An Effectiveness Study of a Smart Institutional Parcel Management System Implemented at Politeknik Mukah

Chen Wong Keong[1], Bong Siaw Wee[2], Alice Supie anak Pila[3]

[1]Department of Mechanical Engineering, Politeknik Mukah, 96400 Mukah,Sarawak, Malaysia.
[2] Department of Electrical Engineering, Politeknik Mukah, 96400 Mukah,Sarawak, Malaysia.
[3]Unit of Communications and Corporate, Politeknik Mukah, 96400 Mukah,Sarawak, Malaysia.
Corresponding Author's Email: [1]chenwk2012@yahoo.com

ABSTRACT –. The institutional parcel management system is becoming increasingly vital for managing all staff packages received by operators at the front desk counter. Institutional parcel management has evolved significantly from a paper-based system to one that is digital and Internet of Things (IoT) enabled, with supported electronic applications. Previous research has resulted in the development of various solutions; however, all of these improvements have been designed for web-based parcel management systems. Available for free on smartphones, but does not support PC and smartphone applications. These systems do not fully utilise the barcode scanner which available in the smartphone for free and not support for both PC and smartphone applications. Therefore, a Smart Institutional Parcel Management System with QR Code Scanner Application has been proposed and developed to significantly support the management of parcel processes. This invention is simply utilised for barcode scanning on smartphones in both Android and iOS applications, and it is also compatible with PC view for front desk managers at institutions. This system is built by combining AppSheet, Spreadsheet, and Google Form technologies to create a simple and low-cost management solution. This method could be simply integrated with a smartphone and used with a phone scanner to easily enter the package tracking number and automatically send the message to receivers. This system has been implemented with 9500 proven of good tracking records and still implemented continuously.

KEYWORDS : Parcel Management System, QR Code Scanner Application, AppSheet, barcode scanning

1.0   INTRODUCTION

In recent years, the increasing complexity of institutional operations and the surge in parcel deliveries have necessitated the adoption of efficient parcel management systems within various organizations as shown in Figure 1. These systems play a crucial role in streamlining the receipt, storage, and distribution of parcels, thereby enhancing overall operational efficiency.

Figure 1. The Parcels are need properly management

There are some latest developments in parcel management systems have been developed by several researchers. Juanita Zainudin et al. have developed a Parcel Tracking System Using Barcode Scanner with Verified Notification. The development method of this

system uses PHP and JavaScript programming languages in Adobe Dreamweaver platform with MySQL programme as the backend of the system [1].

Nik Yasmin Nik Yusoff, and Norhanim Selamat have developed a student parcel management system in Kolej Matrikulasi Kelantan [2]. This is a web-based system to record all the parcel received by admin and collected by students. They adopted the Hypertext Preporcessor (PHP) and MySQL database for system development. Besides, Jainari has developed another web-based Sistem e-Pos for Universiti Malaysia Sabah (UMS) for staffs [3].

Wahab developed an e-parcel management system which is integrated with Global System for Mobile (GSM) networks [4]. Meanwhile, Soon developed a pre-notification parcel tracking system is created so that customers can obtain the latest host location using this system [5]. This paper aims to accomplish the objectives where the customer can obtain the latest host location by using the GPS service on Android devices.

From the above system development, all the innovations are developed for web-based parcel management systems. These systems do not fully utilise the barcode scanner which available in the smartphone for free and not support for both PC and smartphone applications. Therefore, a new Smart Institutional Parcel Management System Scanner with QR Code Scanner Application was proposed and developed as a new innovation project in this research.

Institutional parcel management system is becoming a very important system to manage all the staff parcels received by operators at the frontdesk counter. Institutional parcel management has gone through a very significant evolution from the beginning mainly paper based to become digital and Internet of Things (IoT) based with supported electronic applications. There are several system has been developed by previous researches, however all the previous innovations are developed for web-based parcel management systems. These systems do not fully utilise the barcode scanner which available in the smartphone for free and not support for both PC and smartphone applications. Therefore, a Smart Institutional Parcel Management System with QR Code Scanner Application has been proposed and developed to significantly support the management of parcel processes. This innovation is easily used in smartphone in both android and iOS applications for barcode scanning, and compatible with PC view as well by front desk administrators of institution.

