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PharmaGo: A Pharmaceutical Delivery Application for Small and Medium Pharmacies

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Abstract. Online delivery services have been on the rise and several small and medium enterprises (SMEs) continue to adapt e-commerce to their business operations. In this study, the researchers developed a mobile pharmacy delivery application to support small and medium pharmacies with the purpose of providing a platform to a larger audience within their area of jurisdiction. The end application was tested for its usability and functionality by pharmacy owners, target customers, and delivery drivers using System Usability Scale (SUS) [8]. The average results of the scores were 85.81 for target customers, 85.83 for delivery drivers, and 96.25 for pharmacy owners, which all translate to an Excellent rating in SUS. Overall, PharmaGo passed as a satisfactory pharmaceutical delivery mobile application for its target end-users.

Keywords:mobile application, delivery application, SMEs, pharmacy, e-commerce

1. Introduction

The relevance of this research revolves around the notion of being able to provide a more convenient and accessible approach to pharmaceutical needs for individuals that may need it. Additionally, this will provide small and medium pharmaceutical enterprises a platform to cater to a larger audience that will aid in generating more income and support. This study will not just be aimed to be beneficial to the different pharmacies but also to the drivers that will help them have an alternative source of livelihood.

Small and mid-sized enterprises (SMEs) are any enterprise that maintains their profit, assets, or employees below a certain threshold. SMEs have varying margins around the globe to define what could be called an SME, but in the Philippines, SMEs are constrained to enterprises that have assets valued around ₱3 million to ₱100 million. To be more precise, businesses up to ₱3 million are called micro enterprises, small enterprises are valued at ₱3,000,001 to ₱15 Million, while medium enterprises are within ₱15,000,001 to ₱100 million. According to the Department of Trade and Industry, of the total 946,988 registered establishments, 0.43% are large enterprises, 0.41% are medium enterprises, 9.22% are small enterprises, and 89.94% are micro enterprises. A Community Pharmacy is considered within the boundaries of a small and medium pharmacy.

1.1 Current State

1.1.1 E-Commerce

In ordering products, users tend to order them online in their chosen store's website or an e-commerce platform. (Amazon, Shopee, Lazada, Alibaba, etc.) The reason why most users resort to using these services is because it is very efficient and convenient for them. By visiting the e-commerce application or website, these users can select the product that they want, and provide their billing and delivery. Their chosen product will then be delivered to them right at their doorstep and in turn, these users can safely and easily pick their packages up from their doorstep. It is safer and it costs less than to travel from their homes to the physical store itself. It is also efficient because there is a wider array of products to choose from rather than in physical stores where they have less choices.

1.1.2 Pharmacy applications

There are large e-commerce platforms, such as Lazada or Shoppee that sell medicinal needs or products that can be found in any pharmacy. There are also online sellers on other platforms who are selling medicinal needs, but it will take an appointment to meetup or have it delivered to you in

days. There is also the “Grab Pabili " option on Grab where you will be able to put in your medicinal needs and the driver will try to ask the pharmacy for its availability.

1.2 Objectives

The researchers intend to fulfill the following objectives regarding the use of PharmaGo:

- To propose an online pharmacy application exclusively on selling pharmacy products of small and medium enterprise pharmacies.
- To design a prototype and develop an online pharmacy that will be presented to small and medium enterprise pharmacies.
- To assess if this online pharmaceutical mobile application store will click to the standards of the public and if it will be competitive to the market.

1.3 Business/ Product Description

PharmaGo for users is a pharmaceutical mobile application that allows a user to register as a customer or a driver. The user can purchase their medicinal needs from small to medium-sized enterprises (SME’s). The delivery drivers can accept or reject a customer's order and deliver it to the designated address. The other application is for admins or pharmacy owners that can register their pharmacy on the application and sell their products. The study focuses on the importance and impact of having a pharmaceutical application that focuses on the small and medium pharmacies to customers. The pharmacy can only issue the customers OTC (over the counter) drugs or items. The OTC items do not require any doctor’s prescription. The pharmacy must be able to see the prescription to see its validity and legitimacy before issuing the customer the prescribed medicines. Misused medication can lead to some harmful effects that is why the project is limited to OTC items.

