DESIGN AND DEVELOPMENT OF SMART ASSET HANDPHONE SCANNER APPLICATION

Chen Wong Keong[1], Bong Siaw Wee[2] and Len bin Annuar Rigos[3]

[1,3]Department of Mechanical Engineering, Politeknik Mukah, Malaysia
[2]Department of Electrical Engineering, Politeknik Mukah, Malaysia
[1]chenwk2012@yahoo.com
[2]shaweibong2016@gmail.com
[3]len@pmu.edu.my

ARTICLE INFO

Article history:
Received
10 April 2023
Received in revised form
20 May 2023
Accepted
10 June 2023
Published online
10 July 2023

***Keywords**:*
Asset Management System; Asset Scanner; SWOT AnalysiS

ABSTRACT

Web-based Asset Management System is a centralized asset recording system practiced by many institutions. However, this system does not have smart features in line with the development of smartphone technology, such as bar code scanning, direct contact to asset owners, and fast asset tracking. Furthermore, this system is also not suitable for the use of small-sized smartphone displays. Therefore, Smart Asset Handphone Scanner (SAHS) Application was proposed and developed as an innovation project for helping asset coordinator and workshop/laboratory supervisor to perform asset tracking with ease. SAHS Application has its own database, and this application is developed using Google Appsheet and Google spreadsheet. This application is secured with google security and all the users have been validated. As a result, the smart asset handphone scanner can increase the efficiency of asset inspection process, inspection reporting process, asset monitoring process, and asset tracking. On the other hand, this scanner is also able to increase the clarity and visibility of asset status report with interactive graphs and symbol displays, and minimal cost of the application development and data maintenance. Smart asset handphone scanner also is a smart phone-based application without involve the purchase of additional equipment. This application can be used in offline or online mode. The results of the study show that the developed innovation scanner application can help asset coordinators and workshop/laboratory supervisors to manage and track all assets in the workshop or laboratory in a good and orderly manner. The contribution of this study is this application could also be used by all staff to track the details of all assets and indirectly to nurture the culture of taking good care of assets become the responsibility of all staffs.

1. Introduction

Asset management is an important topic to discuss and comprehend in order a good and efficient asset management could be implemented without failure within an organization. Since the advance of technologies, many proposed methods have been implemented in this process.

Different methods exist for the tracking of assets that range from traditional approaches such as using pen and paper to digital technologies such as barcodes, QR codes, and RFID (Jose et al., 2022a). The traditional approach involves relying on pen and paper to track company assets. Lack of proper and scalable organizational ability leads to wasted time searching for records and instant information exchange is difficult using this approach. Additionally, transparency among the project participants is difficult to keep up, due to the fragmentation of information. Lately, some of the researchers, Elaskari et al.(2021), Aliuddin et al. (2022) and Jose et al. (2022) use of barcodes to track the student attendance and assets in higher education institution in real time manner. Besides, QR code has become more favorite choice of other researchers Sulistyo et al. (2022), Fajriyah et al. (2022) and Wang et al. (2021) used for asset tracking in industries and higher learning institutions. Digital tracking methods speed up the data transfer process through technology and are often used in combination with mobile devices. Using a barcode to track assets, for example, avoids many of the issues in connection to human errors that come with spreadsheets and manual tracking methods.

Multiple types of sensors and tracking technologies exist, including barcodes, QR codes, active RFID, passive RFID, Bluetooth low energy (BLE) devices, and near-field communication (NFC) devices. The requirements for tracing systems of building components is shown in Table 1 (Iluore et al., 2020, Varshney et al., 2020).

