobile applications, or also known as apps, are being used for a number of reasons specifically for making tasks easier like booking tickets, searching for answers, and buying and selling of items. Several mobile app development platforms have been developed. Some popular examples are Massachusetts Institute of Technology (MIT) App Inventor 2, Good Barber, AppSheet, and Thunkable. These platforms are user-friendly by using blocks instead of programming languages. Thunkable is comparable with MIT App Inventor 2; furthermore, it has more components and improvements. Thunkable also supports Google's Firebase Realtime Database, a cloud-hosted NoSQL database that lets users store and retrieve data in real time. Writing server-side code is not necessary when using Firebase or deploying a complex server framework to get an app started with Firebase. [1,2]

The current leave pass system in PSHS-WV is cumbersome and prone to misuse. Mobile applications have been used to automate a number of tasks (e.g. home automation). Several app development platforms are available to create such applications. Using Thunkable and Firebase, the study aims to develop an app for PSHS-WV to improve the process.

Leave Pass. A kind of form written on a small piece of brown paper filled out by the interns in PSHS dormitories in order to leave the campus. As it stated, it is a pass if approved by the dorm manager, allows interns to leave the campus. It requires the interns to provide (i) the type of leave (e.g. home leave, gate pass, or others), (ii) grade and section, (iii) place of destination, (iv) contact number, (v) date and time of departure and arrival, (vi) companion, and (vii) signature. The existing system is paper-based and is submitted to the dorm manager prior to the planned leave (see Figure 1).



PHILIPPINE SCIENCE HIGH SCHOOL SYSTEM
CAMPUS:_____

STUDENT LEAVE PASS

☐ Home Leave ☐ Gate Pass ☐ Others

Specify the purpose_____
Name:_____
Grade & Section:_____
Place of Destination:
Address:_____
Contact No.:_____
Date/Time of Departure:_____
Date/Time of Arrival/Return:_____
Companion:
Name:_____
Relationship:_____
Contact No.:_____
Approved by:

_____
Residence Hall Head

PSHS-00-F-RHU-07-Rev0-04/17/17

Figure 1. Paper-based Leave Pass Form.

Thunkable. An online app building website and it has two platforms: Thunkable Classic Android, and Thunkable X. Thunkable X supports both Android and iOS but is underdeveloped; therefore, Thunkable Classic Android is used in the study which has more

features but only supports Android devices. When it comes to the development, it has two parts: Graphical User Interface (GUI) or front end of the application, and the back-end. It has three ways for live testing: through the use of Thunkable live via Wi-Fi, universal serial bus (USB), or an emulator for the PC. [3]

NoSQL Database. There are two types of databases: non-relational database and relational databases. NoSQL database is an example of a non-relational database that store and manage data in ways that allow for high operational speed and great flexibility on the part of the developer.

Firebase Realtime Database. A cloud-hosted NoSQL database that lets users store and retrieve data in real-time. The Real-time Database is similar to one big JavaScript Object Notation (JSON) object that the developers can manage in real-time. With just a single sip, the Firebase database provides applications with both current value of the data and any updates to that data. Real-time syncing makes it easy for users to access their data from any device, be it web or mobile. Realtime Database also helps users collaborate with one another. [4]

The objective of the study to develop an automated dormitory leave pass mobile applications localized for PSHS-WV dormitories. It specifically aims to:

(i) Develop a working login subsystem for PSHS-WV interns, security guards, and dorm managers

(ii) Develop a working registration subsystem for PSHS-WV's new interns

(iii) Develop a working intern subsystem for PSHS-WV interns, able to file a leave pass, and check its status

(iv) Develop a working dorm manager subsystem for PSHS-WV dorm managers, able to check for the approval of the interns' leave pass, and check interns' log records

(v) Develop a working subsystem for PSHS-WV guards, able to x or out interns who enter or leave the campus

(vi) Evaluate the system using ISO 9241-11 standard quantitative methods of determining usability

Methods. The development of the application, Fygo, was divided into five subsystems: login, registration, intern, dorm manager, and guard subsystem. The login subsystem is responsible in the facilitation of user-account verification of the interns, the dorm manager, and the guards-on-duty. This serves as the primary subsystem to grant the user access to the application. The registration subsystem enables new interns to create their personal accounts that should be used when accessing the software. The intern subsystem is responsible on handling the input data of the interns required to be able to ask permission to leave the campus. It is based on the existing data acquisition of the traditional pen-and-paper method. This subsystem allows all interns to file their requests electronically. The dorm manager subsystem grants the dorm manager the ability to approve or reject the interns' filed requests. The data input from the intern subsystem is fed into a queue that is shown to the dorm manager for review. The guard subsystem allows the guard-on-duty to record the entrance and exit of the interns for easier monitoring, allowing them to assess the integrity of the interns' leave. It was then tested by 45 users; 40 interns, two dorm managers, and three security guards.