2.0 METHODOLOGY

Smart Institutional Parcel Management System with QR Code Scanner Application development process involves five main phases adapted from the ADDIE Model. The ADDIE model stands for Analysis (A), Design (D), Development (D), Implementation (I), and Evaluation (E), as shown in Figure 2. The ADDIE model was developed in 1975 at Florida State University [6] – [8]. It was the first Instructional Design model created, and it became a hallmark of its time. It was used by practically all major educational and business institutions. The ADDIE model was chosen to develop this learning application because the design of the model emphasises repetition for each phase. Each phase is interconnected with the other. If the phase cannot be implemented well, the process can be repeated until it can be completed completely.
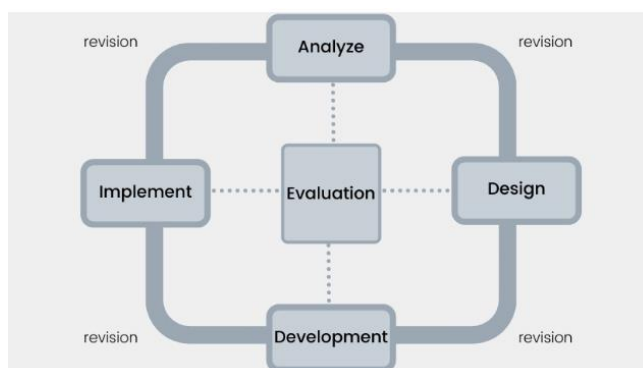

Figure 2. The iterative or circular version of ADDIE

The ADDIE Model is a five-phase approach for developing the Smart Institutional Parcel Management System with QR Code Scanner Application as shown below:-.

Stage 1: Analyse

    The instructional goals, target users, and required resources for develop the Smart Institutional Parcel Management System with QR Code Scanner Application

Stage 2: Design

    A learning solution that aligns objectives and strategies with instructional goals

Stage 3: Develop

    Learning resources, validate and revise drafts, and conduct pilot test

Stage 4: Implement

    The learning solution by preparing the learning space and engaging participants

Stage 5: Evaluate

    The quality of learning resources and how well they accomplish instructional goals

In this project, agile method was adopted to design and develop the smart Institutional Parcel Management System Scanner Application. The Agile methodology is a project management approach that involves breaking the project into phases and emphasizes continuous collaboration and improvement. Agile methodology is a software development approach characterized by its iterative and incremental nature, emphasizing flexibility, collaboration, and customer satisfaction. It aims to deliver high-quality software products efficiently by breaking down the development process into smaller, manageable iterations called "sprints." There are several advantages of agile methodology which include flexibility and adaptability, customer satisfaction, faster time to market, improved quality, increase collaboration and communication and better risk management.
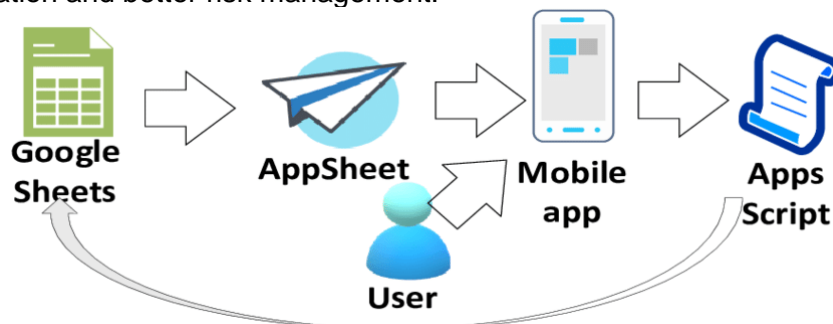

Figure 3. Mobile apps architecture-based AppSheet and Apps Script

The application development is done using Google Appsheet, which has been used to build powerful solutions in application that could simplify work with minimal coding requirements [9] – [10]. Figure 3 shows the Mobile apps architecture-based AppSheet and Apps Script. Besides, Google Spreadsheet and Google Form with addon have been used as database and receiver parcel collection form. Developing an Institutional Parcel Management System with Application using Google AppSheet involves several steps as below:-

    Step 1: Sign Up/Login to Google AppSheet account using the user Google credentials.

    Step 2: Create a New App: Once logged in, click on the "Create" button to start a new app.

    Step 3: Choose a Data Source: AppSheet supports various data sources including Google Sheets, Excel, SQL databases, and more. Choose the appropriate data source for this app.

    Step 4: Define Data Structure: Define the structure of the data within the chosen data source. For example, if using Google Sheets, create sheets and define columns.

    Step 5: Design the App: Use the AppSheet editor to design the user interface of this app. This involves specifying how data is displayed, forms for data entry, workflows, views, and navigation.

    Step 6: Add Functionality: Configure the behavior of this app by adding features such as actions, workflows, and automation. This could include things like adding buttons to perform specific actions, setting up notifications, or integrating with other services.