Table 1: Requirements for tracing systems of building components

Requirements	Barcode	OR-Code	RFID-Active	RFID-Passive	BLE	NFC
Reduction of human error	/	/	/	/	/	/
Line-of-sight range	Low	Low	High	Low	Moderate	Very low
Automatic Identification	x	x	/	/	/	(/)
Simultaneous Identification	(/)	(/)	/	/	/	(/)
Wireless data Transfer	/	/	/	/	/	/
Analysis of movement patterns	x	x	/	x	/	x
Real-time location tracking	x	x	/	x	/	x
Two-way communication	x	x	x	x	/	/
Ease of Application	High	Very High	Moderate	High	Moderate	Moderate
Relative cost of implementation	Very low	Very low	Very high	Low	High	Very high

A spreadsheet-based asset tracking system offers some benefits over using pen and paper. Spreadsheet files are available to multiple users and there is no need for searching of the physical location of your asset records. However, due to manual data entry, spreadsheets are prone to error, and it is difficult for

multiple team members to access and update the files simultaneously.

In this project, a new application development platform was proposed with using the spreadsheet as the main database for recording and keeping all the data while overcoming some of inefficiencies of traditional spreadsheet-based asset tracking system. The named development platform is Google Appsheet. This Smart Asset Handphone Scanner (SAHS) Application was proposed and developed as an innovation project for helping asset coordinator and workshop/laboratory supervisor to perform asset tracking with ease. This application was developed based on several design requirement considerations and user experience is one of the priorities.

SAHS Application has its own database, and this application is developed using Google Appsheet and Google spreadsheet. This application is secured with google security and all the users have been validated. As a result, the smart asset scanner is able to increase the efficiency of asset inspection process, inspection reporting process, asset monitoring process, and asset tracking. On the other hand, this scanner is also able to increase the clarity and visibility of asset status report with interactive graphs and symbol displays, and minimal cost of the application development and data maintenance. Smart asset scanner also is a smart phone-based without involve the purchase of additional equipment for this application. The results of the study show that the developed innovation scanner application can help asset coordinators and workshop/laboratory supervisors to manage and track all assets in the workshop or laboratory in a good and orderly manner.

2. Methodology

Handphone application development basically can be divided into three methodologies, there are waterfall method, rapid application development (RAD) method, and agile approach. In this application, rapid application development (RAD) is selected as the main methodology because of its flexibility to produce a working version of the application as quickly as possible, and then to continuously finetune the application. RAD is willing to change or upgrade the application that is suited to the needs of the user. Following is the detailed explanation of the rapid application development approach provided(Diana et al., 2021).

A new Google account was created for this purpose. Google spreadsheets® were used to design the data tables and were linked to AppSheet® software to generate the graphical user interface of the mobile app of the database. Appearance and features of the App were designed through options provided by the AppSheet® .

Smart asset handphone scanner was developed based on several predetermined design requirements as shown below:

i. Increase the efficiency of asset inspection process.
ii. Increase the efficiency of asset inspection reporting process.
iii. Increase the efficiency of asset monitoring process.
iv. Increase the efficiency of asset tracking.
v. Increase the clarity and visibility of asset status report with interactive graphs and symbol displays.
vi. Minimal cost of the application development
vii. Minimal cost of the application data maintenance
viii. Smart asset scanner is smart phone-based without involve the purchase of additional equipment for this application.

Besides, SWOT analysis is a strategic planning and strategic management technique used to help a person or organization identify Strengths, Weaknesses, Opportunities, and Threats related to business competition or project planning. Table 2 shows the SWOT analysis has been done on the Smart Asset Handphone Scanner (SAHS) Application. From this analysis, it determines the level of SAHS applicable readiness in STRENGTH, grab the advantage provided by OPPORTUNITIES, identify the main WEAKNESS and foresee the THREAT. SWOT analysis on the proposed smart asset handphone scanner is shown in Table 2.

