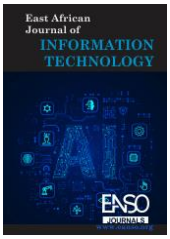

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Original Article

Mobile Application for Enhancing Revenue Collections in Local Government Authorities. A Case of Tanzania

Elia Njogela[1], Dr. Juma Ally, PhD[1], Beston Lufyagila[1] & Francis Ruambo[1]*

[1] Mbeya University of Science and Technology, P. O. Box 131, Mbeya, Tanzania.
* Correspondence ORCID ID: https://orcid.org/0000-0002-3007-2545; email: enjogela15@gmail.com.

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Fake Receipt, Local Government Authorities (LGAs), Mobile Application, Point of Sale (POS), Quick Response (QR) Code)

ABSTRACT

Point of Sale terminals play a significant role in revenue collection and have become rampant to Tanzanian Local Government Authorities. Point of Sale systems monitors cash flow, transactions, and price control while reducing human error and managing staff, customers, and inventory. However, Point of Sale systems are vulnerable to fake receipts, thus reducing revenue collections among Local Government Authorities. The cross-sectional Design was used to facilitate knowledge for the subsequent data collection. Data were collected from 300 respondents in Mbeya and Songwe regions using purposive and simple random sampling. 70% of respondents reported that fake receipt is the major factor affecting revenue collection, followed by lack of training (20%) and security (8%). In this study, we propose a mobile-based solution to enhance revenue collection in Local Government Authorities by addressing major factors affecting revenue collection. The developed mobile application was evaluated and validated; Whereby the results confirm that the designed tool is effective against money fraud, transaction errors, human errors, and defaulters with minimal resource usage. Hence, the designed mobile application can be applied as an auditing tool to reduce money fraud and increase revenue collection for the Local Government Authorities.

APA CITATION

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INTRODUCTION

The Point of Sale (POS) systems have grown from a simple cash register to a wide-ranging suite of business tools and are now considered the core tools of the payment systems of various businesses [1]. POS systems are widely applied to facilitate payment transactions in various sectors, such as Local government authorities (LGAs) and retailers. From 2022 to 2025, the market for POS systems is expected to increase at an average yearly rate of 9.9% and reach USD 116 billion [2]. It is projected that by the end of 2022, the value of daily mobile money transactions globally, including POS transactions, will exceed USD 3 billion [3]. In POS, based on various features, as explained in [4], business payment transactions are facilitated through an appropriate mobile application that acts as an entry between a user and a service provider.

Tanzanian LGAs, like many other developing countries, have adopted POS as a mechanism for effectively and honestly collecting revenues. However, adopting POS systems as a payment mechanism in LGAs poses many factors that hinder effective revenue collection, including money fraud caused by fake receipts, POS malfunctions, and inadequate training for POS users [5]. For instance, money fraud through tax evasion has become a critical problem in LGAs due to poor monitoring of POS transactions. Fake receipts can be generated in various ways. The primary means of generating fake receipts is by putting POS devices offline, and all data in the cache is cleared. In this regard, LGAs lose revenue collections because of a lack of effective mechanisms [6]. Such assaults should be considered when designing a mobile application for enhancing revenue collections using devices.

Currently, POS users in Tanzania LGAs are required to verify revenue transactions manually by just checking the receipts to see whether one has paid tax or not. Notably, the receipts generated have no features to verify fake receipts and are prone to forgery, hence the loss of revenue [7]. Handling receipts through manual checks is cumbersome and prone to errors [8]. As was already noted, the issue might have severe repercussions and cause a significant loss of revenue collections [9]. In this regard, developing a mobile application to verify fake receipt information is necessary to conserve human resources, increase job efficiency, and decrease human errors, enhancing revenue collection utilising POS. The proposed system will enhance revenue collections by verifying fake receipts and prompting POS users to be connected to the internet before clearing the cache. Therefore, data stored while offline will be sent to the server before being deleted.

Previous related research focused on risk [10], Design and implementation [11], limited network coverage, limited internet services, and limited customer response [12]. Other studies focused on security protocols for POS mobile application [13], [14], and [15]. Some researchers address automation issues in revenue collections using POS mobile applications in LGAs. However, there is a significant disparity in the literature regarding enhancing revenue collections using mobile applications in LGAs. The reason could be the LGAs' unique characteristics. In this regard, we propose an effective mechanism to enhance revenue collections by developing a mobile application prototype for tracking and verifying fake receipts. The application also includes a Quick Response (QR) code feature that verifies valid and invalid receipts of POS transactions. QR Codes are

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information concealed in a dotted image, and they have low cost and ease of production [16] as well as the willingness of users to look for it, making QR code an effective tool against cyber criminals [17], [18].

Furthermore, the designed tool acts as a backup and auditing tool for financial transactions. The developed application works in real-time and suffices the objective of this study. Specifically, the study seeks to answer the following research questions; (i) What are the major factors facing revenue collection in LGAs? (ii) How can a mobile application be developed to enhance revenue collection in LGAs?

LITERATURE REVIEW

This section covers related works mechanisms based on the mobile application to for enhancing revenue collections in LGAs as follows:

The study by [19] aided the development of a Local Government Revenue Collection Information System (LGRCIS) mobile application for Android-based smartphones and smart POS machines. The system aimed to apply digitalisation and automate the manual revenue collection system in LGAs. The LGRCIS mobile application contributes to increased revenue collection in LGAs by improving gross revenue. Also, the system covers more revenue collection sites and net revenue by lowering revenue collection administrative costs. The system enables LGAs to collect revenue from taxpayers through various revenue sources included in the system, print receipts, view reports, and create new users. Revenue collection data is stored in the databases maintained in the database servers. However, the system lacks a mechanism for checking fake receipts. The mechanism could enhance revenue collections by reducing money fraud and data breaches for POS transactions. Currently, POS users check for the validity or invalidity of receipts manually. Furthermore, there is no backup option in that mobile application that could be applied as an auditing tool.

The authors in [20] investigated the effectiveness of utilising an automated revenue collection system in two Kenyan counties: Taita Taveta and Kiambu. The study examined how the government implemented automated revenue-collecting technologies to help with tax transparency and accountability. Automated revenue-collecting systems resulted in revenue growth in two counties. Most county officials believe that the POS system is the tool that is utilised to calculate the income collected. The study focused too much on only the POS device without considering fake receipt verification. The system is ineffective on its own as it lacks automation system modules specifically prohibiting the data from being cleared in the cache in offline mode.