Hardware. The hardware consists of laptops and mobile phones. Laptops were used to run the needed software in developing Fygo. On the other hand, mobile phones were utilized in order to live test Fygo while being created.

Software. Fygo was developed from Thunkable, an application programming interface (API), and Firebase as the database archive.

Application Operation Flowchart. The application operation flowchart is composed of two different processes, the registration and the login process. The registration operation flowchart depicts the situation where a new intern uses the application and tries to register an account. After requesting to register, the dorm manager would see the pending registration of the new intern and he/she could choose to approve or disapprove it (see Figure 2). The login operation flowchart depicts the situation where either a registered intern, a dorm manager, and a security guard log in to Fygo. When the respective users log in, they would be redirected to different modules depending on their type of user (see Figure 3).

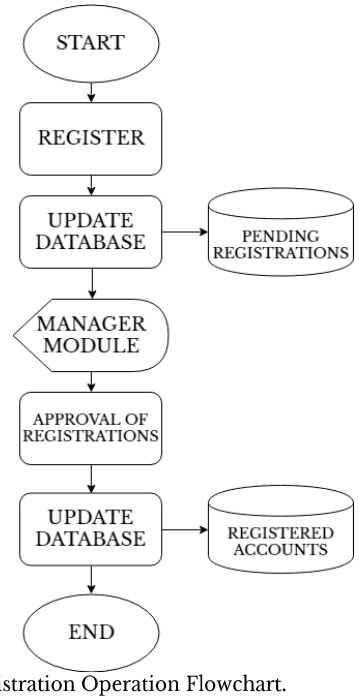


Figure 2. Registration Operation Flowchart.

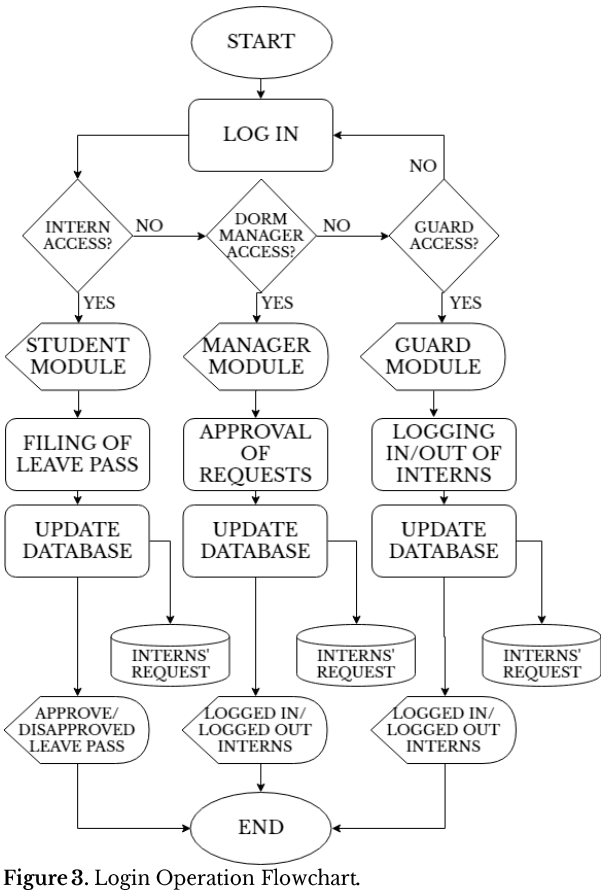


Figure 3. Login Operation Flowchart.

Data Analysis. The ISO 9241-11 standard measure of usability had been used to evaluate Fygo. These three attributes according to ISO 9241-11 that have been considered are: effectiveness, efficiency, and satisfaction. Moreover, specific attributes belonged under these attributes and were utilized.