Step 7: Test the App: Use the built-in emulator to test this app's functionality. Make sure everything works as expected across different devices and screen sizes.

Design framework in Figure 4 shows the important parts of the system development. A smartphone application was developed for the front desk administration with several important buttons, include parcel scanner button, receiver records, stuff details and records of parcel collection. When the barcode of the parcel is scanned by administration, it will trigger an email and send automatically to the receiver as shown in Figure 5. Important information in the receiver emails include the parcel tracking number, receiver name, parcel collection form, and list of parcel receivers.
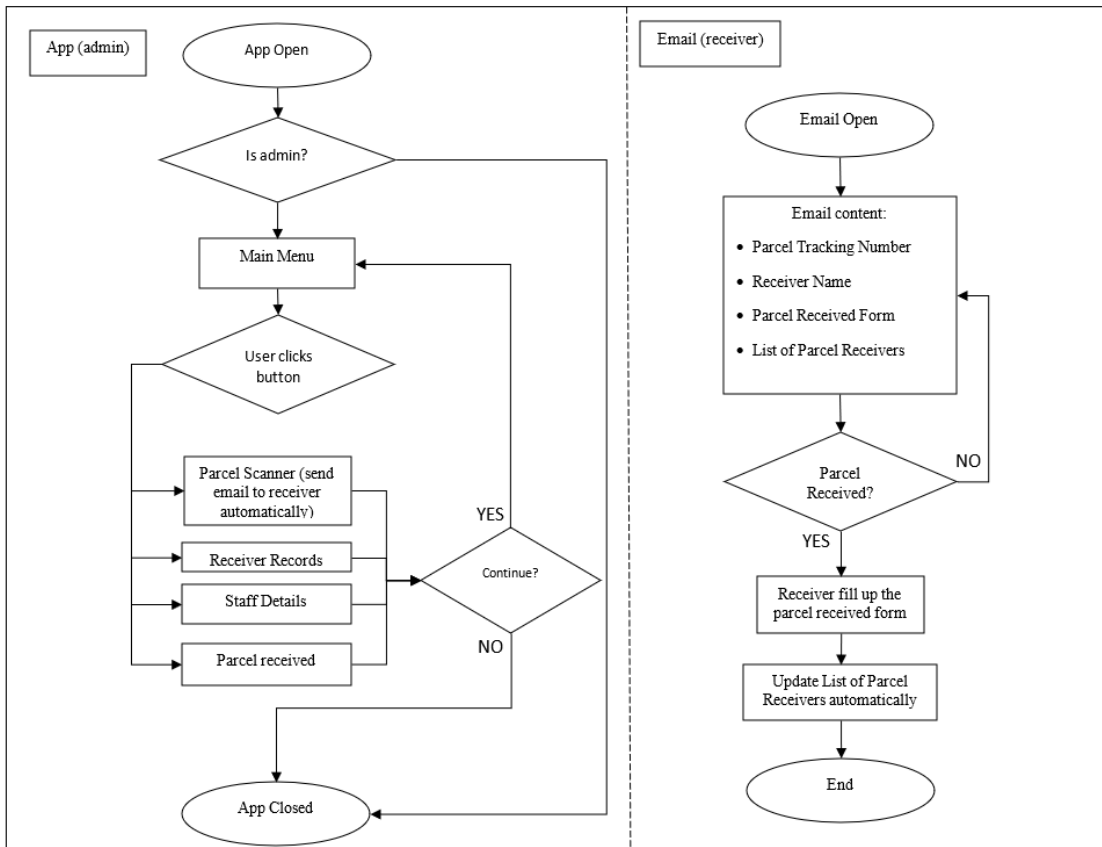
Figure 4. Design framework of Institutional Parcel Management System Scanner Application
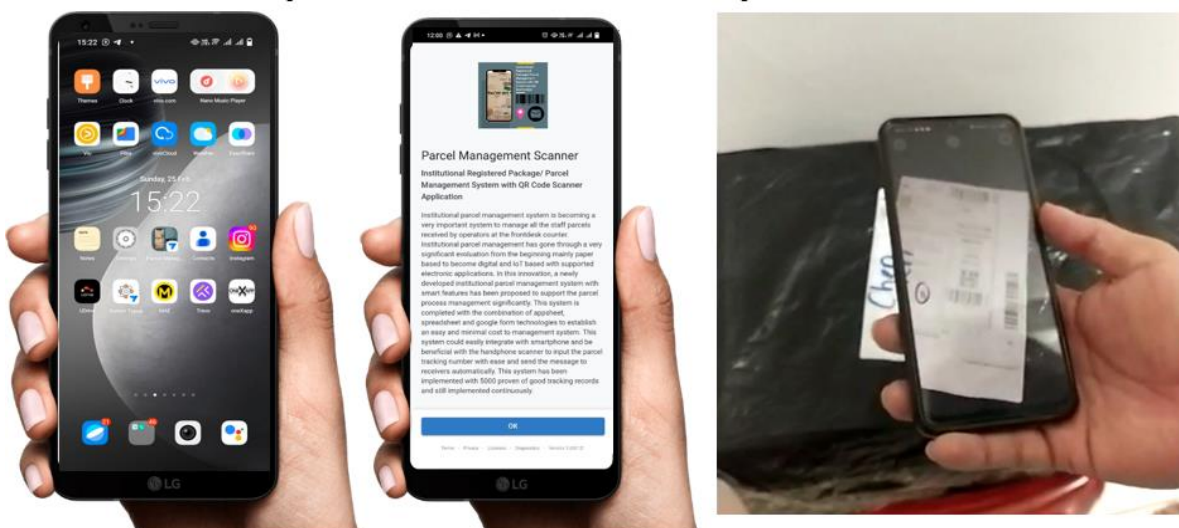
Figure 5. Scan the barcode of the parcel by using this Institutional Parcel Management System Scanner Application