The research work in [21] studied challenges that cause data mismatch between Local Government Revenue Collection Information Systems (LGRCIS) and POS machines, identifying human and technological causes. The study proposed risk reduction mechanisms that could help the system work efficiently. One of the mechanisms proposed is that the government agrees with telecommunication providers to provide a reliable and high-speed internet connection to all places in rural areas with poor network coverage. While these techniques are useful, there is no clear strategy to combine the multimodal interface with the possibilities offered by the device to verify the receipts after the transaction process, particularly in POS devices used in LGAs.

Conversely, the research in [22] evaluated the success of the LGRCIS and information system (IS) established in Tanzania using the DeLone and McLean model. According to the findings, system and information quality had a substantial positive influence. However, the study did not evaluate security features in LGRCIS mobile application system, specifically the use of QR codes for receipt verification to validate fake receipts.

Authors in [23] proposed an embedded fingerprint biometric authentication method for the POS network. Fingerprint biometric technology was combined with personal identification numbers (PINs) for authentication to improve security. The proposed idea addressed customers' issues, such as theft, counterfeiting, and oblivion. The customer is recognised by just placing a finger on the reader (based on finger scanning), and the system identifies the user without needing keys. However,

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the study did not indicate the application of QR codes in verifying the receipts to customers.

On the other hand, the authors in [24] created an informative parking mobile application to help the local government manage illegal parking using POS. The system enables the government to obtain revenue from parking retribution. The application can monitor parking fees, employees, and hardware and show the revenue generated based on the parking area. The waterfall model was used during the development of the system. However, the system did not include mechanisms such as using QR codes for POS transactions and mobile phones as a fake receipt verification tool.

Although the authors' remarkable contributions have been demonstrated in the previous studies, there is still a need for more studies into how mobile applications can enhance revenue collections by verifying fake receipts, particularly in LGAs. In our experience, there is no comprehensive mobile application to verify fake receipts after POS transactions in LGAs. This paper proposes a mobile application prototype for enhancing revenue collections in Tanzania LGAs. The mobile application detects fake receipts by scanning and comparing the QR code to check the validity of receipts and reports fake receipts to respective LGAs' officers. Further descriptions of the developed mobile application and operation to enhance revenue collections follow in Section III.

METHODOLOGY

Field Survey

Description of the Study Area

The research was carried out at Tanzania's four LGAs in Mbeya and Songwe regions. Mbeya City Council and Rungwe District Council were chosen from the Mbeya region, while Mbozi District Council and Tunduma Council were chosen from the Songwe region. In the aforementioned selected LGAs, we investigated similar factors affecting revenue collection using POS in LGAs. The four LGAs were advantageous for this study since it was predicated on the idea that all LGAs use POS and have the same main sources of income as listed in the local government finance Act, Cap 290 section 4 [25]. The selected LGAs also are ranked with the highest and middle list in revenue collections in Tanzania and have both characteristics of network availability. Field surveys were conducted between February and June 2022 in four LGAs to investigate factors affecting POS revenue collections in LGAs.

Population and Sample Size

The study population comprised ICT officers, revenue accountants, auditors, and POS agents. Two conditions were insisted upon to collect high-quality data: i) Respondents (POS revenue collectors) must have worked in the revenue collection sector for at least two years; ii) ICT officers, auditors, and accountants must have participated in the implementation of the LGRCIS and in being involved in revenue collection teams in their institutions. We adopted the Yamane (1973) formula to get the sample size, as shown in equation 1 [26].

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Whereby: n = estimated sample size, N= Total population, e= The desired level of precision (Margin error).

In this study, the total population (N) in the given study area was approximately 1051 POS users, and the margin error (e) was estimated at 5% at the confidence level of 95%. After substituting, the sample size (n) was required to be at least 289 POS users. In our study, Purposive sampling and simple random sample approaches were used to pick a sample of respondents. Three hundred thirty-nine (339) respondents participated in this study. The full summary is depicted in *Table 1*.

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Table 1: Sample Size and Demographic Characteristics of participants

Items		Total	Percentage
Age	25–35 years	164	54.7%
	36–45 years	108	36.0%
	Above 45 years	28	9.3%
Gender	Males	206	68.7%
	Females	94	31.3%
Occupation	POS Revenue collection agents	255	85.0%
	ICT Officers	12	4.0%
	Revenue Accountants	17	5.7%
	Auditors	16	5.3%

Source: Field Data

Data Collection

The cross-sectional Design of this study allowed for the consecutive collection of data from all four (4) LGAs. When comparing the prevalence of features, attitudes, and knowledge in validation and reliability studies, a cross-sectional design is more pertinent than a longitudinal one because the last calls for repeated data collection events at various points in time [27]. Therefore, when one wants to gather information at once in such a situation, a cross-sectional design is preferable to a longitudinal one. Structured questionnaires were used in this study. Three hundred (300) questionnaires were correctly completed and returned to the researchers, equivalent to 88.5%, which is sufficient, according to [28]. Questionnaires were designed for different categories of respondents to obtain different types of data from categories of respondents [29].

Software Development

Software development employs a variety of development methodologies to develop web and mobile applications. We developed a mobile application prototype using agile development methodology based on requirements collected through structured questionnaires conducted during the study. The application was developed using the agile methodology because of its repetitive, incremental approaches to enable early development of the system delivery, authentic communication, and teamwork [30], [31]. Instead of delivering the product as a complete, agile methodology supplied it in iterations. Each iteration follows the system development life cycle (SDLC), with each repetition delivering a complete product increment [32]. We used scrum as one of the agile development frameworks in our work (*Figure 1*). Scrum adjustments can be made at any point to enhance efficiency and effectiveness [33]. All requirements are stacked up periodically in a scrum to generate a product backlog. Our study identified three primary actors (Admin, Revenue collector, and Verifier); the case diagram is shown in *Figure 2*.