Table 2: SWOT analysis on the proposed smart asset scanner

STRENGTH	**WEAKNESS**
i. Every supervisor and asset officer has their own Smartphone. ii. Institute owns a good integrated google suite system. iii. The institution has its own institutional google domain. iv. Having a SPA system that is easy to manage asset records. v. Can use this smart scanner to access asset information even if there is no internet network. vi. Has a good security system from google platform. vii. Coordinators and officers have high skills in handling the application. viii. The smartphone is equipped with QR code and barcode scanning function.	Could not update the asset status to the database in cloud when there is no internet. But could be saved in local smartphones and will automatically update to database once internet coverage is available.
OPPORTUNITIES	**THREAT**
i. Government supports and encourage every innovation efforts that can improve the productivity of institutions. ii. This innovation has the potential to compete at the national level and get good recognition. iii. The SPA system is an integrated system used by most ministries. iv. Has a high chance of being applied to other institutions. v. Simple and effective barcode printing. vi. There are many application platforms that can facilitate the development of applications effectively.	Technology is evolving rapidly, and it is likely that smartphones will be replaced by more sophisticated devices in future.

The flow chart shows the main process in asset inspection and asset tracking as shown in Figure 1. This process starts with scanning the bar code using handphone, and the contents of the bar code will be detected and match with the asset records in database. Based on the bar code, the system could determine the owner of the assets and if the user is the owner of the asset, he/she can further update the asset status through the application. The system will work on and update all checking records as checked or unchecked asset lists. Besides, important information will be generated automatically by the system, such as monthly asset inspection list, list of assets that require maintenance, list of assets based on location, by inspector, by frequency of inspection and all this data could be displayed in an interactive graph.

