PASABAY: An Errand Crowdsourcing Mobile Application for UPLB Community

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***Abstract*— PASABAY is an Android mobile application developed to provide a user-friendly errand crowdsourcing platform for UPLB students and employees. This application allows its users to post and sign up for errands, as well as to chat, rate, and block other users. After surveying 35 individuals, the mobile application was found to have an excellent user experience with an average of 87.7 SUS score.**

***Index Terms*— crowdsourcing, mobile application, Flutter, Firebase, Android**

I. Introduction

The advancement of mobile applications that cater to the need for smooth access and doorstep delivery services resulted in their dominance in the market as well as a consistently growing patronage among mobile users. These mobile applications, like online shopping and food delivery services, greatly help in easing the workload of many users who cannot afford to take time and physically travel to accomplish their everyday tasks.

Similarly, many students and employees at the University of the Philippines Los Baños (UPLB) are currently experiencing a hard time to accomplish multiple errands due to their hectic academic schedules and personal commitments. On the other hand, various students and employees are experiencing difficulties in terms of their budget and financial needs. As a result, they opt to look for freelance labor that could help them augment their budget and gain additional income. These include services such as tutoring, proofreading, transcribing, cleaning, selling, and the likes. Currently, transactions being made by students and employees with their clients do not follow a standard transaction platform.

Fritz Villacarlos, a student of UPLB, cleans comfort rooms for extra allowance. His cleaning services fee starts at Php 200. According to Villacarlos, cleaning has been his sideline and a way to ease his depression. At the same time, he is thankful because he has been a source of help and inspiration to others [1].

In 2017, a startup company known as Machine Ventures launched an on-demand mobile application, MyKuya, which crowdsourced workforce that will do selected errands as requested by an application user [2] . However, this application is not highlighted for the needs of UPLB students and employees, because it is currently only active in Taguig and Makati. Hence, the developer aims to design and create a mobile application to serve as a transaction platform for the service needs of UPLB students and employees with UP Mail using Flutter and Firebase.

Flutter is an open-source software development kit made by Google. It is used to develop mobile applications for both Android and iOS, as well as web and desktop applications, from a single codebase [3]. Firebase, acquired by Google in 2014 [4], provides backend services for mobile applications such as database, storage, and authentication [5]. The UP Mail is Google's email service solely for UP students and employees. It has a simplified domain name (@up.edu.ph) and is standard to all constituent university [6].

A. Statement of the Problem

UPLB students and employees use social media to post errands that need to be done or services that they offer. However, there are multiple online platforms to choose from, such as Facebook, Twitter, and the likes. Since not all students or employees use all platforms, some posted errands may be missed by someone who would have been a good fit. Also, most of the existing crowdsourcing mobile applications are not yet available to the UPLB community and not centered on its contexts and activities. Thus, a dedicated platform for such posts, limited to UPLB students and employees, would streamline this process.

B. Objectives of the Study

The main objective of this study was to design and create a user-friendly errand crowdsourcing mobile application for UPLB students and employeess. Moreover, this study specifically aimed:

- to develop a mobile application for Android using Flutter and Firebase; and
- to test the mobile application to UPLB students and employees with UP Mail.

C. Significance of the Study

The mobile application developed served as an accessible platform for many college students and employees who need help in looking for extra income, as well as those who would like to request for assistance regarding their errands or school and work-related requirements. It will also be mutually beneficial for both parties as it would satisfy the former for its financial needs. At the same time, it would help the latter by making sure that their other tasks are accomplished despite their hectic schedules.

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D. Scope and Limitation

The study limited its scope to the creation of a mobile application to the UPLB area only. The test and use of the application were limited solely to UPLB students and employees who have access to their UP Mail accounts. The direct transaction and dealings of the application users were beyond the coverage of the study as it only focuses on creating a standard platform where the users can interact. It was published and released for public use and consumption.

Moreover, an application developed in Flutter can work on both Android and iOS. However, the developed mobile application was only tested through Android smartphones due to the lack of macOS platform at hand. Therefore, its compatibility with a tablet and iOS is not guaranteed.

II. Review of Related Literature

Several studies explored crowdsourcing based on the use of mobile phones. For example, Eagle [7] deployed txteagle, a mobile system that allows people in Kenya to earn small amounts of money by completing simple tasks such as translating texts, transcribing audios, and even taking surveys with the use of their mobile phones. However, because it operates on short message service (SMS), the communication and the tasks accomplished are limited in length and number, respectively, using simple text messages.

While txteagle relies on SMS, mClerk operates via multimedia messaging service (MMS) to allow its users to send and receive small images for graphical tasks [8]. Similarly, MobileWorks enables its users to transcribe images of text on their mobile phones, but it requires the use of a web browser with a data or an internet connection [9]. Unlike MobileWorks that operates in any mobile phone that has a web browser, a mobile crowdsourcing application called mCrowd is only exclusive for iPhone devices [10]. It enables mobile users to post and accomplish tasks for monetary rewards.