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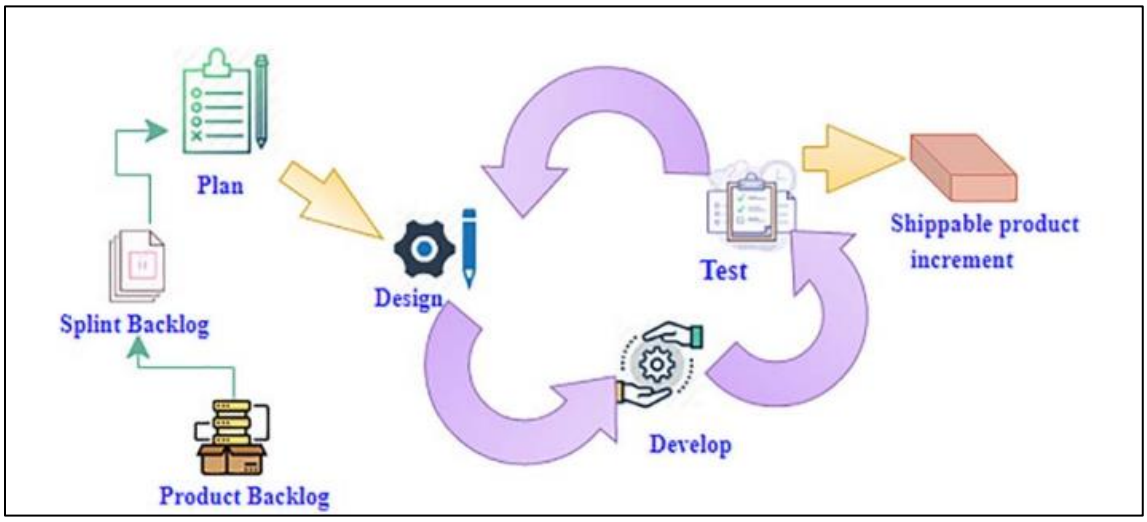
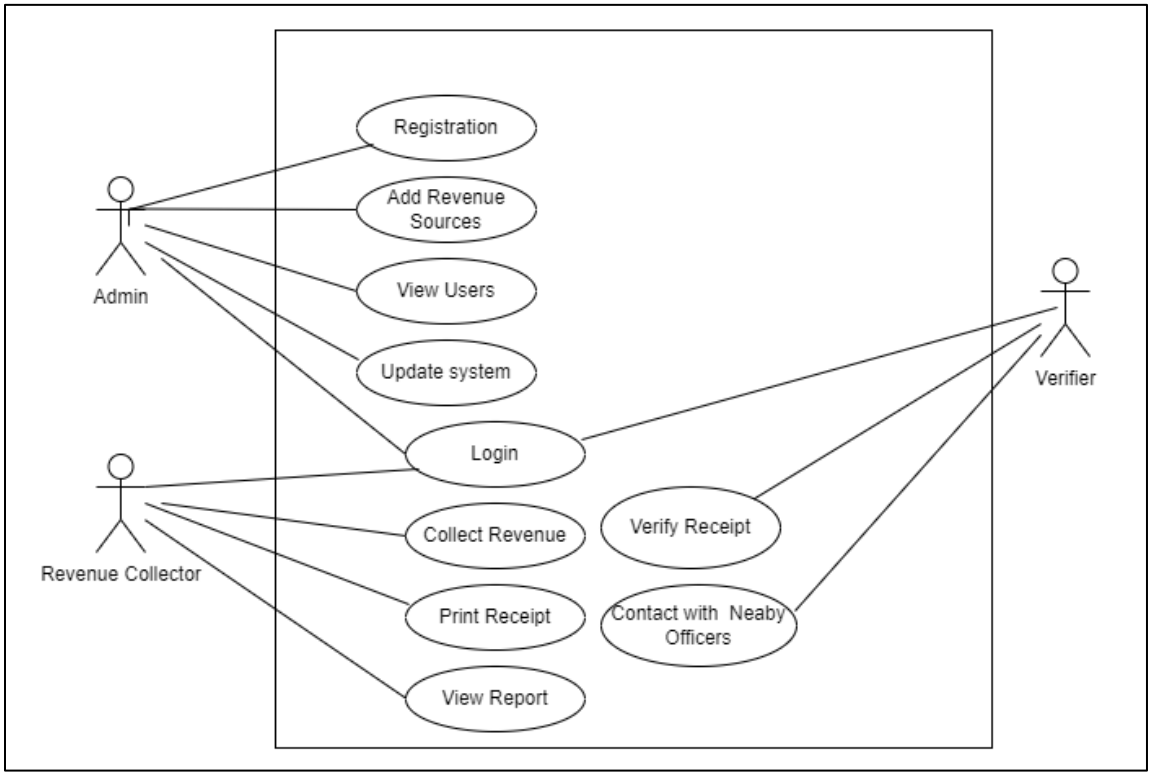
Figure 1: Agile (Scrum) software development model.



Source: Lufyagila, 2021

Figure 2: POS mobile application use case diagram



Source: Authors, 2022

Architecture

A two-tier client-server architecture was used to create the mobile application prototype for enhancing revenue collections using POS. Generally, the architecture of mobile devices does not typically differ greatly from one another in terms of storage, processing, and application [34].

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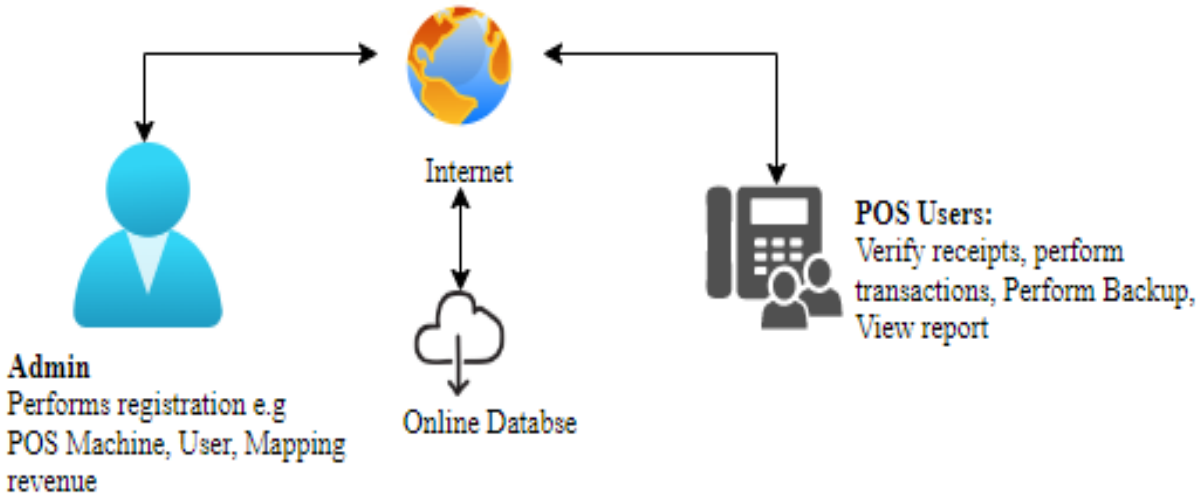
The mobile application conducts the basic functions and displays the related data, while the database server stores data over the internet. *Figure 3* shows the proposed solution prototype of the POS system mobile application in Tanzania LGAs. The features in the mobile application are simple to use and understand. All the information necessary by both actors is maintained in an online database; POS users and admins can access the information stored through the internet using the user-friendly interface provided by the smartphone and POS machine. Admin is responsible for registering POS machines and users, mapping revenue sources, generating control numbers, and providing other services. Simultaneously, POS users can sell products or services by providing receipts, verifying receipts, viewing reports, and performing backups using their POS or smartphones. Backup is done through data synchronisation, and the information recorded can be used for auditing and monitoring.