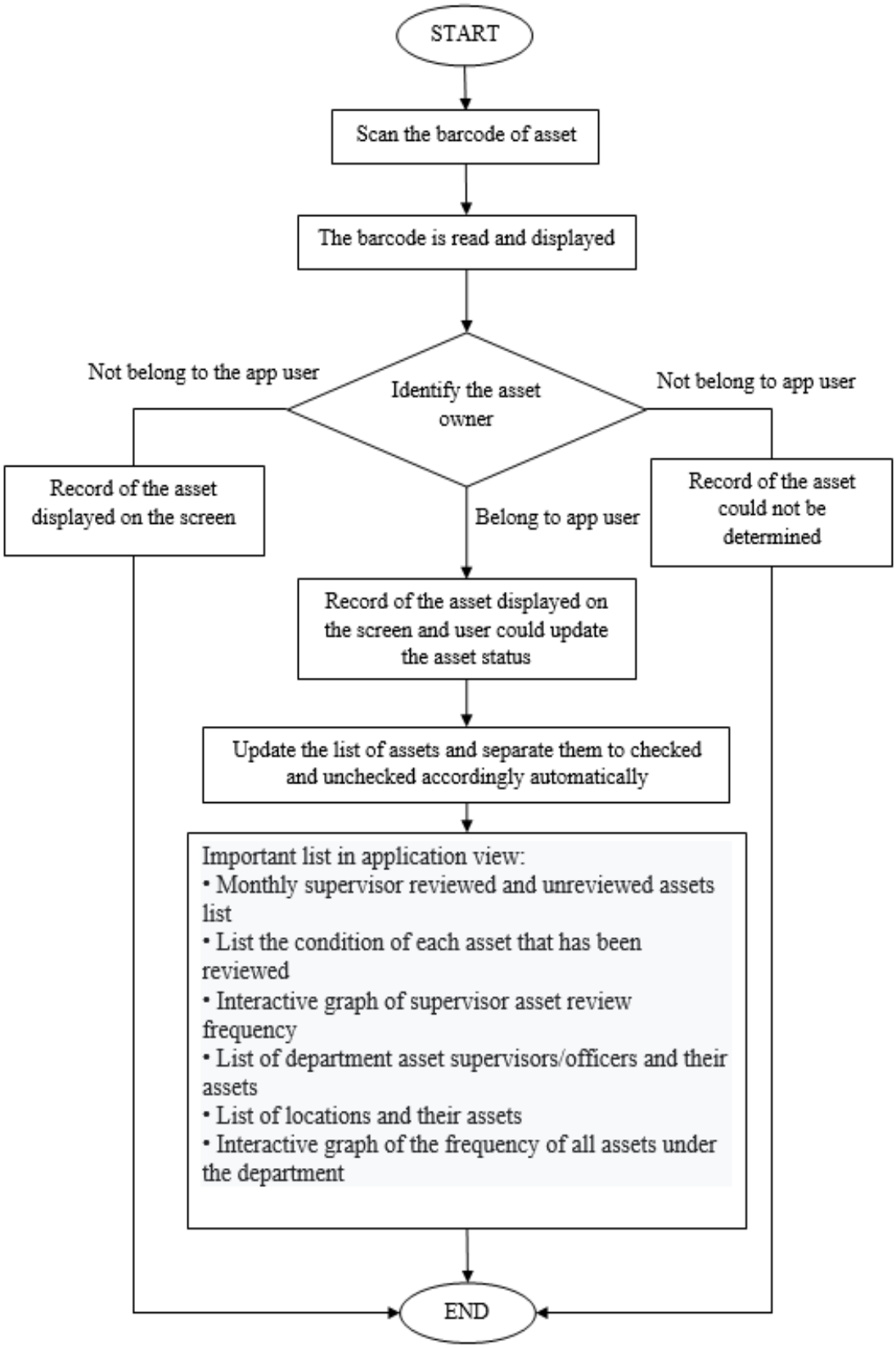

Figure 1: Flow chart for the proposed system

3. Results and Analysis

In this section, the interface of the completed SAHS will be shown and explained. Figure 2 shows the interface of SAHS with three main buttons at the bottom, which are scan asset barcode, status of asset under coordinator supervision, status of asset in the whole department.

When user press on the first button, this application will create a new form for the user to input the asset code by either key-in or scan the barcode & QR code as shown in Figure 3, Figure 4 and Figure 5. The asset details will be displayed in the application when the asset code is matched with the database. The details of the asset will be displayed, such as asset location, name of asset, asset coordinator name and asset coordinator contact number. This information is important for tracking the asset easily and could identify the authorized person for this asset. Besides, coordinator could update the status of the asset by either stating this asset is still used, asset is down, asset under maintenance and so on. Overall, the first button is important for asset tracking and status update.

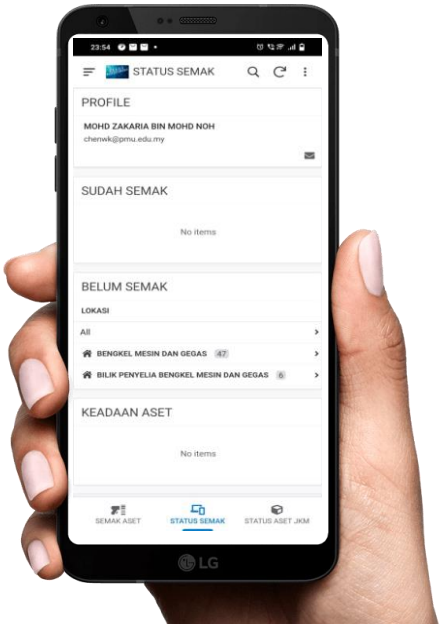

Figure 2: The interface of smart asset handphone scanner with three main buttons

Figure 3: The developed application is able to scan current asset barcode sticker in the institution

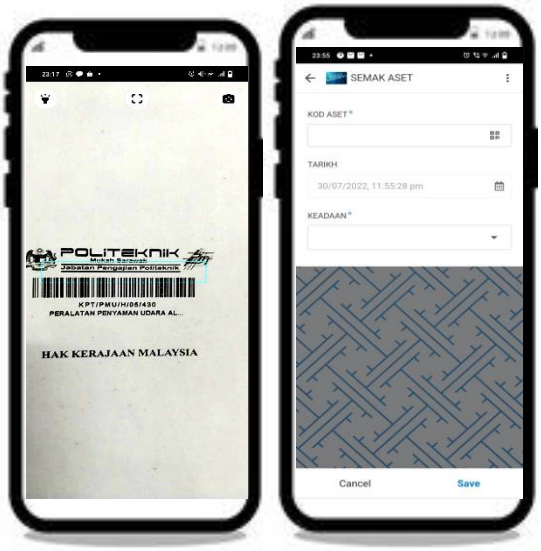

Figure 4: The application tracks the asset details through handphone scanner by scanning the barcode