Despite these prior efforts on mobile phones to enable micro-tasking for marginalized workers, there are other crowdsourcing services that most probably draw more users from developing countries but require computer and internet access. For instance, Amazon's Mechanical Turk provided several businesses an online platform to outsource thousands of simple tasks that require human intelligence to be accomplished [11]. Tasks such as identifying objects in images, finding relevant information, taking surveys, and the likes would be too complicated (if not possible) for the computers to perform. On the other hand, Samasource established outsourcing centers and partnered with local organizations where they manage and maintain a dedicated employee workforce supported by Internet-enabled computers [12].

Meanwhile, the upsurge of mobile applications that provide crowdsourced workers, courier, and concierge on-demand instantly grew and became a steady option for most busy Filipinos. There are existing applications that cover tasks such as buying foods or groceries, cleaning houses, and even taking care of laundry. The best example of it would be MyKuya. In 2015, MyKuya was then HeyKuya, a subscription-based SMS that allows users to text a request for help in errands. However, HeyKuya only lasted for eight months as it retracted and further developed into a mobile application, MyKuya [13].s

MyKuya is a mobile application that possesses the same rationale and purpose as its predecessor, HeyKuya. This new application remains to offer a wide range of services and personnel, but with new features and better user interface [14]. The application now runs through a matching algorithm where users are instantly matched with the right person who can best do the task desired based on their location and gravity of work. Currently, MyKuya is only active in Taguig and Makati.

The preceding review presents meaningful information on the existing crowdsourcing platforms online and on mobile phones. However, paSabay is distinguished from these prior crowdsourcing platforms in two respects. It will be the first mobile crowdsourcing application for UPLB students and employees, and, to the best of the developer's knowledge, it will also be the first mobile crowdsourcing application developed using Flutter. Hence, it will be compatible on both iOS and Android devices.

III. Methodology

A. Technologies

The mobile application was developed using the following technologies:

1) Software
   - Adobe XD
   - Visual Studio Code with Dart and Flutter plugins
   - Flutter Software Development Kit
   - Firebase
   - Android Studio
2) Hardware
   - Acer Predator Helios 300 Laptop
   - Samsung Galaxy S9 Plus (Android 10) Smartphone

B. System Requirements

Since Flutter can generate apps for both Android and iOS, the mobile application for Android is compatible with API level 16 (Jelly Bean) and newer versions. On the other hand, for iOS, the mobile application is compatible with iOS 8 or later. The minimum hardware requirements includes ARM-based Android devices and iPhone 4S or newer.

C. Mobile Application Functionalities

Figure 1 shows the Use Case Diagram of the mobile application. It requires at least two (2) users. The following are the general functionalities implemented in the app:

1) Sign in with UP Mail: This allows users to instantly sign in through the application with the use of their UP Mail account. Also, this will serve as a way for the system to verify if they are a bonafide UPLB student or employee, and to eliminate spam user registration.

2) Post Errand: This allows you to post what you need to get done, how to do it, and how much you are willing to pay for it. All unfulfilled posts will be expired after a week. If users want to renew its expiration date, they just need to edit the post. Users are not allowed to delete posts with existing transactions.

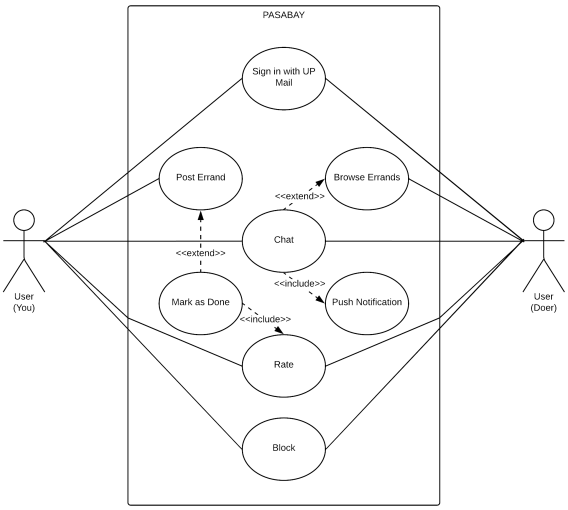

Fig. 1. Use Case Diagram

3) Browse Errands: This allows the user, who is looking for an errand, to search, sort, and filter errands. There are initial categories for a user to choose from.

Cleaning: This service includes sweeping and mopping floors, making beds, tidying, bathroom cleaning, vacuuming, surface cleaning, car washing, laundry and ironing, and following the customer instructions.

Delivery: This service includes purchase and pick-up of desired items, groceries, food or beverages, and delivery of the purchased items to a specified location. Quantity of orders needs to be agreed upon between users before purchasing of items.