3.0 RESULT
3.1 A Design of Institutional Parcel Management System Scanner Application

Figure 6 shows the Icon and link for Institutional Parcel Management System Scanner Application. Cover page for Parcel Management System Scanner App is shown in Figure 7.
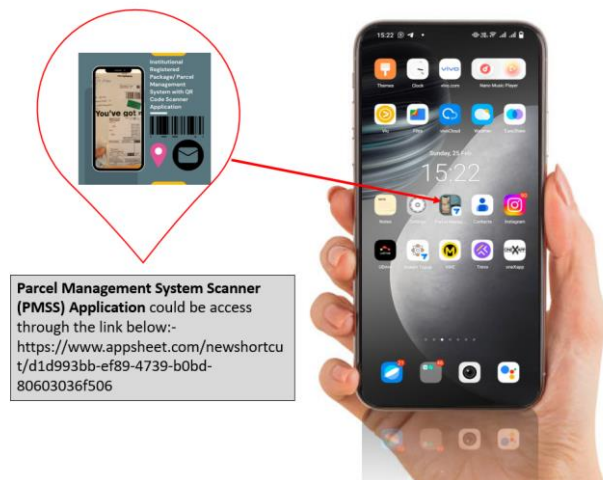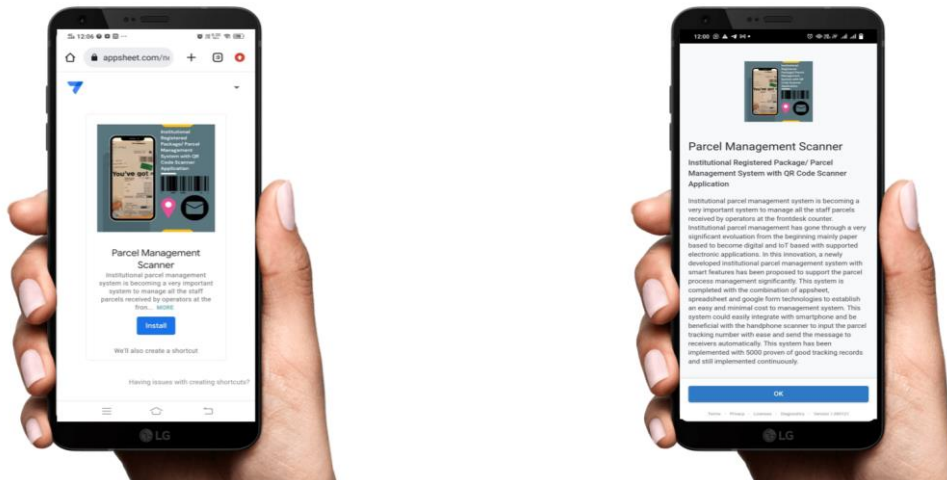

Figure 6. Icon and link for Institutional Parcel Management System Scanner Application

| (a) Install the Institutional Registered Package/ Parcel Management System with QR Code Scanner Application	(b) Introduction of Parcel Management System Scanner Application