Figure 3: The architecture of the proposed Mobile Application Prototype



Source: Authors, 2022

Operation for the Mobile Application Prototype:

The operation mode of a mobile application for enhancing revenue collections using POS is online. Each user must be registered to have an account on the server to use the application. Here, we assume that each user already has a server account. A username and password must first be used to authenticate the user. After successful login, data are shown once checked in the local server, provided the online mode is enabled and there is internet connectivity. The user can scan a QR Code to access information that has been embedded there. Users can locate the QR code tags and scan them to validate the receipt. After scanning the QR code, the mobile application can only obtain the officers' contact information if the receipt is not valid for further communication. Once the code is read, additional verification information is received and shown if the receipt is authentic, as shown in Figure 4. a flow chart for the application. The system keeps monitoring the locally-stored data as a backup.

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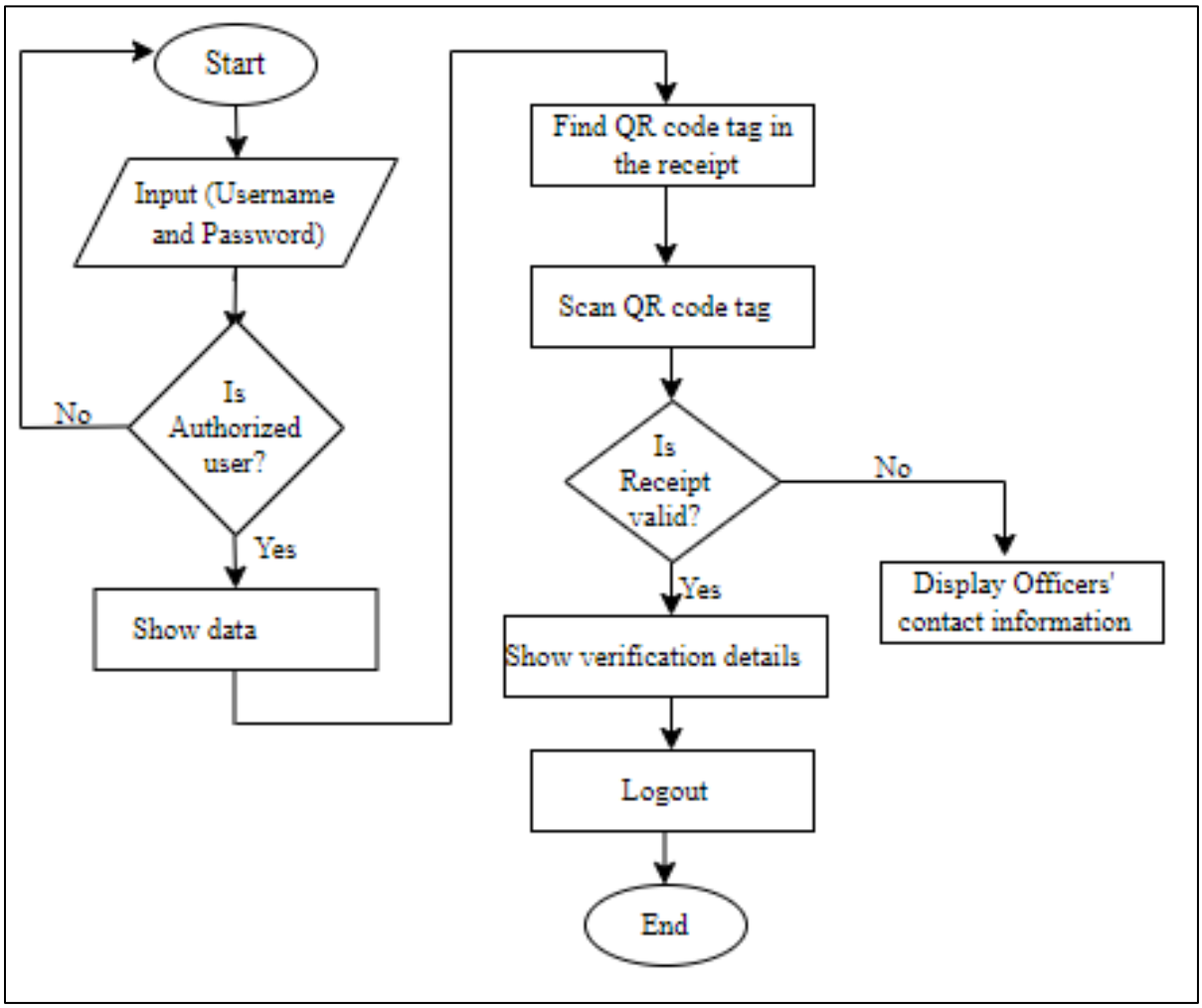
Figure 4: Flow chart for Mobile Application Prototype



Source: Authors, 2022

Development Tools

We used Java, PHP, MySQL, and Android Studio frameworks to develop mobile application components in stages to enhance revenue collections using POS with QR codes in LGAs. MySQL is a framework for developing mobile applications and web application platforms [35]. The most prevalent queries, such as how to add, insert, remove, or update, are supported by MySQL. Moreover, for Android development, the official Integrated Development Environment (IDE) is used. The Android operating system (OS) is a Linux-based open-source platform that anyone can use for free and without restrictions. Android OS is the most prevalent operating system in the smart device ecosystem [36]. The system requirements and modules were tested before encapsulating them to confirm that they performed as expected and that there were no problems.