Effectiveness. The effectiveness of a system is based on the accuracy and completeness with which users achieve specified tasks.

Efficiency. The efficiency of a system is based on the resources expended in relation to the accuracy and completeness with which users achieve tasks. There are two categories under the efficiency, time-based efficiency and overall relative efficiency. Both are measured using two equations (see Equations 1 & 2). Time-based efficiency was utilized to measure the database storage speed of Fygo when a dorm manager, intern and security guards perform different required tasks; wherein the dorm manager and the security guards did the task 40 times. Meanwhile, the overall relative efficiency was used to measure the overall database storage speed of Fygo's different specified tasks.

$$Time\ Based\ Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N}\frac{n_{ij}}{t_{ij}}}{NR}$$

Where:

N = The total number of tasks (goals)

R = The number of users

n_{ij} = The result of task i by user j; if the user successfully completes the task, then $n_{ij} = 0$, if not, then $n_{ij} = 0$

t_{ij} = The time spent by user j to complete task i. If the task is not successfully completed, then time is measured till the moment the user quits the task

$$Overall\ Relative\ Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} n_{ij}t_{ij}}{\sum_{j=1}^{R}\sum_{i=1}^{N}} \times 100\%$$

Satisfaction. The measure of satisfaction of a system for a user is based on the comfort and acceptability of use. User satisfaction is measured through standardized satisfaction questionnaires which can be administered after each task and/or after the usability test session. This attribute also has a specific attribute under it, the test level satisfaction. It is measured by giving a formalized questionnaire to each test participant at the end of the test session. This serves as a measure of the participant's impression on the tested system's overall ease of use.

The questionnaire that had been utilized was QUIS: Questionnaire for User Interaction Satisfaction. It had been improvised in order to fit the required specifications of Fygo and the improvisations made had been validated by the consulted experts.

Results and Discussion. Using Fygo, the intern can register an account and use it to store his information and records. Fygo is supported by Google's Firebase which serves as the cloud database of the application. An intern can file a leave pass afterwards. The dorm manager will be the administrator of the application where the filed leave pass could easily be monitored. He/ she could be able to see also the log records on a daily basis. Moreover, he/she could access pending registrations of new interns who wants to create an account. The security guards are also users of the developed app. They are able to record the interns' daily logs.

In addition, all tasks performed by the users for the testing of the automated leave pass system were completed successfully and

for the time taken by each user to complete a task.

Login Subsystem. The login subsystem is composed of the main screen and interface of Fygo. Interns, the dorm manager, and security guards could log in their accounts to access the developed application. The register button can be also found in this subsystem (see Figure 4).

Registration Subsystem. The registration subsystem allows interns to register an account at the application. Interns fill out an information sheet which asks for necessary information from the intern (see Figure 5 and 6).

Intern Subsystem. The intern subsystem is composed of several functions that lets interns file a leave pass. Once an intern has filed a leave pass, he/she can view the status of his/her leave pass before the dorm manager decides to approve or disapprove it (see Figure 7, 8 and 9). Moreover, it showed that the

storing of its data in the database has an effectiveness of 100%, time-based efficiency of 19.15 stores/second, and an overall relative efficiency of 100%.

Dorm Manager Subsystem. The dorm manager subsystem allows the dorm manager to be able to check the list of requests, log records and pending registrations (see Figure 10 and 11). It also depicted that the storing of its data in the database has also an effectiveness of 100%, time-based efficiency of 136.46 stores/second, and an overall relative efficiency of 100%.

Security Guard Subsystem. The security guard subsystem allows the guards to view a list of approved leave pass and login or out interns (see Figure 12 and 13). In the testing of this subsystem, two tasks were tested, the logging in and out of interns. In logging in of interns, the storing of its data in the database has an effectiveness of 100%; the time-based efficiency of this subsystem is 59.39 stores/second, and an overall relative efficiency of 100% also. Furthermore, the logging out of interns have been tested and it can be seen that the storing of its data in the database has an effectiveness of 100%, time-based efficiency of 81.85 stores/second, and an overall relative efficiency of 100%.

Figure 4. Login screen.

Figure 5. Registration screen.