Figure 7. Cover page for Parcel Management System Scanner App

Figure 8 shows the important buttons and interfaces of the smart Institutional Parcel Management System Scanner (PMSS) Application which are used by administration to record the all the parcels dropped at the front desk counter. This application has four important buttons which are parcel scanner, records, staff details, and list of collected parcels. Every time when administration received the parcels from parcel runners at font desk, admin could use this application to record the tracking number of the parcel by barcode scanner of the application, insert the receiver's name, and capture the picture of the parcel all using the application parcel scanning button and save the records as shown in Figure 8(f).
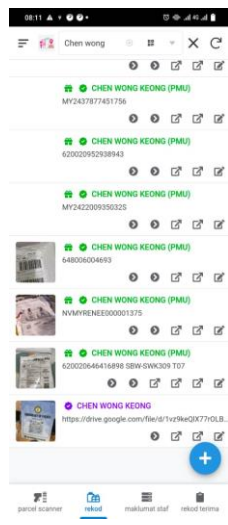
The parcel management system will send the notification via email to parcel receivers automatically later. The second application button as shown in Figure 8 (b), (c), (d) and (e) are

all the parcel records have been scanned by admin. From here, admin can easily search the parcel receiver, status of parcels and all the parcel details. The third button is the list of staff name with their email address and the fourth button is the list of parcels which have been collected and updated by receivers. All the data stored at google drive and could be accessed any time anywhere by admin.

The data is stored in google sheet, which is encrypted in-transit and at-rest. Google sheet provides services like spam filtering, virus detection, malware protection and the ability to search for files within individual account and process the content. Besides, Google respects user privacy. Google access user private content only when google have user permission or are required to by law. With the Google Transparency Report, google share data about how the policies and actions of governments and corporations affect privacy, security, and access to information.
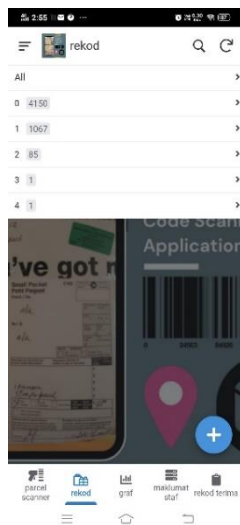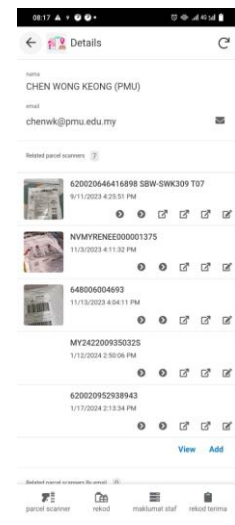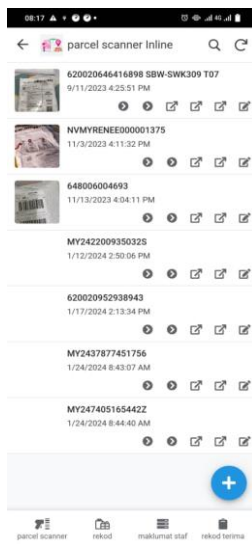