1.4 Significance of the Study

The project will benefit the following:

- User - as the pharmaceutical application will be able to attend to the customer’s needs from the convenience of their devices and deliver their purchased products directly to their homes.
- Small and Medium Enterprise Pharmacies - as the application will be able to provide the pharmacies a platform to showcase their products and allow them to generate another way to earn profit alongside their physical stores.
- Delivery Riders - PharmaGo will be an opportunity for the delivery riders to have an extra income since there will be a demand to those delivery riders who are going to deliver the ordered products of the customers.
- Future Researchers - This study may serve as their guidance to gather information and may serve as a steppingstone to start or develop a study.

2. Review of Related Literature

In the research conducted by **Azarmju** [1] in 2020, it was stated that in the pharmacies, there is a high risk of COVID-19 transmission. It is because the pharmacy is the go-to place for the people who are sick and need to buy their medicine. Most of the people who go to the pharmacy can either be sick or have contact with the person who is sick. He also stated that the employees of the pharmacy such as the pharmacists, assistants, clerks, etc. are more prone to the virus since they are the one who attended to the needs of the customers who can be a carrier of the said virus. Another one is that the possible carrier of COVID-19 virus can go to the pharmacy without knowing that they are infected already in which they seek for a flu medicine considering the mild cases have those kinds of symptoms. Next is that when a COVID-19 carrier goes to the pharmacy and grabs something and then turns out that he/she returned the item, the one who got the same item can be infected since the virus can spread through the different surfaces.

According to **Zheng** et al., (2020) Pharmaceutical services during the pandemic must hold different circumstances or attributes because of the disease and must support patients, especially those struck with the

virus must be supported well with the medication given that precautions must be followed as well as to ensure safety to promote control as well over the pandemic [2].

The structure of a delivery application includes 3 separate applications according to **Patel** [3] that in 2020, the following stakeholders includes the User - A customer application which is installed and will be used by the customers. Key features include the search, order, favorite, discounts, real-time tracking, in application chat, and payment. Next would be the Admin - Used by the owner, which usually will be the pharmacy owner/manager, that controls and manages the deliveries, orders, and the contents or details of the application. Lastly, the Delivery Driver - Used by the Delivery personnel that will handle the pick-up and drop off orders.

With digital and technological advancements through the years, more and more applications have been present in most smartphone integrations. Major brands like Amazon, Nike, Adidas, and even fast-food restaurant chains like McDonalds integrate their services into a mobile application. All these brands have also integrated a delivery service within their application in which a consumer can order their specified item and have it delivered right to their address. It is also stated in an article by **Vakhnenko** [4] stated that pharmacies and other drug stores can potentially integrate most of their services into a mobile application with said delivery services as well. It is also stated that setting up an e-commerce application that focuses on pharmaceutical necessities could bring benefits not only to the company of that pharmacy but also its customers. One of which is mentioned within the benefits of having a mobile application-based pharmacy is that there will be an increasing number of buyers and willing customers to use the service. Another benefit that is stated is that the company that has set up its business through a mobile application will have a better chance in the competition compared to traditional pharmacies or other drug stores that do not have any integration within a mobile application whatsoever.

Pharmaceuticals have also the potential to integrate a delivery service within their mobile application or their website. Mercury Drug Store, a Philippine based pharmaceutical has this integrated in their website meaning the customer can select and check out their item which will then be delivered to their address. As stated by **Armour** (2021), having a delivery setup for pharmaceuticals has the potential to benefit both customers and the pharmacy itself. One benefit, which was described and identified by Armour was that the customer has the potential to regularly check on or regularly observe their medications. Another benefit is that of course, since this model is very similar to the ones that restaurants and e-commerce platforms have, this will greatly increase efficiency with less cost and higher quality of service as well [5].