Officework: This service is on-site and includes inbound and unbound calls, typing and word processing, operating office machines, filing data entry, office inventory and replenishment, running errands, and following the customer instructions. Customer shall provide the materials, tools, and necessary training for the doer to perform the task.

Pet Sitting: This service includes dog sitting, replenishing of pet food and water, walking dogs in permitted areas, cleaning up after dogs, and playtime.

Schoolwork: This service includes tutoring, editing and proofreading papers, transcribing, editing videos, designing posters, participating in focus group discussions, interviews, or surveys, statistical analysis and the likes. Customer shall provide the materials, tools, and necessary training for the doer to perform the task.

The default sorting algorithm is the most recently posted errand first. Also, there is an in-app search bar that looks into the titles of available errands and filter them based on the search keyword.

4) Chat: This allows the users to transact with each other in order to further clarify the scope of selected errand through sending of texts and images. Also, push notifications have been added so that users still receive messages even if they are not in the app.

5) Rate: After an errand is marked as done, you will rate your experience (on a scale of one to five stars) based on the performance of the user who completed the errand and vice versa. The system will calculate the average based on all the ratings received by the users. Users who have an average rate of less than three will receive constant alert dialog. However, once they reached an average rate of less than two, the system will automatically block them from using the application. They will not be able to log in to the system anymore.

6) Block: This allows you to block users if you receive unjust treatment from them, including but not limited to, scamming and harassing. If you block a user, they cannot see your posted errands and message you. Also, it would terminate any ongoing transaction between you and the user.

D. Entity Relationship Diagram

The Entity-Relationship Diagram (ERD) of the mobile application is shown in Figure 2. A user can post zero or many errands, and block zero or many users. Each post can have zero or many transactions. On every transaction, there is one or many message, and a one and only one rating.

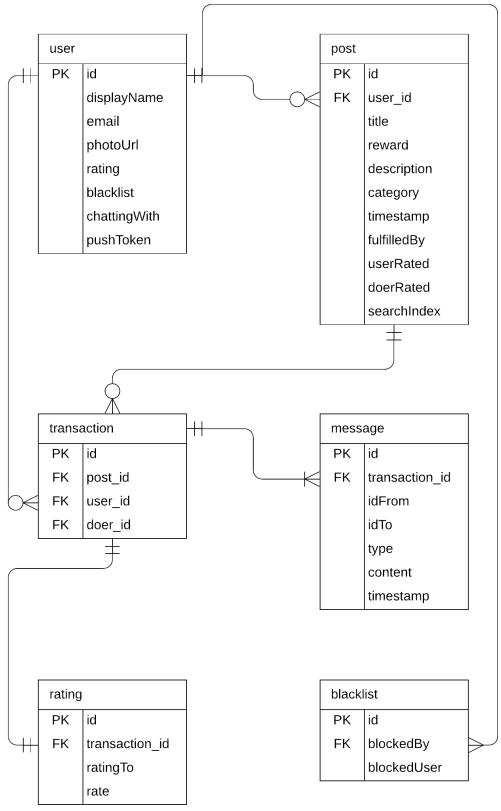

Fig. 2. Entity Relationship Diagram

User entity has the following attributes: *id*, *displayName*, *email*, *photoUrl*, *rating*, *blacklist*, *chattingWith*, and *pushToken*. The *blacklist* is a list of *user_id*s that are blocked by the user. While *chattingWith* is the *user_id* of the user who the current user is chatting with. Moreover, *pushToken* is a unique key generated by Google to create a connection between the app and the Android device.

Post entity has the following attributes: *id*, *user_id*, *title*, *reward*, *description*, *category*, *timestamp*, *fulfilledBy*, *userRated*, *doerRated*, and *searchIndex*. The *fulfilledBy* is the *id* of the user who accomplished the post. While *userRated* and *doerRated* contains a Boolean value to check if the user has already rated the post. Furthermore, the *searchIndex* is a list of keywords use to search post by title.

Transaction entity has the following attributes: *id*, *post_id*, *user_id*, *doer_id*. The *user_id* is the *id* of the user who owns the post. While *doer_id* is the *id* of the user doing the post and the *post_id* is the *id* of the post where the users are having a transaction.

Message entity has the following attributes: *id*, *transaction_id*, *idFrom*, *idTo*, *type*, *content*, and *timestamp*. The *idFrom* is the *id* of the user where the message came from, while the *idTo* is the *id* of the other user who will receive the message. Also, the *type* is the type of message which can be text, image, or a sticker, and *timestamp* is the time and date the message was sent.

Rating entity has the following attributes: *id*, *transaction_id*, *ratingTo* and *rate*. The *rate* is an integer from 1 to 5 while the *ratingTo* is the *id* of the user who will receive the rating.

Blacklist entity has the following attributes: *id*, *blockedBy*, and *blockedUser*. The *blockedBy* is the *id* of the user who will block the *blockedUser*.