Testing

The application was tested in terms of both functional and non-functional features. A use-case test technique was also used to do black-box testing. The use-case ensures that the project does black-box testing [37]. Furthermore, a system components test was performed to ensure that the software meets user expectations and is free of critical flaws.

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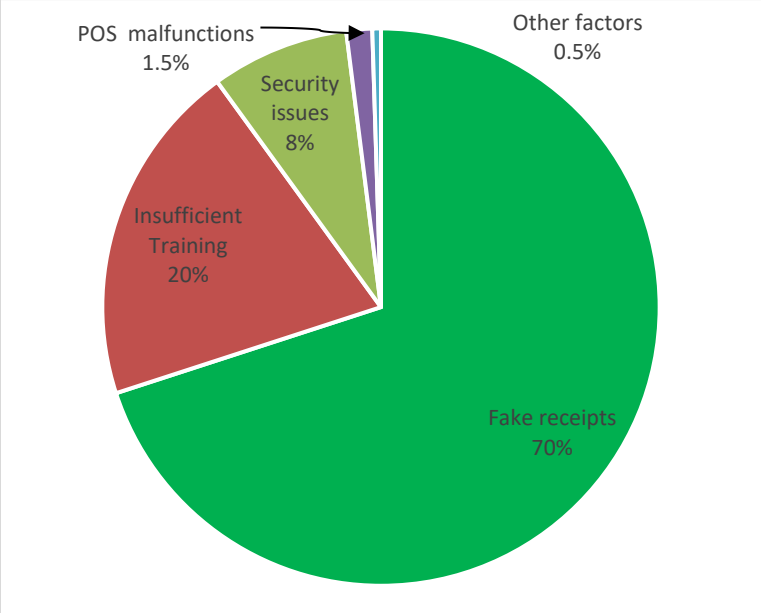
RESULTS AND DISCUSSION

Factors Affecting Revenue Collection in LGAs

The results showed that males (68.7%) were more employed using POS than females (31.3%). The gender disparity arose by chance, as most participants were chosen randomly. 54.7% were between the ages of 25 and 35, and the rest were older than 35. 85.0% of participants were POS revenue agent collectors, 5.7% were revenue accountants, 5.6% were auditors, and 4.0% were ICT Officers (*Table 1*). The study revealed that 70% of respondents reported that fake receipts are the major factor affecting revenue collection in LGAs. In comparison, 20% reported a lack of sufficient training. Furthermore, the study found that 8% are affected by security concerns, 1.5% are affected by POS malfunctions, and only 0.5% are affected by other factors. These findings are indicated in *Figure 5* and reveal a need to develop a user-friendly mobile application that addresses fake receipts and security issues.

Figure 5: Factors affecting revenue collection in LGA



The Developed Mobile Application

Based on the survey, we developed and validated the mobile application called **Ikuti POS** to enhance revenue collections in LGAs. **Ikuti POS** comprises features that enable agent collectors to collect revenue, verify the validity of the receipts, print reports, and back up every transaction. We have also incorporated Multifactor authentication and Installed Secure Security Layers (SSL) in the mobile application and the server to enhance revenue collection. *Figure 6* depicts a login screen where the user enters credentials (username and password) to connect to the gateway. After supplying the correct credentials, the user is presented with the main dashboard (*Figure 7*) upon supplying the One Time Password (OTP) sent to the user's mobile phone.

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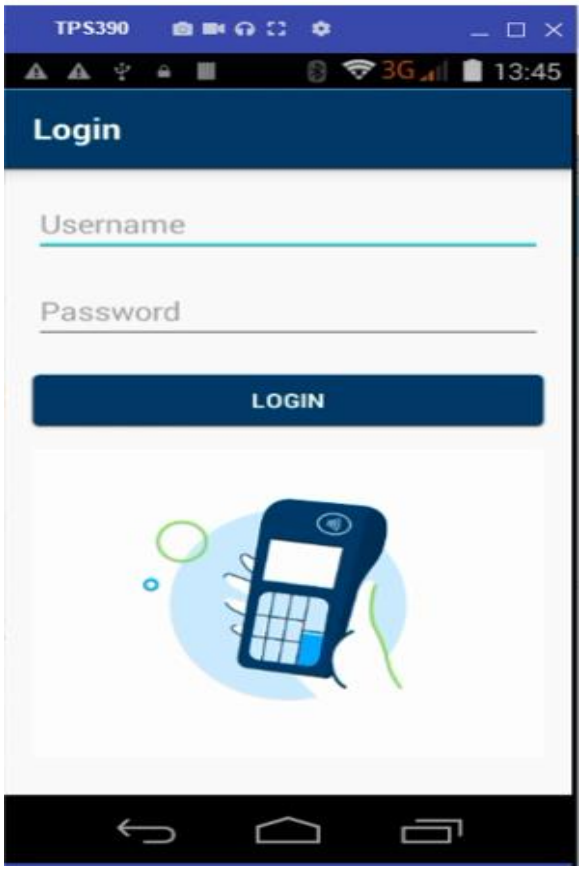
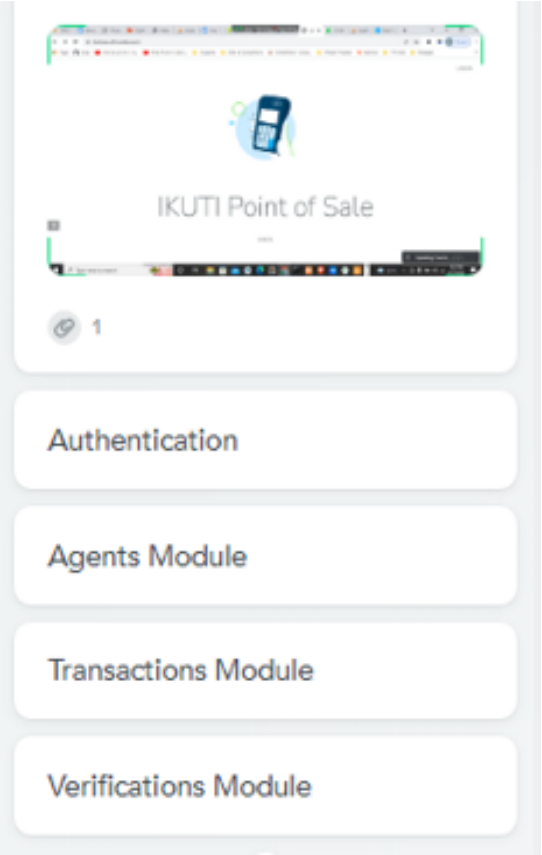
Figure 6: Login User Interface of Ikuti POS Ap