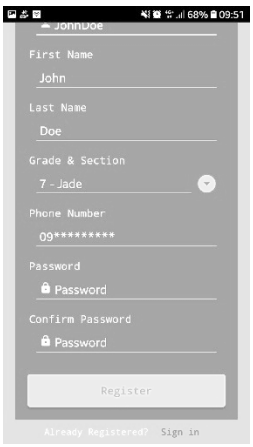


Figure 6. Continuation of the registration screen.

Figure 7. Main menu screen (Intern subsystem).

Figure 8. Leave pass filing screen.

Figure 9. Continuation of the leave pass filing screen.

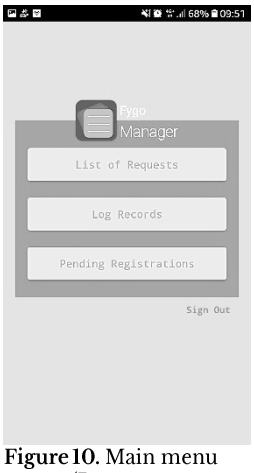


Figure 10. Main menu screen (Dorm manager subsystem).

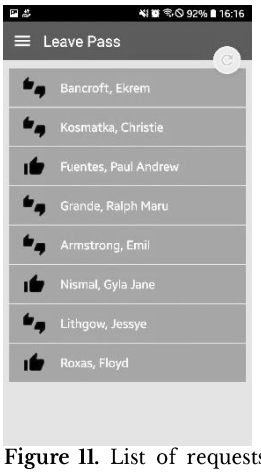


Figure 11. List of requests screen.

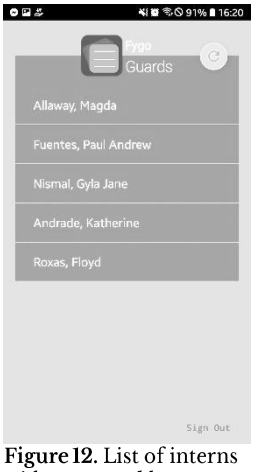


Figure 12. List of interns with approved leave pass screen.

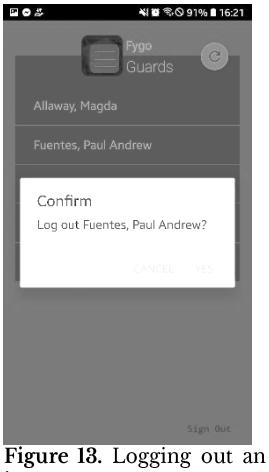


Figure 13. Logging out an intern screen.

The survey on the other hand showed that Fygo had a positive feedback coming from the users. A total of forty-five (45) respondents were surveyed this included forty (40) students, two (2) dorm managers, three (3) guards. The lowest rating is 4.69 and the highest is 4.93 from the computed average (see Table 1).

Table 1. Ratings based on the QUIS with their corresponding descriptions.

Tested Attributes of the System	Rating	Description
User Friendliness	4.93	Fygo is simple and easy enough to use.
Response Time	4.80	Fygo responds quickly to user interactions.
Reliability	4.69	Fygo is comparable to the conventional leave pass system. This rating is the lowest since it could still be improved to be more convenient.
Reading characters on the screen	4.84	The presentation of the app's GUI is clear and readable enough.
Highlighting simplifies task	4.87	Fygo has components that aids the user to complete a task much easier.
Organization of information	4.89	The content of the app is well organized and well presented.
Sequence of screens	4.91	Fygo clearly directs the user to its designated screen.
Use of terms throughout the system	4.91	The terms used in Fygo is understable enough to the users.
Terminology related to task	4.93	The terms used are appropriate enough for each tasks the users do.
Position of messages on screen	4.91	The messages are aligned properly for the user's understanding.
Prompts for input	4.89	The users could easily know when and what to input.
Computer informs about its progress	4.87	Fygo clearly informs the user about its progress and when an action is done.
Error messages	4.80	Fygo shows error messages that helps users correct errors easily.

Fygo was successfully developed with the core purpose of automating the leave pass system here in Philippine Science High School- Western Visayas. Interns could file a leave pass without manually submitting leave pass paper forms to the dorm manager for its approval, the dorm manager could approve a leave pass anytime, security guards could login and logout interns with just few taps on a smartphone.