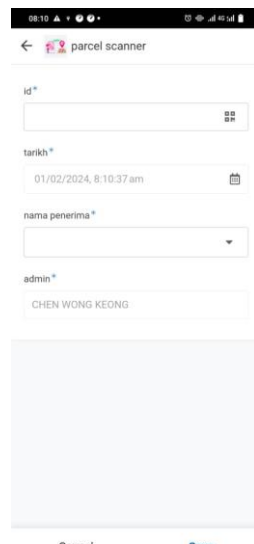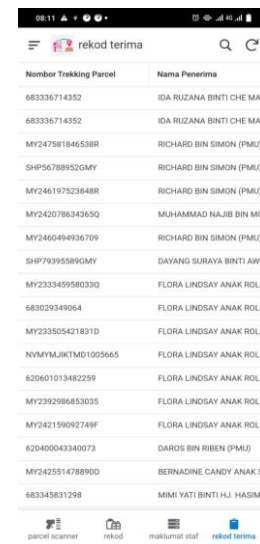| (a) Records of all parcels	(b) Search function by name of staff	(c) Details of parcel	(d) Example of record of parcels by name of staff
(e) All the records of parcels by name of staff	(f) Interface for scanning the parcel barcode tracking and name of receiver used by admin	(g) Database of staff and email	(h) Records of collected parcel
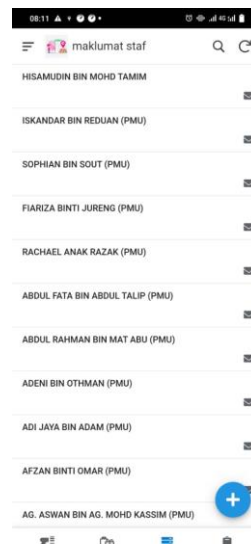
Figure 8. Important buttons and interfaces of the smart Institutional Parcel Management System Scanner Application for administration
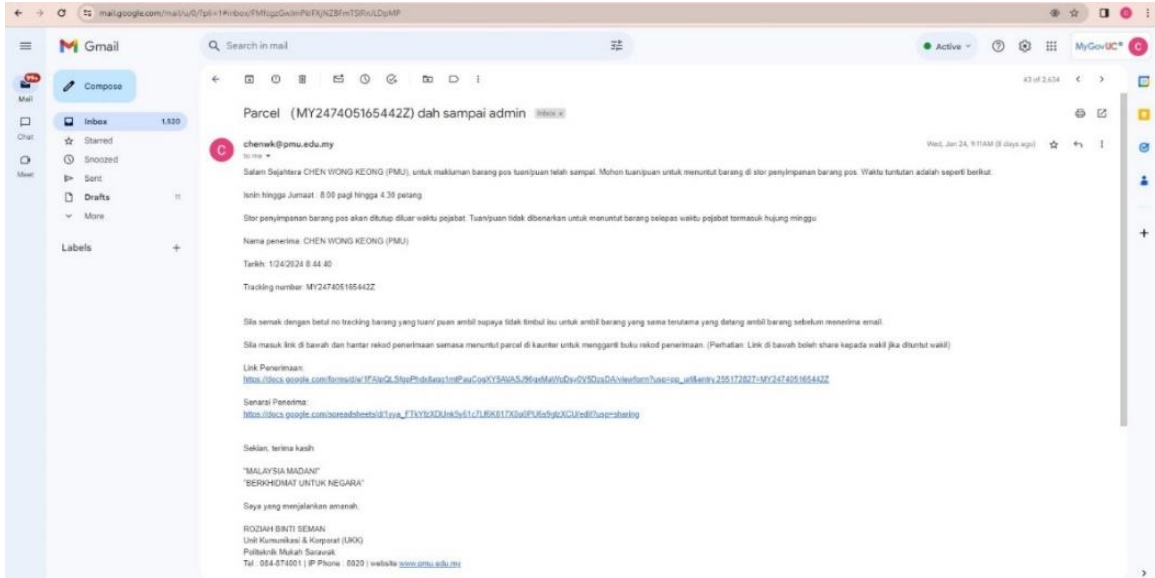
Figure 9. Automatic notification via email to parcel receivers after the details of the parcels are recorded to application by admin

Figure 9 shows one of the examples of automatic notification via email sent to parcel receiver. The content of email included with the details of parcel, parcel collected link (Figure 10) and link of receivers (to remind receivers update the link after parcels collected). Figure 11 shows the number of Recorded Parcel in this First Seven Months (August 2023 until May 2024).
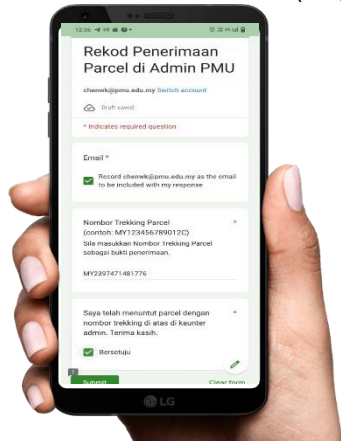

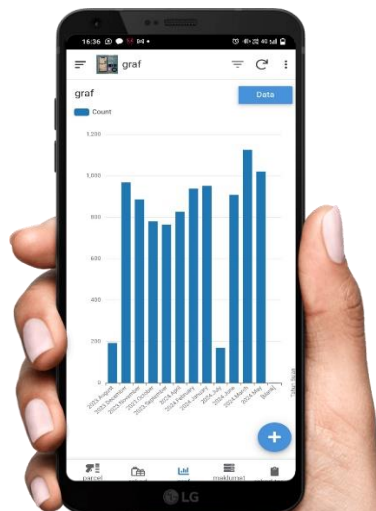**Figure 10.** Receivers have to update the parcel status after collected the parcels

Figure 11. Number of Recorded Parcel in this First Nine Months (August 2023 until May 2024)

3.2 Research Finding for the Effectiveness Study on Receivers of Smart Institutional Parcel Management System with QR Code Scanner Application in Politeknik Mukah

This effectiveness study has been successfully implemented to get feedback on receivers of Smart Institutional Parcel Management System with QR Code Scanner Application in Politeknik Mukah. A total of 70 staffs have conducted this study following different sections. This study is divided into two parts: Part I is the information of the staffs, Politeknik Mukah, and Part II is the content and design of the Smart Institutional Parcel Management System with QR Code Scanner Application. The Landell method was used to grade the mean score to 3 main criteria, as in Table 1. In this study, the researcher selected. The Landell method, due to the mean score range value for the best level (Good / Agree), is high at 3.80 - 5.00. This high mean score value gives reliable analysis results because the range for the score is high.