Ever since smartphones were widely used by most consumers, they found out that with a variety of uses, one of them would be to shop and buy products online using their mobile devices. One e-commerce platform, “Amazon” which has its own website and application caters to consumers by putting products from different brands for sale. This greatly benefits consumers since they do not need to visit stores which could both be time and energy consuming. However, pharmacies can also utilize this to greatly benefit its consumers, since most pharmaceutical consumers are elderly or people with disabilities who have trouble travelling to the pharmacy and buy their medication. **Kidecha** [6] discusses in 2020 that an opportunity to pharmacies could use which is to become an e-pharmacy platform meaning pharmacies can sell their supplements online in which customers can easily checkout and be delivered right at their home address. These benefits would most likely be customers, specifically elderly and people with disabilities who frequently visit pharmacies to buy their medications. However, there are still certain considerations to follow regarding setting up of the E-Pharmacy application. One must still consider the necessary licensees since one cannot operate an application which caters to other brands of medications without the proper licenses, otherwise it would be deemed illegal. Another of which is that there should be proper application maintenance (regular updates, bug fixes, etc.).

As we all know, we can do a lot of things with the use of the Internet. We can transact our online banking needs, order our food, conduct research, conduct online classes and meetings, etc. Transactions that can be done online are much in demand to limit the movement of the people and to further stop the spread of the said virus. Online transactions such as stores, restaurants, pharmacies, etc. have their own advantages and disadvantages compared to the conventional ones. In the study of **Chordiya and Garge** in 2018 [7] talks

about the E-Pharmacy which is in demand right now and the conventional pharmacy. The study also tackles the purpose, advantages, and disadvantages of both types of pharmacies. Research conducted was able to discuss what E-pharmacy means. It is a type of pharmacy that operates in the field of the Internet. It sells different vitamins and other medicinal products that's usually available in the physical pharmacy store. Customers will be able to order their needed medicines from certain pharmacy websites or applications and later on be delivered to their doorsteps. The author also stated in this study how E-Pharmacy functions. E-Pharmacy requests their customers to upload a screenshot of a prescription if they're acquiring medicines that need a prescription from a doctor. Next is that when an order is being placed by the customer, it will be checked and validated by pharmacists to ensure the safety of its clients. After the medicines are being validated by the pharmacists, they will then be sent to the pharmacies to prepare the orders of a certain customer. Pros and Cons of having a E-Pharmacy are being discussed in the study such as E-Pharmacy being Convenient, Timesaving, Lower Price, Future Technology, etc. for the advantages and having a lack of physical evaluation, doesn't protect personal information, etc. are the factors that considered as a disadvantage to E-Pharmacy. On the other hand, conventional pharmacies are the physical pharmacy stores that we always see wherein pharmacists can validate the medicine ordered to them and supplies the public who goes to the pharmacy and acquire their needed medicinal products.

3. Methodology

3.1 Research Framework

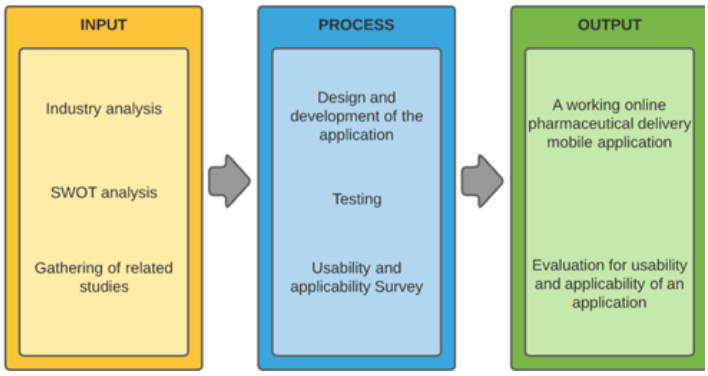

Fig. 1: Input Process Output.

The researchers used industry analysis to understand the situation in the technology and pharmaceutical industry. After that, the researchers gathered data from various related studies on how the pharmaceutical application's general structure will be. Purposive sampling is used for the data gathering for this research.

3.2Design of Information Systems

The functional and non-functional requirements are a result of a series of interviews with target end-users, and existing similar applications.