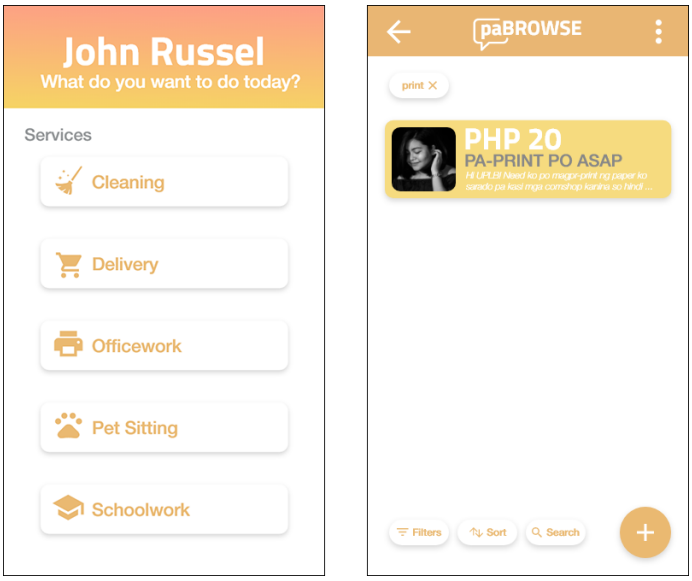

Fig. 3. The application's Home and Browse user interface prototypes

E. Development Process

The user interface prototype of the mobile application was made using Adobe XD. The application's Home, Request, Chat, and Rate UI prototypes are shown in Figures 3 and 4.

For developing the application, the Flutter SDK and Firebase was used along with Visual Studio Code running on the Windows operating system. The application was tested by using the Android Studio's Android emulator, and by connecting an Android smartphone and previewing the app on the device.

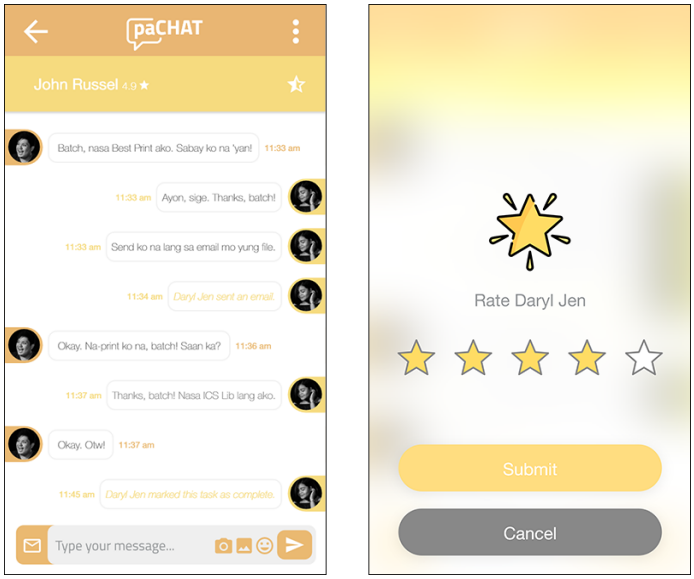

Fig. 4. The application's Chat and Rate user interface prototypes

F. User Testing and Survey

The System Usability Scale (SUS) was used to assess the user experience (UX) of the mobile application. It involves answering a questionnaire with ten items and five choices for each item, 1 being the strongest disagreement, and 5 being the strongest agreement [15]. It follows a specific computation for the final score of the application.

Then, the developer asked 35 individuals to use and explore all the features of the application. Afterward, the individuals evaluated the application by answering the 10-item questionnaire regarding their experience in using the app. Lastly, the SUS score was computed from each of the responses, and the average of all those scores represented the final SUS score of the mobile application.

IV. Results and Discussion

A. User Interface (UI)

The mobile application UIs are made to resemble the prototypes as closely as possible. Minor changes were done to improve readability and functionality. The overall UI of the mobile application uses Material Design and is deemed responsive; it can adapt to small screen sizes like the Google Pixel display and big screen sizes on tablet devices. It is also noteworthy that the mobile application UI tries to avoid notches and rounded corners to make sure that all parts of the UI remain visible. Furthermore, a dark-themed UI is added for battery saving and preferential purposes. The designed UIs are shown in Figure 5.

B. Functionalities

1) Sign in with UP Mail: An Onboarding page appears when the mobile application is newly installed and there is no user currently logged in. If the user clicks the "Get started!" or "Skip" button, it will navigate to the Login page.