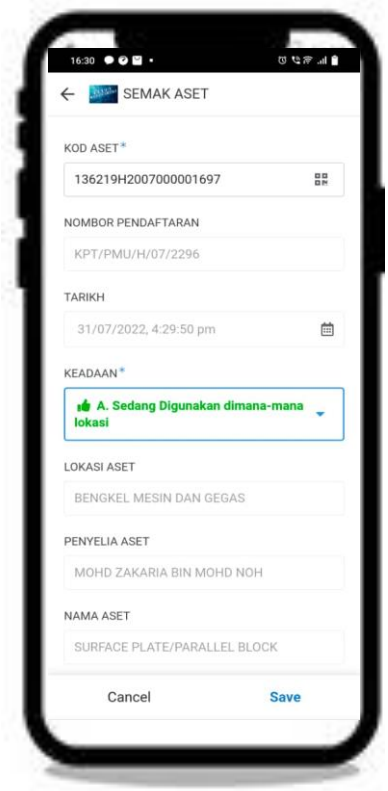

Figure 5: The application could tracks the asset details through handphone and used to update the asset status with ease

The second button shows the status of the assets in detail under the supervision of coordination. From this button, coordinator could easily identify status of asset either have been updated or not. Meanwhile, the third button shows the status of all the assets under the department which are updated or not as shown in Figure 6. Besides, asset status reports are equipped with interactive graphs and symbol displays to increase clarity and visibility. Figure 7 shows the details of record for one of the assets.

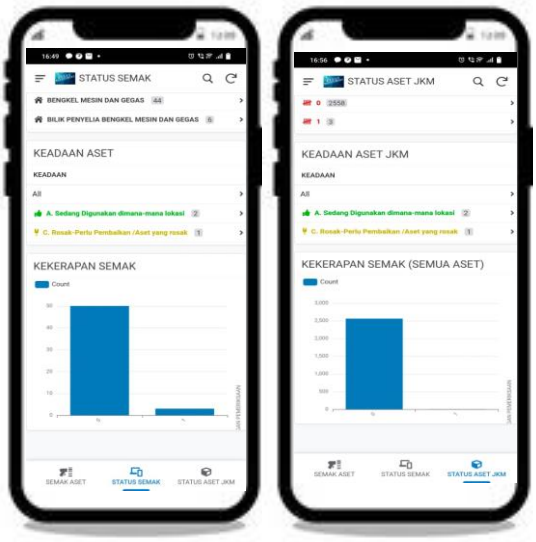

Figure 6: Increase the clarity and visibility of asset status report with interactive graphs and symbol displays

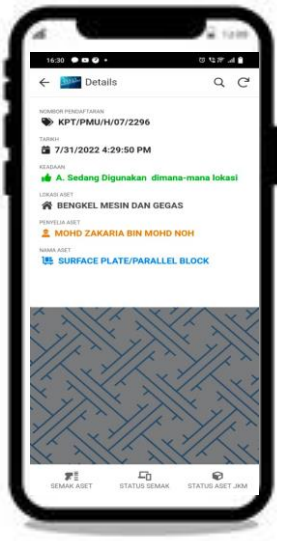

Figure 7: Details of asset status records

Table 3 shows a comparison between web-based asset management system and smart asset handphone scanner. From this, can be concluded, smart asset handphone scanner equipped with several features which have more advantages, such as barcode/ QR code reading, attractive user interface, interactive summary graph display, ease of asset tracking and save budget from purchasing scanner.