The ISO 9241-11 standard usability metrics consist of certain equations and a questionnaire that has been improvised and validated to fit the requirements of the system that have been tested. In getting the effectiveness of Fygo, it had been calculated by measuring the completion rate of each subsystem of the application. As it was observed, each subsystem of Fygo has a completion rate of 100%. This depicted that the dorm managers, the interns, and the security guards have finished each and every task assigned to them.

The storing of data to the database on each subsystem was tested in order to measure their effectiveness, time-based efficiency, and overall relative efficiency. As stated by Holzinger et al. [5], mobile computing applications have been accepted in the field Medicine and Health Care. He also added that retailers, service providers, and content developers are interested in mobile applications which is defined to be an efficient and effective method. To support the gathered outcome regarding the efficiency of Fygo, Holzinger et al. [5] said that a mobile system, can be measured by the ISO 9241-11 standard method with three key aspects: efficiency, effectiveness, and satisfaction. In addition, he also mentioned that through a mobile system, a previous system can improve the efficiency of data entry and retrieval. As observed, the time-based efficiency of each subsystem: intern subsystem, dorm manager subsystem, security guards log in subsystem, and log out subsystem; is 19.15 stores/s, 136.46 stores/s, 59.38 stores/s, and 81.86 stores/s. These depicted that the storing of data to the database of the application can store at the very least 19 times per second. [5,6,7]

There are four (4) tasks that were being considered, the login of the user to the application, registration of the required user, approval of leave pass, and the login or logout of the intern out of the campus. These tasks are performed by the designated users, the dorm manager, the interns, and the security guards. Different dormitories have different databases that would separate their data.

In order to measure the test level satisfaction, the users experience in using Fygo, a single questionnaire has been selected out from different questionnaires provided by the ISO standard. The Questionnaire for User Interaction Satisfaction (QUIS) have been utilized in order to measure the test level satisfaction of the application. In addition, it has been improvised in order to fit the Fygo's system application specifications. Afterwards, it has been validated by two Computer Science Teachers in Technology Unit of PSHS-WVC. The respondents' ratings for Fygo ranged from 3-5 while the mean of it is 4.86. The lowest ranked of the attributes was the reliability at 4.69 and highest ranked was its user friendliness at 4.93. Thus, Fygo can be implemented in Philippine Science High School dormitories since it is developed with the sole purpose of replacing the paper-based leave pass system that is being used in PSHS-WV dormitories. For clarification, Fygo was not made for marketing purposes.

It was mentioned in a study by Georgsson et al. [8] that the ISO 9241-11 usability standard has been employed to assess the set of effectiveness, efficiency, and satisfaction measures of a system. Moreover, it was also discussed that using these ISO standard usability metrics, a system can be evaluated in valid measures. With this data, it can be concluded that a good impression was obtained from the users after using Fygo. [8]

However, there are certain limitations that has not been addressed. Fygo is only available in android mobile devices. Therefore, iOS users may not be able to use the application. Fygo also needs an internet connection in order to be utilized by the user. Fygo cannot be used without internet connection. The PSHS-WV campus has a campus-wide free internet connection for anyone who is inside the campus. Yet only certain parts of the campus are reachable by the internet connection.

Conclusion. The use of an automated dormitory leave pass mobile application (Fygo) is a good alternative to the current system implemented. All of the necessary subsystems are functional and were successfully integrated with one another.

The development of Fygo has been finished. Fygo is promising enough to be considered as an alternative to the conventional system. It is capable of filing a leave pass for interns, approving a leave pass for dorm managers, and logging in or out an intern for security guards. Fygo can still be improved by adding more features to the application and improving its graphic user interface. Moreover, the successful development of Fygo entails that automated mobile applications are the next step to make tasks simpler on any kinds of systems in various fields.

Recommendations. To improve the application, it is recommended to add the capability of the user to edit the password and a failsafe if the account becomes inaccessible. it is also recommended to localize the server of Fygo to lessen its dependence on internet connection.

To further put the application into standard it should add the terms and data privacy clauses in relation to Republic Act No. 10173 so that to assure the protection of the data of the users.

Lastly it is encouraged that future researchers to develop an extension or method that adds the features of a database listener. Currently Thunkable has no such extension, it is unable to automatically update when changes are made to the database. With this extension it would add the feature of sending of real time push notifications and updates to the users.

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