3.2.1 Functional Requirements

- Users should be able to register freely.
- Admin should be able to add pharmacies and their products.
- Admin should only access his/her pharmacy on the application.
- Admin should be able to accept or reject orders of a customer.
- Admin should be able to contact customers before or after the order is accepted or rejected.
- Admin should be able to view the order log
- Customers must be able to order products from available pharmacies.
- Customers should be able to view if an order is accepted, canceled, or pending.
- Customers cannot order at two different pharmacies at the same time.
- Customers should be able to view their cart
- Customers should be able to view the pharmacy profile.
- Customers should be able to view the driver profile.
- Customers should be able to view the order log.
- Delivery drivers can accept accepted orders from the pharmacy.
- Delivery drivers should be able to contact customers after accepting orders.

- Delivery drivers can cancel pending orders that go back to the queue and be fetched by other available drivers.
- Delivery drivers must be able to view the pharmacy location and customer profile.
- Delivery drivers can view the order log.

3.2.2 Non-functional requirements

- The application should not crash.
- The application should be accessible if there is an internet connection.
- Products that are bought in a pharmacy must be reduced in quantity/stock.
- All transactions and updates should be in real time.

3.3System Architecture

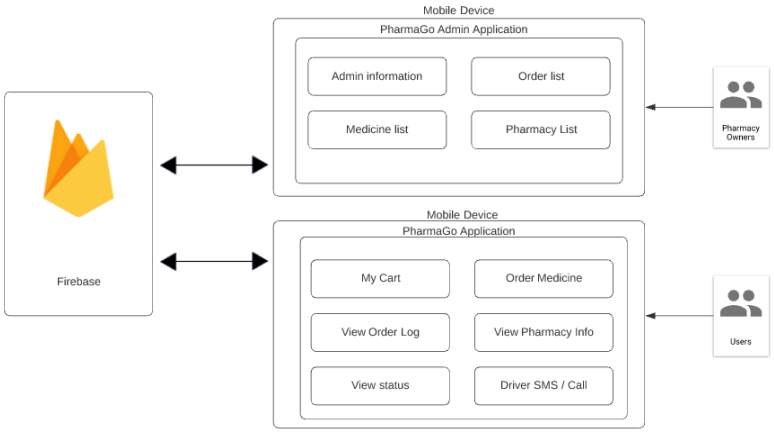

Fig. 2: System Architecture

The figure presented above is the system architecture for both PharmaGo applications, users (customers and riders) and the admins (SME Pharmacy owners). This serves as an overview of the structures of the mobile application. The admin can post their pharmacy and products while the customers can order the listed products for them to order. The delivery driver and the admin will be able to accept or reject orders of the customer and can contact them.

The mobile application used firebase as their database specifically the firestore database and the firebase authentication. The following are used for storing data such as when admins will post their products or the order list and logs. Authentication will also be used for authenticating users that will be using the application.

3.4Design and Development

The researchers looked for pharmacies that are considered a small and medium pharmacy in a particular location since purposive sampling was the one that the researchers used in conducting the said data gathering. The group also gathered information through related literature about the design that will be used in the development of the app. Once the data is already gathered, it will go with the design and development of the app itself. The group came up with a prototype of what the app will look like in which it would be the researcher's guide in the app development. After that, the group assessed what tools they are going to use such as programming language, device to test the app, etc. then it will proceed to the development proper.

Lastly, is the evaluation part. Once PharmaGo is already developed, application testing and evaluation is done by the researchers together with the stakeholders to test the functionality, compatibility, usability of the app since it's one of the objectives of the study that the researchers want to address. Checking of bugs and errors will also be conducted before the finalization of the PharmaGo app.

4. Results and Discussion

4.1 Mobile Application Proper

Fig. 3: Application Icon

There are two PharmaGo applications. One for the pharmacy owners which is the PharmaGo Admin and one for both the customer and delivery driver.