Table 3: A comparison between web-based asset management system with Smart Asset Handphone Scanner

	Web-Based Asset Management System	**Smart Asset Handphone Scanner**
Barcode/ QR Code scanning by smartphone	No	Yes
Good user interface for smartphone	No	Yes
Interactive summary graphs display	No	Yes
No extra purchase of additional equipment	No	Yes
Ease of asset tracking	No	Yes
Minimal cost of system development	No	Yes

4. Conclusion

In conclusion, this smart asset handphone application has been developed successfully for helping the asset coordinators in asset inspection, asset tracking and monitoring. This application is developed with minimal cost which uses google spreadsheet as the main database storage while Appsheet as application development platform. This application could be accessed by all the academic staff and making the asset supervision become the responsibility of each of them. For further applications, this smart handphone scanner could be used for other applications in preparing a more sustainable E-campus.

References

Aliuddin, S. M., Anwaruddin, M., & Mehreen, S. (2022). Asset Tracking Solution Based On Iot. *International Journal of Scientific Research & Engineering Trends*, *8*(5), 2023–2028. https://ijsret.com/wp-content/uploads/2022/09/IJSRET_V8_issue5_477.pdf

Diana, A. R., Chen, W., & BOng, S. (2021). Development of To-Do List and Monetary Management System. *International Applied Business and Engineering Conference*. https://www.appsheet.com/

Elaskari, S., Imran, M., Elaskri, A., & Almasoudi, A. (2021). Using barcode to track student attendance and assets in higher education institutions. *Procedia Computer Science*, *184*, 226–233. https://doi.org/10.1016/j.procs.2021.04.005

Fajriyah, R. F., Tyas, F. A., & Basir Azhar. (2022). Aplikasi Labeling dan Tracking Aset Menggunakan QR Code Berbasis Web Di STMIK MPB. *Jurnal Teknik Informatika Dan Sistem Informasi(JURTISI)*, *2*(1), 34–40. https://jurtisi.stmikmpb.ac.id/index.php/jurtisi/article/view/26

Iluore, O. E., Mamudu Onose, A., & Emetere, M. (2020). Development of asset management model using real-time equipment monitoring (RTEM): case study of an industrial company. *Cogent Business and Management*, *7*(1). https://doi.org/10.1080/23311975.2020.1763649

Jose, G. J., PrasannaVenkatesan, S., & Kumanan, S. (2022a). Real time asset tracking in field services using barcode system: a case study. *International Journal of Services Operations and Informatics*, *12*(1), 40–57. https://doi.org/10.1504/IJSOI.2022.123561

Jose, G. J., PrasannaVenkatesan, S., & Kumanan, S. (2022b). Real time asset tracking in field services using barcode system: a case study. *International Journal of Services Operations and Informatics*, *12*(1), 40–57. https://doi.org/10.1504/IJSOI.2022.123561

Sulistyo, T., Achmad, K., & Purnama, I. B. I. (2022). The Asset Management and Tracking System for Technical and Vocational Education and Training (TVET) Institution Based on Ubiquitous Computing. *ComTech: Computer, Mathematics and Engineering Applications*, *13*(1), 23–34. https://doi.org/10.21512/comtech.v13i1.7342

Varshney, P., Saini, H., & Erickson, V. L. (2020). Real-time Asset Management and Localization with Machine Learning and Bluetooth Low Energy Tags. *Proceedings - 2020 International Conference on Computational Science and Computational Intelligence, CSCI 2020*, 1120–1125. https://doi.org/10.1109/CSCI51800.2020.00208

Wang, Z., Pei, H., Zhang, X., Wang, C., Chen, X., & Zhou, T. (2021). Application of KKS Coding and QR Code Technology in Transmission Asset Management. *2021 IEEE 2nd China International Youth Conference on Electrical Engineering, CIYCEE 2021*. https://doi.org/10.1109/CIYCEE53554.2021.9676758