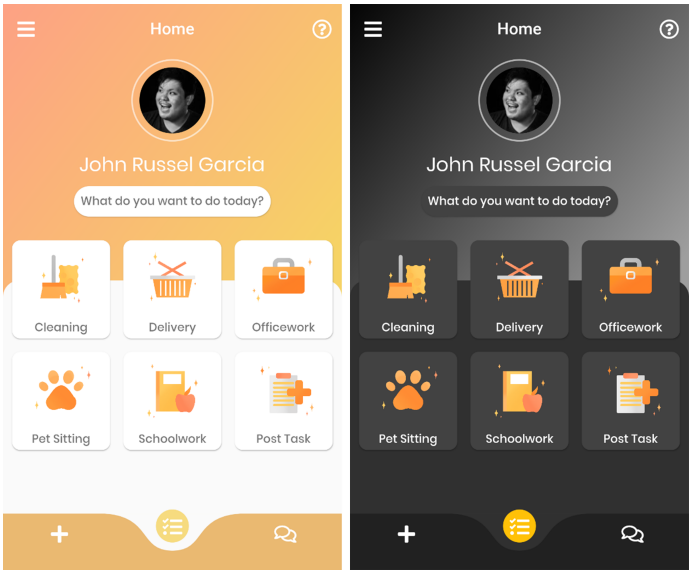

Fig. 5. Light and dark theme

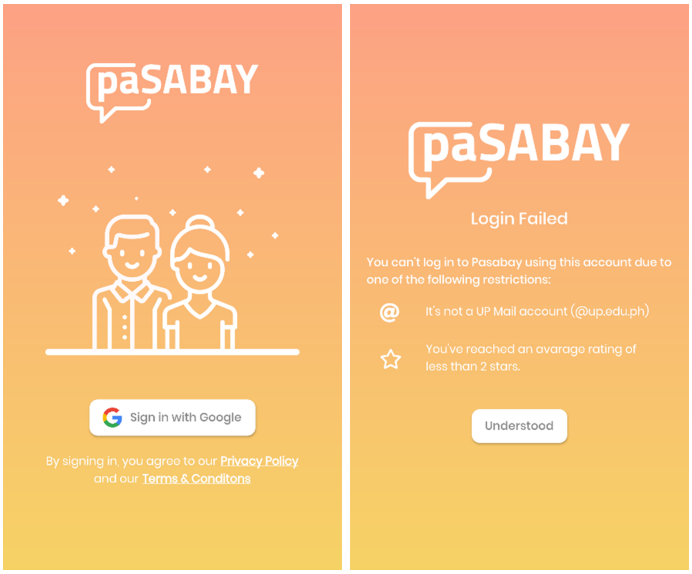

Fig. 6. Login and Login Failed page

The Login page shown in Figure 6 contains a "Sign in with Google" button and hyperlinks to Privacy Policy and Terms Conditions of the mobile application. Meanwhile, the Login Failed page appears when: 1) a user did not log in using a UP mail or; 2) the user had an average rating of less than 2 stars. If the account is successfully logged in, the user will be navigated to the Home page shown in Figure 1. In addition, a user who has its account still logged in will be automatically navigated to the Home page once they open the mobile application again.

2) Post Errand: The Post Errand page shown in Figure 7 has two tabs – Active and Inactive. The Active tab contains the list of the ongoing and still unfinished errands posted by the user. On the other hand, the Inactive tab contains all the tasks that were already finished by other users, as well as the tasks that have reached their 1-week expiration date.

If the Add FloatingActionButton (FAB) is tapped, the user

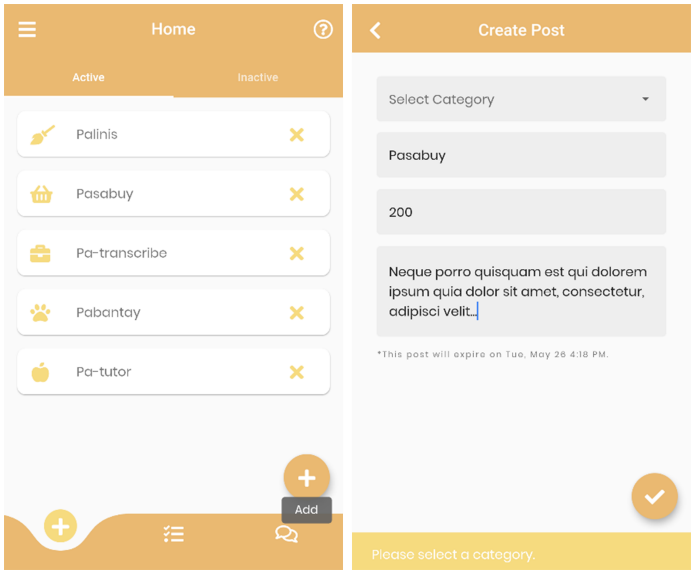

Fig. 7. Post Errand and Create Post page

will be navigated to the Create Post page shown in Figure 7. The Create Post page requires the user to input a category, title, reward, and description. A SnackBar will appear if the user leaves a blank on the form and a TextInputFormatter is added to the form so that the user cannot input invalid characters. Once the form is completed, the user can tap the Create FAB, and an information dialog stating that the post has been created will appear.