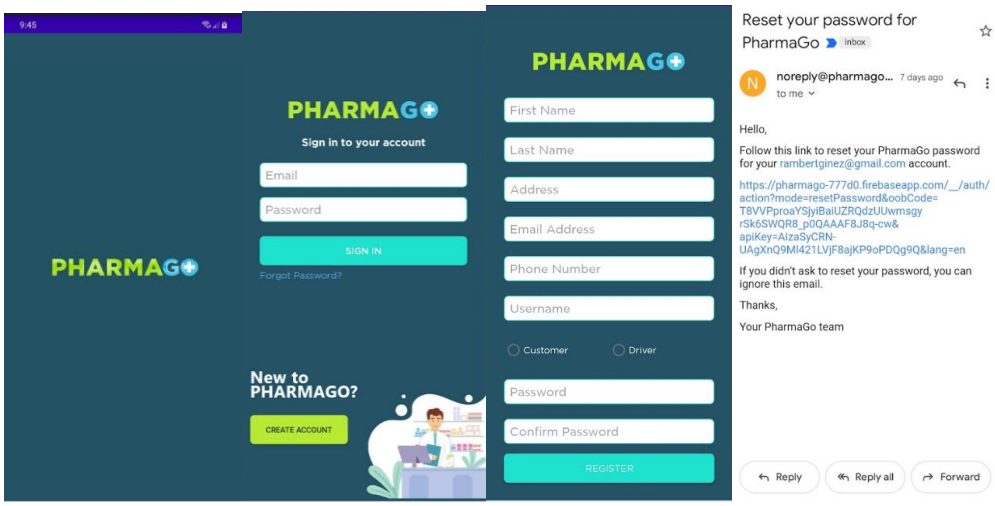

Fig. 4: Sign up and verification

Figure 4 is showing the sign up and log in screens for the application. Verification process will be done using your email address.contact them.

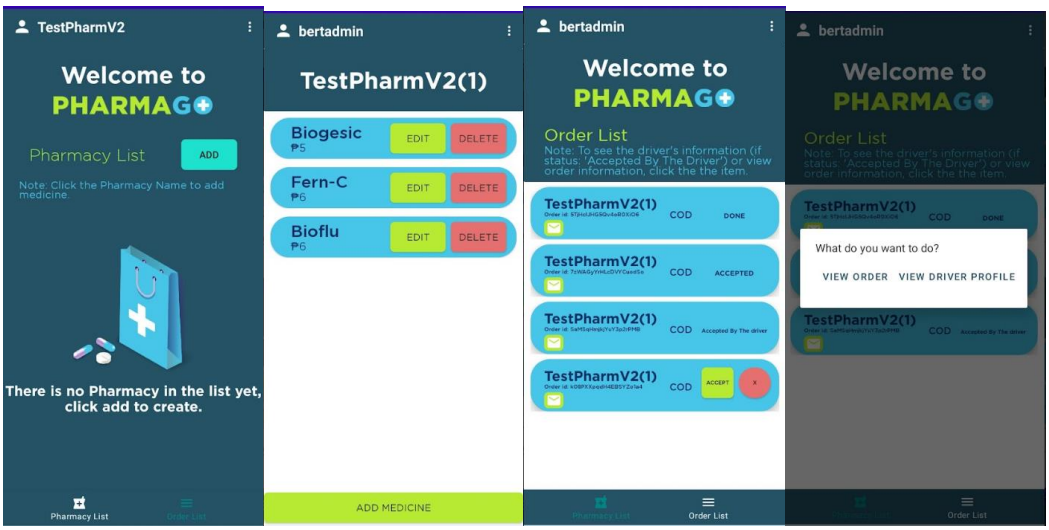

Fig. 5: Pharmacy owner

Figure 5 shows the pharmacy owner screens which the pharmacy owners can post their items and see updates in their order lists to see if someone is ordering in their pharmacy. They can see the customers and driver's profile. The pharmacy owners can also see the customers' orders so that they can prepare it. If they do not have the item, they can contact the customer via text message and cancel their order so that the customers can reorder.