Table 1. Landell method

Score Landell	Comprehension / Acceptance Level
1.00 – 2.39	Unsatisfactory / Disagree
2.40 – 3.79	Moderate / Disagree
3.80 – 5.00	Good / Agree

Data for gender and working department for respondents are presented in pie charts as shown in Figure 12 and Figure 13. Table 2 shows the mean and standard deviation values for the Part II content and system design.
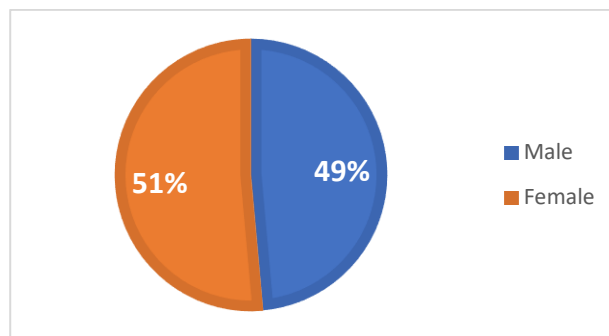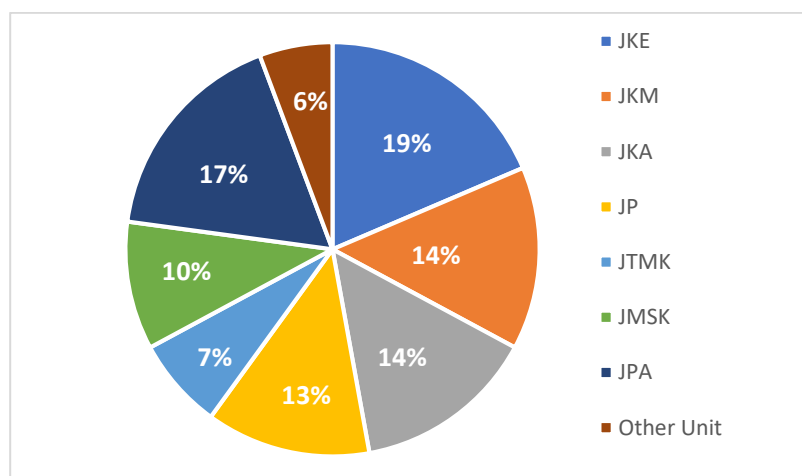

Figure 12. Gender of Respondents

Figure 13. Respondents Department

Table 2. Content and System Design

After using the Smart Institutional Parcel Management System with QR Code Scanner Application, I think…

	Content	Mean	Interpretation	Std. Deviation
1.	Parcels that arrive at admin can be quickly identified through a formal email notification in the parcel management system.	4.91	Good / Agree	0.2800
2.	The parcel management system provides a parcel acceptance form that is easy to fill out	4.77	Good / Agree	0.4199
3.	An efficient parcel management system allows parcels to be managed more safely.	4.96	Good / Agree	0.2026
4.	The parcel management system supports paperless efforts and is more environmentally friendly.	4.94	Good / Agree	0.2321
5.	The parcel management system managed my parcel efficiently and did not drop out	4.87	Good / Agree	0.4113
	Overall Average Mean:	4.89	Good / Agree	

3.3 Research Finding for the Effectiveness Study on Admin Users of Smart Institutional Parcel Management System with QR Code Scanner Application in Politeknik Mukah

This effectiveness study has been successfully implemented to get feedback on admin users of Smart Institutional Parcel Management System with QR Code Scanner Application in Politeknik Mukah. A total of 2 staffs have conducted this study following different sections. This study is divided into two parts: Part I is the information of the staffs, Politeknik Mukah, and Part II is the content of the Smart Institutional Parcel Management System with QR Code Scanner Application as shown in Table 3.

Table 3. Content

After using the Smart Institutional Parcel Management System with QR Code Scanner Application, I think…

	Content	Mean	Interpretation
1.	Smart barcode scanner in parcel management simplify parcel record work.	5.00	Good / Agree
2.	Automatic email notification to recipients makes work easier and improves effectiveness of message delivery.	5.00	Good / Agree
3.	Smart barcode scanner application provides an easy search button to track parcel records by receiver.	5.00	Good / Agree
4.	The application can save pictures on Google drive which saves phone storage space efficiently.	5.00	Good / Agree
5.	Smart barcode scanner in parcel management simplify parcel record work.	5.00	Good / Agree
	Overall Average Mean:	5.00	Good / Agree

Smart Institutional Parcel Management System with QR Code Scanner Application was implemented in Politeknik Mukah starting from August 2023 until now. This system has been implemented with 9500 proven of good tracking records and still implemented continuously. Hence, this innovation project will increase the security and efficiency of parcel management at organisations and institutions.