Users are only allowed to create up to five active posts to avoid spam posts. The user can only add task, when the previous tasks were already finished or expired. When a user attempts to add more than five postings, a warning dialog will appear.

In order to edit a post, a user needs to tap the post itself. The user will be navigated to the Edit Post page.

To delete a post, a user needs to tap the Delete button on the right side of the post itself. A confirmation dialog will appear if the post has no existing transactions. Otherwise, a warning dialog will appear.

3) Browse Errands: The Browse Errands page shown in Figure 5 also contains six buttons – Cleaning, Delivery, Officework, Pet Sitting, Schoolwork, and Post Task. The user will be navigated to a filtered list of errands shown in Figure 8 based on the category he or she has chosen.

In order to view further information on a post, the user needs to tap the post itself to navigate to the View Post page shown in Figure 9. By tapping on the Chat FAB, the user will be navigated to the Chat page shown in Figure 9.

Once the Search FAB is tapped, the user will be navigated to the Search page (shown in Figure 8). In order to view a search result, the user needs to tap the search result itself to navigate to the View Post page shown in Figure 9.

4) Chat: The Transactions page has two tabs – Current and History. The Current tab contains a list of ongoing transactions. Meanwhile, all transactions that were fulfilled by the current user or the other users will be placed and listed on the History tab. When the user taps the Archive button of a