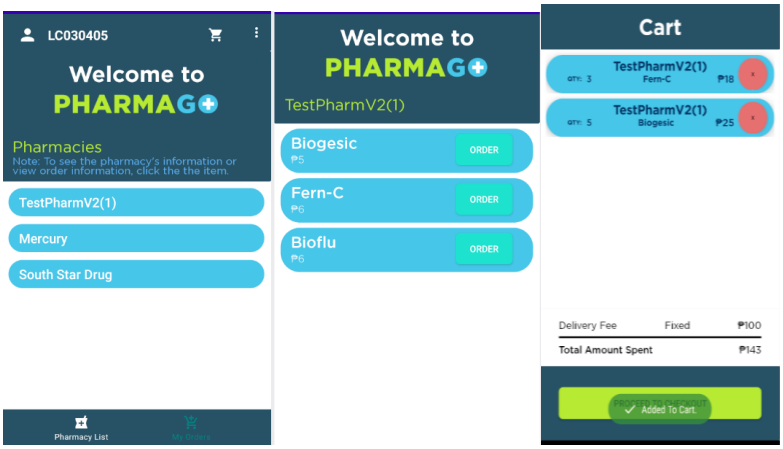

Fig. 6. Customer

Figure 6 shows the customer application wherein they can see the list of pharmacies available and order their products. The customers can also see the status update of their item if it is pending, accepted, or accepted by driver.

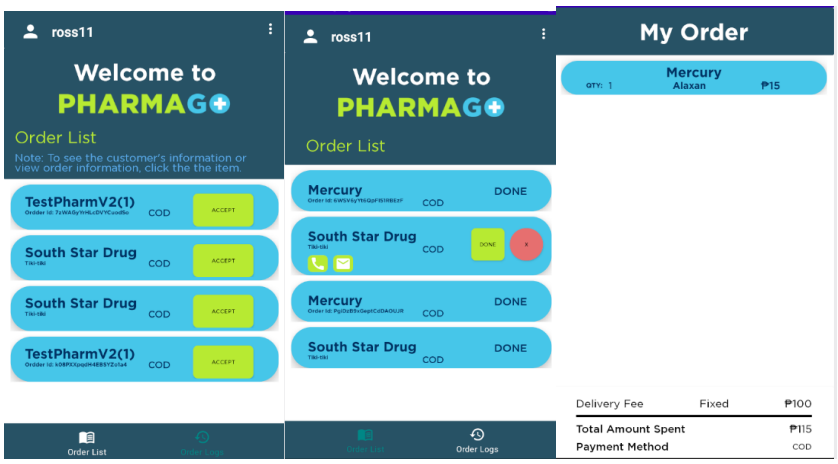

Fig. 7. Driver Application

Figure 7 shows the driver application. The driver can accept a customer's order and either call or send an SMS to them for updates. Drivers can see the customers addresses and orders.

4.2 Functionality Testing

There were features in the mobile application that were not able to be made during the initial testing phase such as the Admin order listCustomer order, and the shopping cart. After several fixes on the mobile application, the researchers were able to test the application again and come up with the final test results.

Table 1: Initial Testing

Initial testing	
Action	*Result*
Registration Admin	PASS
Registration Customer / Driver	PASS
Log in/Logout PharmaGo	PASS
Log in/Logout PharmaGo Admin	PASS
Forgot Password	PASS
Admin home	PASS
Add pharmacy	PASS
Add medicine	PASS
Admin Order List	FAIL
Customer home	PASS
Customer order	FAIL
Customer My Order	PASS

Shopping cart	FAIL
Driver Home	PASS
Driver order log	PASS

Table 2: Final Testing

Final Testing	
Action	*Result*
Registration Admin	PASS
Registration Customer / Driver	PASS
Log in/Logout PharmaGo	PASS
Log in/Logout PharmaGo Admin	PASS
Forgot Password	PASS
Admin home	PASS
Add pharmacy	PASS
Add medicine	PASS
Admin Order List	PASS
Customer home	PASS
Customer order	PASS
Customer My Order	PASS
Shopping cart	PASS
Driver Home	PASS
Driver order log	PASS

4.3Compatibility Testing

Fig. 8. Build Gradle

The researchers conducted a compatibility testing to test the mobile applications functionalities and features to other mobile devices and android versions. The build.gradle was shown above. This shows the minimum SDK version which is android 7.0 and the target SDK version which is android 11.