Source: Authors, 2022

Figure 7: Interface for performing Ikuti POS App



Source: Authors, 2022

Validation of the Developed *Ikuti POS App*

The study conducted user acceptance testing to validate the developed ***Ikuti POS App***. We developed validation aspects and administered them to 15 respondents from various occupations; whereby five (5) were POS Revenue collection agents, four (4) were ICT Officers, three (3) were Revenue Accountants, and three (3) were Auditors. The study showed that the application is secure and user-friendly and simplifies their means of verifying revenue transactions and services effortlessly. In addition, five (5) participants stated that the mobile application should also be in-cooperated with a forum for conducting discussions and actions to enhance revenue collection instead of using WhatsApp groups. The respondents recommended that other institutions should use POS to improve revenue collection. The overall rating for the mobile application to enhance POS transactions was qualified and is consistent with previous studies [38]. The validation results are summarised in *Table 2*.

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Table 2: Validation of the developed Ikuti POS App

Evaluation /Validation aspects	SA	A	NAD	D	SD	Mean Score
The application interface is user friendly	8	6	1	0	0	4.53
The application is more interactive and attractive	11	4	0	0	0	4.8
The application is useful for enhancing LGAs' revenue collections	9	6	0	0	0	4.7
The application is useful in enhancing security	11	4	0	0	0	4.80
The application provides savings in terms of cost and time	9	5	1	0	0	4.60
The forum should be deployed in the application for easy sharing of information	9	4	2	0	0	4.27
Key: SA = Strong Agree, A = Agree, NAD = Neither Agree nor Disagree; D = Disagree; SD = Strong Disagree						

Performance Evaluation of the Ikuti POS App

We measured the mobile application's performance based on how the user perceived the application's responsiveness to the length of time needed to complete each operation. Upon conducting extensive experiments on the developed mobile application, it was observed that the average cost time perceived in processing data was 497.3 milliseconds. At the same time, 303 bytes was the average size taken for important components to run the application. Table 3 illustrates the essential components used in performance evaluation and the computational time for each part. The evaluation metrics obtained are sufficient and significant for the application to run as enlightened in [39].

Table 3: Performance Evaluation for Mobile Application for enhancing revenue collection

Task	Authentication	Transaction	Verification	Sell Product/ service	Total
Time (Milliseconds)	681	421	390	421	1913
Size (Bytes)	292	327	292	327	1238

Security Evaluation:

Every application must provide confidentiality, integrity, authentication, authorisation, assurance, and non-repudiation for enhancing revenue collections using mobile transactions, including POS transactions [40]. In our study, we observed the mobile application encrypting all POS data at login and decrypting it only once it reaches the server. A real-time business perspective would also help, enabling proactive behaviour and faster decisions. Applying the Hypertext Terminal Protocol Secure (HTTPS) and SSL security protocols allowed for the security assurance of the application [41]. The application of QR codes for verifications proved efficient and convenient for enhancing revenue collection in LGAs using POS. The user can validate the receipt using the QR Code Identity tag camera for mobile applications in the android POS or smartphone to scan the QR code *(Figure 8).*

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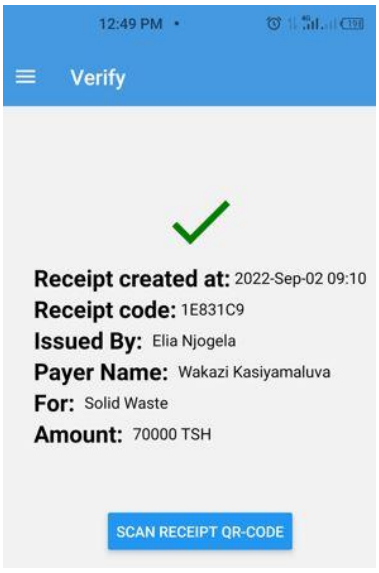
Figure 8: Receipt with QR Code of Ikuti POS App

Source: Authors, 2022

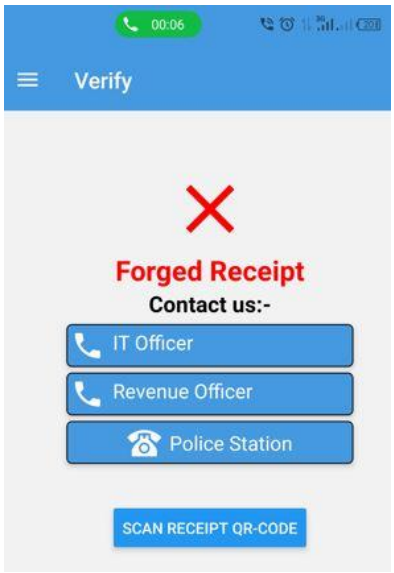
The user can eventually see important information for a valid receipt (*Figure 9*); a "Forged Receipt" message is displayed for an invalid receipt after selecting a specific action to verify the receipt (*Figure 10*).