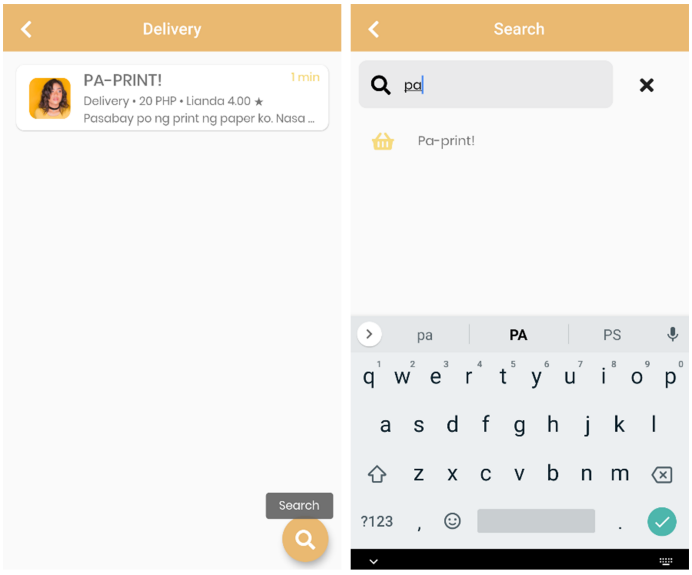

Fig. 8. Filtered Errands and Search page

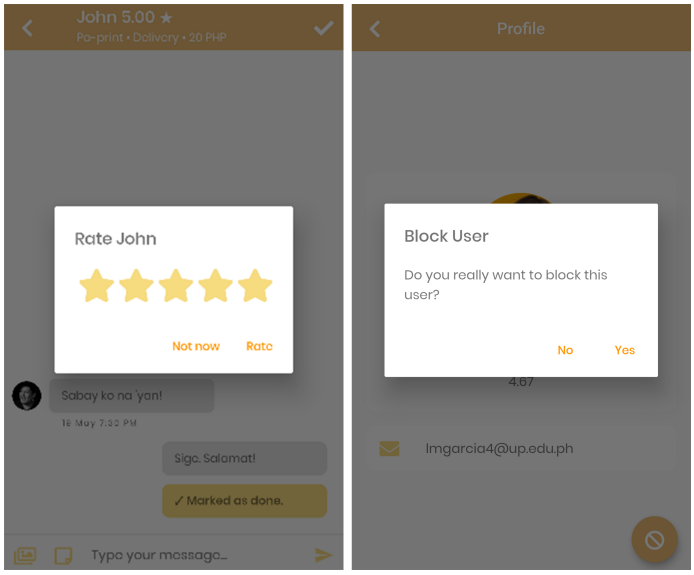

Fig. 10. Rating and Block User dialog

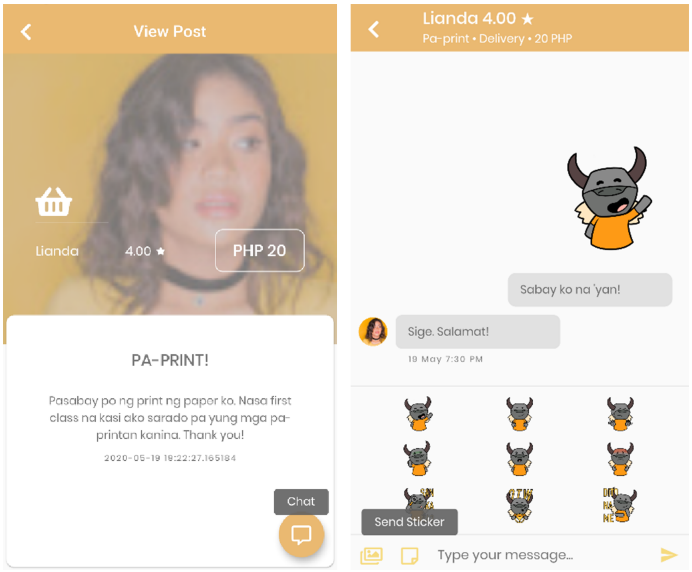

Fig. 9. View Post and Chat page

transaction, a confirmation dialog will appear. Once confirmed, the transaction will be hidden until the current user taps the Chat FAB in Figure 9 again.

In order to chat with other users, the user needs to tap the transaction itself to navigate to the Chat page (as shown in Figure 9). This allows the users to transact and communicate with each other to further clarify the particulars of selected errands through sending of texts and images. Furthermore, a user can send stickers by tapping the Send Sticker button shown in Figure 9. A push notification will be sent to a user when the application is not open or a user is not in the Chat page.

5) Rate: Once the other user (the one who did the errand) is done, the current user (the one who posted the errand) can mark the transaction as done by clicking the Mark as Done button. Then, a confirmation dialog will appear. If the current user confirmed, a star rating dialog shown in Figure 10 will appear. Finally, the other user can also rate the current user by tapping the Rate button at the right side of the AppBar.

6) Block: The current user can block other user by viewing their profile on the Chat page. In order to do that, he or she needs to tap the other user's avatar to navigate on their Profile page. Once the current user tapped the Block FAB, a confirmation dialog shown in Figure 10 will appear. If the current user confirmed, he or she will no longer see posts and messages of the other user. Also, the other user will be listed on the Blacklist page. To unblock a user, just go to the Blacklist page and tap the Unblock button at the right side of the user itself.

7) Miscellaneous: The Home page shown in Figure 5 contains a navigation bar with three buttons in the bottom-most part of the page. The 'addition symbol', 'bullet', and 'speech bubble' icons correspond to the three major functionalities of the app which are 'Post Errand', 'Browse Errands', and 'Chat', respectively. Also, there is an AppBar at the uppermost part of Figure 5, this allows a user to access on the Drawer in the left and the Info page in the right.

The Drawer contains a DrawerHeader which contains the user's avatar, name, and email. Also, navigators to Profile and Blacklist pages are also included there. The user will be navigated to the Profile page if they tap the Profile navigator inside the Drawer. The Profile page contains the user's avatar, name, rating, and email. If the user rating reached an average rate of less than three stars, an warning dialog will appear.

The Blacklist page contains the list of users that were blocked by the current user. In order to unblock a user, the current user needs to tap the Unblock button. Then, a confirmation dialog will appear and require the current user's response.

In addition, a dialog will appear when the user taps the Dark Mode button. The information dialog contains instructions on how to enable the dark theme of the app. Lastly, when the Sign Out button is tapped, the user will be signed out and

navigated back to the Login page.

The Info page contains necessary information about the app features and categories. It uses Expandable, a Flutter widget that can be expanded or collapsed by the user.

C. User Testing

The installer or the Android Package (APK) of the app was uploaded to Google Drive and distributed to the respondents, and the survey was conducted online using Google Forms. The respondents were requested to install and explore the app on their own before answering the survey.

The SUS score of the mobile application from the responses of 35 individuals varied from 65 to 100. The ages of the respondents ranged from 18 to 25, and all of them are bonafide UPLB students from varied courses. They were asked to score the following 10 items with one of five responses that range from Strongly Disagree to Strongly Agree:

1) I think that I would like to use this app frequently.
2) I found the app unnecessarily complex.
3) I thought the app was easy to use.
4) I think that I would need the support of a technical person to be able to use this app.
5) I found the various functions in this app were well integrated.
6) I thought there was too much inconsistency in this app.
7) I would imagine that most people would learn to use this app very quickly.
8) I found the app very awkward to use.
9) I felt very confident using the app.
10) I needed to learn a lot of things before I could get going with this app.

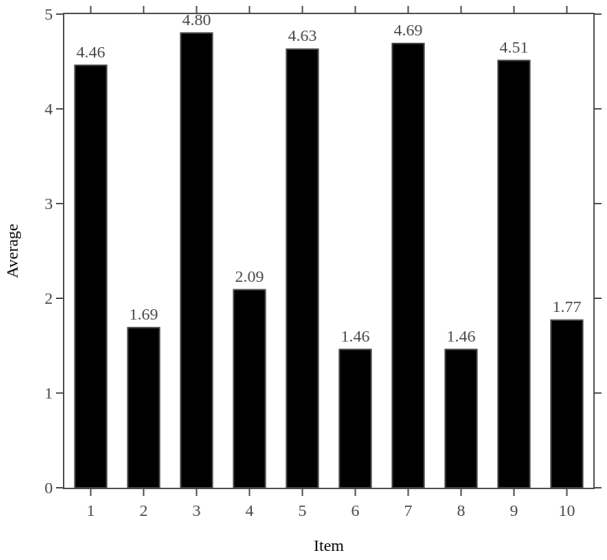

Fig. 11. Bar graph showing the average score for each SUS item

The average score for each item is shown in Figure 11, and based on the top three highest scored items on the survey results, most of them thought that the app was easy to use, would imagine that most people would learn to use the app very quickly, and found the various functions in the app were well integrated.