The researchers conducted compatibility testing to identify the devices together with several versions that supported PharmaGo. The researchers used an emulator to mimic a certain device and android version for the compatibility testing. In the specifications and results, it states the specific Android version together with a mobile phone wherein the application was tested. It also states the resolution that's being used and the action in which the researchers conducted the application using a particular device. As for the result, among all the Android versions that the researchers tested from Android 7 to Android 11, it all passed the compatibility testing. In the last 3 devices of the compatibility testing, the researchers used their own Android mobile phones to conduct the testing, not just using the Android emulator.

4.4 Usability Review

[8] ("System Usability Scale (SUS)," 2013) is a reliable tool in measuring the usability. It contains a questionnaire with 10 questions assessing the usability of the system or an application. With this tool, the respondents will assess a particular question with an option from strongly disagree being the lowest to strongly agree which would be the highest satisfactory. It also became a standard to different industries as

well since it is easy to scale, generate results that are reliable, and it differentiates an effective application to the ones that are not.

In this study, the researchers used SUS to assess the insights of its users if the PharmaGo application is considered as above average or below average based on their testing experience. The users will be given a survey after testing the application for its usability based on their satisfaction from strongly disagreeing to strongly agree. After that, the researchers will calculate the collected ratings and come up with a conclusion if the application is excellent or needs improvement.

Strongly Disagree = 1 point

Disagree = 2 points

Neutral = 3 points

Agree = 4 points

Strongly agree = 5 points

To calculate the total score:

$$X = \text{Sum of the points for all odd} - \text{numbered questions} - 5$$

$$Y = 25 - \text{Sum of the points for all even} - \text{numbered questions}$$

$$\text{SUS Final rating} = (X + Y) * 2.5$$

Table 3: SUS Adjective Rating

SUS SCORE	GRADE	ADJECTIVE RATING
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	F	Awful

System Usability Scale has 10 questions regarding the application, and it is formatted by the odd numbers being in a positive tone, and even numbers being in a negative tone.

There are a total of 39 respondents who have tried the PharmaGo application. With the location limitation, all chosen respondents that include the pharmacy, and the pharmacy owners are located inMabalacat, Pampanga. 34 of the respondents were able to impersonate a customer in ordering medicines, 2 delivery drivers, and 2 pharmacy owners handling their own pharmacy.

Computing for the average will be the SUM of the total scores divided by the total number of scores. In the table above, the total SUM is **2917.50** and dividing it by 34 is **85.81**.

The overall total response would return an adjective rating of **Excellent** with an average of **85.81**. This type of scoring method will be able to tell you if the system, whether it be an application, or a website will be usable in terms of its SUS results average. This shows how the usability or the functions in the applications were successful and satisfies the user. In using these results, the researchers will be able to determine if minor or major improvements should be done with the application.

The researchers also conducted a survey on the admin and delivery drivers. Getting the average of the total scores, the delivery driver has an average of **85.83** which translates into **Excellent** and the admin having **96.25** average rating that also indicates an **Excellent** rating.

5. Conclusion

Researchers were also able to propose and create an application that focuses on small and medium pharmacies. Respondents who are potential customers, pharmacies, and riders also have the chance to test PharmaGo to know their comments and suggestions with regards to the application. It was also tested to know their perception if PharmaGo will meet their standards. The researchers also conducted 3 types of testing that includes Functionality Testing, Usability Testing, and Compatibility Testing. As for the Functionality Testing, the researchers conducted an initial testing wherein out of 15 actions that are being

done, 2 actions are not working so it is considered as “Fail”. Accessing the Admin Order List together with the Shopping Cart are those actions that are considered “Fail”. As for the Final Testing that was conducted by the researchers, All of the actions that were tested are all functional. For the Compatibility Testing, the researchers tested PharmaGo applications with the Android Studio emulator together with different devices. The minimum SDK version for the testing is Android 7 and the target version in which the researchers achieved in testing is Android 11. Overall, PharmaGo has passed all the testing and requirements and has been found satisfactory as a pharmaceutical delivery mobile application.

6. Acknowledgment

The researchers cannot express enough thanks to the following people who had helped in the fulfillment of this project. The researchers’ parents, for their sincere love, understanding, sacrifices and support to the completion of the project. The pharmacy owners and respondents, for their trust and support by providing the researchers what they need for the whole duration of the study.

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