There are several advantages of an Institutional Registered Package/ Parcel Management System with QR Code Scanner Application which include:-

i. Save manpower and time
ii. Reduce the use of raw materials, cost savings, and environmentally friendly.
iii. Can access the app at anywhere and at any time
iv. Flexibility and adaptability
v. customer satisfaction
vi. improved quality, increase collaboration and communication

4.0 CONCLUSION

In conclusion, the objective of developing a smart institutional parcel management system with handphone application has been implemented successfully. This system has recorded 9500 data with the number of data will be growing day by day and all the parcels have been collected by receiver successfully. This system was developed based on latest technology such as Google AppSheet, google spreadsheet and google form with addon. Admins have used this system easily and notification will be sent to receivers automatically. This system could be expended for the application of students parcel management in institutions in future. Email notification can be further details with the number of locker/ rack for easy tracking when receiver come to collect the parcel.

REFERENCES

[1] J. Zainudin, H. Samad, F. Miserom and S. Sabri. "Parcel Tracking System Using Barcode Scanner with Verified Notification." In *IOP Conference Series: Materials Science and Engineering*, vol. 1062, no. 1, pp.1-10, 2021. https://iopscience.iop.org/article/10.1088/1757-899X/1062/1/012039/pdf

[2] N. Y. N. Yusoff and N. Selamat. "Pembangunan Sistem Pengurusan Bungkusan Pelajar: Student Parcel Management System." *Applied Information Technology And Computer Science* 4, no. 1, pp. 824-841, 2023. https://publisher.uthm.edu.my/periodicals/index.php/aitcs/article/view/7451

[3] M. H. Jainari. (2021). "Manual Pengguna E-Pos", ums.edu.my. [Online]. Available: https://www.ums.edu.my/v5/files/2017/Manual-Pengguna-E-Pos. [Accessed: 07- January- 2024]. https://www.ums.edu.my/v5/files/2017/MANUAL-PENGGUNA-E-POS.pdf

[4] M. H. A. Wahab, D. M. Nor, A. A. Mutalib, A. Johari and R. Sanudin. "Development of integrated e-parcel management system with GSM network." In *Proceedings of the 2nd International Conference on Interaction Sciences: Information Technology, Culture and Human*, 2009, pp. 1081-1085. https://dl.acm.org/doi/abs/10.1145/1655925.1656121

[5] K. Kim and J. H. Kim. "A Development of an Low Cost Smart Parcel Service System with Enhanced Security." *Journal of Convergence for Information Technology* 8, no. 6, pp.193-199, 2018. https://koreascience.kr/article/JAKO201809258120268.page

[6] N. Dwitiyanti, S. A. Kumala and F. Widiyatun. "Using the ADDIE model in development of physics unit convertion application based on Android as learning media." *Formatif: Jurnal Ilmiah Pendidikan MIPA* 10, no. 2, pp. 125-132, 2020. https://journal.lppmunindra.ac.id/index.php/Formatif/index

[7] A. M. Almelhi. "Effectiveness of the ADDIE model within an E-learning environment in developing creative writing in EFL students." *English Language Teaching* 14, no. 2, pp. 20-36, 2021. https://eric.ed.gov/?id=EJ1284437

[8] H. R. Saeidnia, M. Ausloos, Z. Mohammadzadeh, A. Babajani and M. Hassanzadhh. "Mobile-based self-care application for COVID-19: Development process using the ADDIE model." In *Informatics and Technology in Clinical Care and Public Health*, IOS Press, pp. 110-113. 2022. https://ebooks.iospress.nl/doi/10.3233/SHTI210871

[9] C. W. Keong, B. S. Wee and L. A. Rigos, L., "Design and Development of Smart Asset Handphone Scanner Application," *JKTSS*, 57, pp. 26, 2023. https://www.puo.edu.my/webportal/wp-content/uploads/2023/10/FULL-PAPER-JKTSS-VOL-9-ISSUE-1.pdf#page=30

[10] D. Ringgau, C. W. Keong and B. S. Wee, "Development of To-Do List and Monetary Management System," *International ABEC*, 2021, pp.90-97. https://abecindonesia.org/iabec/index.php/iabec/article/view/4