Figure 9: Interface for a valid receipt of the Ikuti POS App



Source: Authors, 2022

Figure 10: Interface for invalid receipt of Ikuti POS App



Source: Authors, 2022

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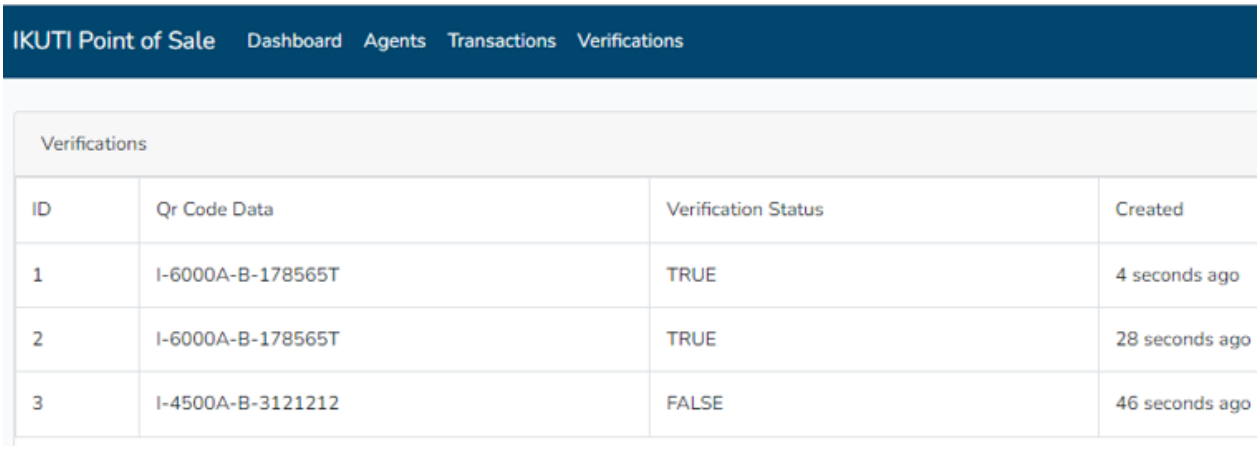
Furthermore, POS users can use available officers' contact information for any POS-related information, support, or technical assistance. The system administrator or assigned officer on the web page can check the verification status on the system dashboard displaying QR code data, verification status, and time created, as indicated in Figure 11. The "TRUE" verification status is for the valid receipt, and the "FALSE" verification status is for the invalid receipt. The application also performs a backup of information so that data can be used in the future for auditing.

Figure 11: Security evaluation on Ikuti POS App receipt Verifications



Source: Authors, 2022

CONCLUSION AND RECOMMENDATIONS

This study indicated that fake receipts, lack of insufficient training, and security concerns are major factors affecting revenue collections in Tanzanian LGAs. In response to this situation, we developed a mobile application prototype for POS revenue collection enhancement in LGAs. The application has been successfully designed, developed, and tested to meet its intended objectives. The developed tool effectively combats financial fraud, transaction errors, human errors, and defaulters. The application enhances revenue collections by verifying the receipts using QR codes with sufficient response operation costs by reducing money fraud. Moreover, the application performs backup, which is vital in monitoring and auditing. Also, the data stored as backups are protected against other cyber-attacks, such as ransomware.

However, this study has several limitations, including a restricted platform and online discussion forum. The mobile application can only be run on Android-based POS devices and smartphones. In the future, the study will be complemented by developing a mobile application that implements other platforms apart from Android, such as IOS or Windows Operating systems. Moreover, emerging security technologies such as blockchain will be complemented while developing a mobile application for the initial diagnosis of money fraud in the system. Lastly, developing an online forum where different discussions will be conducted will be an additional feature that can contribute significantly to the current study.

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Conflict of Interest

The authors declare that there is no conflict of interest exist regarding the publishing of this paper.

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REFERENCES

[1] S. M. Gachago, 'Mobile-based verification in anti-counterfeit commodity supply chain management systems', *African Journal of Science, Technology, Innovation and Development*, vol. 5, no. 5, pp. 379–388, 2013, doi: 10.1080/20421338.2013.829299.

[2] M. R. Pongsakorn and Tikapichart, 'Factors Influencing Thai SMES to Adopt Point-Of-Sales System (POS)', pp. 04–05, 2018.

[3] Gsma, 'State of the Industry Report on Mobile Money 2021', pp. 06–08, 2021, [Online]. Available: www.gsma.com/mobilemoney

[4] S. Aloyce Nchimbi, M. Ally Dida, J. Marwa, M. Kisangiri, and G. K. Janssens, 'MAGITS: A Mobile-based Information Sharing Framework for Integrating Intelligent Transport System in Agro-Goods e-Commerce in Developing Countries'. [Online]. Available: www.ijacsa.thesai.org

[5] Y. Wang, C. Hahn, and K. Sutrave, 'Mobile Payment Security, Threats, and Challenges', pp. 04–05, 2016, Accessed: Aug. 31, 2022. [Online]. Available: https://sci-hub.se/10.1109/MOBISECSERV.2016.7440226

[6] C. Kichere, 'Annual General Report of the Controller and Auditor General on the Audit of Information Systems', 2021. [Online]. Available: www.nao.go.tz

[7] C. H. Wanga, 'Electronic Theses and Dissertations', pp. 19–23, 2017, [Online]. Available: http://su-plus.strathmore.edu/handle/11071/5690

[8] T. Tater *et al.*, 'AI Driven Accounts Payable Transformation', 2022. [Online]. Available: www.aaai.org

[9] C. Kichere, 'Annual General Report of the Controller and Auditor General for the Financial year 2019/2020', pp. 51–75, 2021, [Online]. Available: www.nao.go.tz

[10] E. Taylor, 'Mobile payment technologies in retail: a review of potential benefits and risks', *International Journal of Retail and Distribution Management*, vol. 44, no. 2, pp. 159–177, Feb. 2016, doi: 10.1108/IJRDM-05-2015-0065.

[11] S. I. Lestariningati, 'Mobile point of sale design and implementation', in *IOP Conference Series: Materials Science and Engineering*, Sep. 2018, vol. 407, no. 1. doi: 10.1088/1757-899X/407/1/012094.

[12] T. R. Mrosso and O. Swallehe, 'Assessment on Public Mobile Service Delivery Towards Customer Satisfaction in Tanzania Telecommunication Industry.', *East African Journal of Information Technology*, vol. 5, no. 1, pp. 20–30, Feb. 2022, doi: 10.37284/eajit.5.1.558.

[13] E. Bertin, M. Badra, N. el Madhoun, and G. Pujolle, 'New Security Protocols for Offline Point-of-Sale Machines', pp. 17–18, 2022, [Online]. Available: https://www.researchgate.net/publication/358388512

[14] S. T. Ebimobowei, Z. Enebraye Peter, and Y. Pual, 'The Role of Software in a Cashless Economy (Case Study Nigeria)', *International Journal of Research -GRANTHAALAYAH*, vol. 6, no. 1, pp. 177–186, Jan. 2018, doi: 10.29121/granthaalayah v6.i1.2018.1607.

[15] T. Bradford, F. Hayashi, and Y. L. Toh, 'Developments of QR Code-Based Mobile Payments in East Asia', 2019.

[16] V. Uzun and S. Bilgin, 'Evaluation and implementation of QR Code Identity Tag system for Healthcare in Turkey', *Springerplus*, vol. 5, no. 1, Dec. 2016, doi: 10.1186/s40064-016-3020-9.