It is also worth mentioning the comments of the respondents regarding the UI being simple, clean, and pleasing to the eye. However, a very few respondents reported that some parts of the UI are not showing properly due to the small screen of their devices even if the UI is responsive. Also, some of the respondents suggested to add features such as payment methods and locations, and to improve functionalities on the Chat page.

The average SUS score is 68. Whereas an average of 87.7 SUS score was computed for the mobile application based on the survey results. Therefore, the SUS score for the mobile application landed on the above average mark.

V. Conclusion and Recommendations

An Android mobile application was designed and developed to provide a user-friendly errand crowdsourcing platform for UPLB students and employees. Since the overall SUS score of the mobile application is 87.7, the user-experience of the mobile application is considered Excellent based on the general guideline on the interpretation of SUS score:

SUS Score	Rating
> 80.3	Excellent
68 – 80.3	Good
68	Okay
51 – 68	Poor
< 51	Awful

The developer recommends creating a real-time location update so that the user knows the location and proximity of the other user. To avoid any privacy issues, upon installing the app, it should initially ask permission to enable the user's location upon installing it for the better use of the application. It should also be clarified and assured that the location details will not be in public. Rather, it will only be visible upon the transaction of two users. It is also noteworthy to have a recommender system that will recommend users to do posted errands that are based on their activities inside the app. A matching algorithm that will suit a user to another user that can immediately finish and complete errands may also be added to further enhance the user experience. Having a Settings page where users can choose color themes, font type, and font size might improve the overall user experience since it allows users to customize the UI based on their preferences. Furthermore, adding a Share button to different social media platforms would help users to disseminate their posts and to also publicize the app itself.

References

[1] "Happinews," Sep 2019. [Online]. Available: https://news.abs-cbn.com/tvpatrolreplay
[2] "Your helping hand on demand." [Online]. Available: https://www.mykuya.com/
[3] "Flutter - beautiful native apps in record time." [Online]. Available: https://flutter.dev/
[4] J. Tamplin, "Firebase is joining google!" Oct 2014. [Online]. Available: https://firebase.googleblog.com/2014/10/firebase-is-joining-google.html
[5] "Firebase." [Online]. Available: https://firebase.google.com/

[6] "The up mail: University of the philippines information technology development center." [Online]. Available: https://itdc.up.edu.ph/uis/the-up-mail

[7] N. Eagle, "txteagle: Mobile crowdsourcing," in *International Conference on Internationalization, Design and Global Development*. Springer, 2009, pp. 447–456.

[8] A. Gupta, W. Thies, E. Cutrell, and R. Balakrishnan, "mclerk: enabling mobile crowdsourcing in developing regions," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 2012, pp. 1843–1852.

[9] P. Narula, P. Gutheim, D. Rolnitzky, A. Kulkarni, and B. Hartmann, "Mobileworks: A mobile crowdsourcing platform for workers at the bottom of the pyramid," in *Workshops at the Twenty-Fifth AAAI Conference on Artificial Intelligence*, 2011.

[10] T. Yan, M. Marzilli, R. Holmes, D. Ganesan, and M. Corner, "mcrowd: a platform for mobile crowdsourcing," in *Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems*. ACM, 2009, pp. 347–348.

[11] A. Kittur, E. H. Chi, and B. Suh, "Crowdsourcing user studies with mechanical turk," in *Proceedings of the SIGCHI conference on human factors in computing systems*. ACM, 2008, pp. 453–456.

[12] F. Gino and B. R. Staats, "Samasource: give work, not aid," *Harvard Business School NOM Unit Case*, no. 912-011, pp. 2013–12, 2012.

[13] Z. Salim, "From deliveries to cleaning, this app will run your errands for you at only php49/half hour," Jun 2018. [Online]. Available: https://vulcanpost.com/641534/mykuya-errands-app-philippines/

[14] S. Shabibi, "Mykuya: We are sharing the journey with you and we mean it," Feb 2019. [Online]. Available: https://medium.com/mykuya/mykuya-3-0-we-are-sharing-the-journey-with-you-we-mean-it-c47436027d4

[15] J. Brooke, "Sus-a quick and dirty usability scale," *Usability evaluation in industry*, pp. 189–194, 1996.