[17] A. Waqas, M. Hassam Yousaf, S. Siraj, U. Ahmed, H. J. Shinde, and A. Lavanya, 'A Secured Architecture for Transactions in Micro E-Commerce using QR scan, e-Wallet Payment Applications with Adaptation of Blockchain', *Article in International Journal of Emerging Technologies in Learning (iJET)*, vol. 11, no. 5,

Article DOI: https://doi.org/10.37284/eajit.5.1.901

pp. 611–615, 2020, [Online]. Available: www.researchtrend.net

[18] Soumitisircar and Y., 'Soumiti Ghosh Payments overview-China an Internship Project on Banking and Payments System in China for Finance Finland as Part of Hanken Sse's Business Lead Program', 2018.

[19] PO-RALG, 'LGRCIS implementation-Field Visit Report: PO-RALG and USAID/Tanzania Public Sector Systems Strengthening Activity.', 2017.

[20] M. N. Njenga -Author and J. Sevilla-Author, *A Survey of the Effectiveness of Automated Revenue Collection Systems in County Governments in Kenya A Case Study of Kiambu and Taita Taveta County Governments*.

[21] B. Bahati, 'Data integrity risk assessment of local government revenue collection information system in Tanzania', pp. 05–06, 2018, [Online]. Available: http://repository.udom.ac.tz

[22] J. M. Sausi, E. J. Kitali, and J. S. Mtebe, 'Evaluation of local government revenue collection information system success in Tanzania', *Digital Policy, Regulation and Governance*, vol. 23, no. 5, pp. 437–455, Nov. 2021, doi: 10.1108/DPRG-04-2021-0055.

[23] H. Adnan Alzame, M. Alshabanah, and M. K. Alsmadi, 'Point of Sale (POS) Network with Embedded Fingerprint Biometric Authentication', *Int J Sci Res Sci Technol*, pp. 95–111, Sep. 2019, doi: 10.32628/ijsrst119659.

[24] M. Isnan, 'street parking system-Andi Muhammad', pp. 06–07, 2020.

[25] A. Kilangi, 'The Local Government Finance Act', pp. 19–23, 2019.

[26] U. Chanuan, C. Kajohnsak, and S. Nittaya, 'Sample Size Estimation using Yamane and Cochran and Krejcie and Morgan and Green Formulas and Cohen Statistical Power Analysis by G*Power and Comparisons', *Apheit International Journal*, vol. 10, no. 2, pp. 77–84, 2021, Accessed: Aug. 31, 2022. [Online]. Available: https://so04.tci-thaijo.org/index.php/ATI/article/view/254253/173847

[27] V. Venkatesh, H. Bala, and V. Sambamurthy, 'Implementation of an information and communication technology in a developing country: A multimethod longitudinal study in a bank in India', *Information Systems Research*, vol. 27, no. 3, pp. 558–579, 2016, doi: 10.1287/isre.2016.0638.

[28] P. W. Mucheru, 'Factors motivating the application of Sustainability Management Accounting Tools among corporations in East Africa', pp. 36–37, 2019, [Online]. Available: http://su-plus.strathmore.edu/handle/11071/6608

[29] J. J. L. García, D. Lizcano, C. M. Q. Ramos, and N. Matos, 'Digital marketing actions that achieve a better attraction and loyalty of users: An analytical study', *Future Internet*, vol. 11, no. 6, pp. 05–07, Jun. 2019, doi: 10.3390/fi11060130.

[30] E. Turban, L. Volonino, and G. Wood, 'Information Technology and Management', vol. 10, pp. 131–135, 2015.

[31] A. O. Jarikre, Y. K. Sharma, A. K. John, and S. K. Bailey, 'Analysing the Obstacles in Agile Software Development Approach: A Review', *East African Journal of Information Technology*, vol. 5, no. 1, pp. 1–6, Jan. 2022, doi: 10.37284/eajit.5.1.520.

[32] B. Lufyagila, D. Machuve, and T. Clemen, 'IoT-powered system for environmental conditions monitoring in poultry house: A case of Tanzania', *African Journal of Science, Technology, Innovation and Development*, 2021, doi: 10.1080/20421338.2021.1924348.

[33] R. Leon-Ayala, G. Gómez-Cortez, and L. Andrade-Arenas, 'Mobile Application Aimed at Older Adults to Increase Cognitive Capacity'. [Online]. Available: www.ijacsa.thesai.org

Article DOI: https://doi.org/10.37284/eajit.5.1.901

[34] G. Aceto, V. Persico, and A. Pescapé, 'A Survey on Information and Communication Technologies for Industry 4.0: State-of-the-Art, Taxonomies, Perspectives, and Challenges', *IEEE Communications Surveys and Tutorials*, vol. 21, no. 4. Institute of Electrical and Electronics Engineers Inc., pp. 3467–3501, Oct. 01, 2019. doi: 10.1109/COMST.2019.2938259.

[35] T. Riihimäki, 'ASP.NET Core 2.1 Web API For A Mobile Application', pp. 09–18, 2019.

[36] M. Abdul, R. Khan, N. Kumar, and R. C. Tripathi, 'Detection of Android Malware App through Feature Extraction and Classification of Android Image'. [Online]. Available: www.ijacsa.thesai.org

[37] S. Wijaya *et al.*, 'DEVELOPMENT OF SALES INFORMATION SYSTEM FOR SME WITH THE WATERFALL METHOD: A GROCERY STORE BSR CASE', vol. 3, no. 4, 2022, doi: 10.20884/1.jutif.2022.3.4.263.

[38] P. Wandee, Z. Bussabong, S. Duangkum, and Vol. 13, No. 5, 2022 International Journal of Advanced Computer Science and Applications, 'Application for a Waste Management via the QR-Code System', International Journal of Advanced Computer Science and Applications, Vol. 13, No.5, 2022. [Online]. Available: www.ijacsa.thesai.org

[39] B. Wisnuadhi, G. Munawar, and U. Wahyu, 'Performance Comparison of Native Android Application on MVP and MVVM', Dec. 2020. doi: 10.2991/aer.k.201221.047.

[40] V. Raja, 'Merging Multi Cloud Deployment with Multi Bank Payment with Security', *International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)*, vol. 26, no. 7, pp. 01–04, 2019.

[41] B.-R. Chang, H.-F. Tsai, and H.-C. Huang, 'Implementation of Smart Mobile Point-of-Sale Cash Register System', *Taiwan Ubiquitous Information*, vol. 3, no. 3, p. 811, 2018.

