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An Electronic Payment System for Revenue Collection in the Kassena Nankana Municipality

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Traditionally, revenue collection in Kassena-Nankana Municipal Assembly (KNMA), as in Ghana, was manual, with some ICT systems employed recently.This study designed an E-payment system for revenue collection in the KNMA. The research focused on the development and implementation of an electronic payment system, to facilitate revenue mobilization. The study utilizes tools such as HTML, CSS, PHP, JavaScript, MYSQL, SQL, and other resources like VS Code, and payment APIs for the development of the system as well as azure key vaut and secureauth for incription and muti-factor authentication(MFA).As part of the research, it is revealed that, there is a strong willingness among people to embrace electronic payment methods for their taxes, finding it convenient to pay via the internet from anywhere. The E- system developed during this study demonstrated the flexibility expected of an Electronic Payment System, allowing users to create

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and update accounts, make payments in instalment or in full in any location using their phones. The study establishes a positive impact between the electronic systems and improved revenue generation processes which support the notion that there is indeed a correlation between ICT systems and revenue generation processes, against the notion that there is no correlation.

Keywords: Mobile payment system; revenue collection; ICT; KNMA.

1. INTRODUCTION

The financial capacity of local governments depends largely on their ability to mobilize revenue, which allows them to provide essential services and support local development efforts. However, many local governments face challenges in collecting revenue efficiently, and thus seek innovative ways to improve their tax collection and revenue generation. Electronic technology systems have advanced rapidly across the world, offering new opportunities for enhancing revenue collection. Researchers have highlighted the positive effects of electronic technology on improving the quality and performance of local government revenue [1]. Numerous studies from different regions have shown a strong link between the use of electronic technology and revenue collection Extensive studies conducted worldwide have consistently demonstrated a positive correlation between the adoption of electronic technology and revenue collection.

While most of the reviewed research has indicated a positive correlation between ICT usage and revenue mobilization, some studies have presented contradictory findings. For instance, research by Chijioke et al [2]. observed that despite the deployment of e-taxation, tax revenue, federally collected money, and the tax-to-GDP ratio in Nigeria did not show significant improvements, instead resulting in a decreased tax-to-GDP ratio. Similarly, studies by Okafor, Nnubia, Chukwunwike, and Asogwa [3] suggested that ICT might not significantly impact tax revenue generation in Nigeria, revealing only minor effects on the production of capital gains charges.

Furthermore, research conducted by National Audit Office Tanzania revealed several weaknesses in the revenue collection systems of Local Government Authorities (LGAs). The findings indicated that more than 70% of LGAs did not achieve their annual revenue targets, pointing to significant challenges that persist even after the implementation, necessitating further research to identify suitable solutions.

According to the 1992 Constitution (Articles 245 and 252) and the Local Government Act, 1993 (Act 462), district assemblies in Ghana are in charge of the overall development of their areas. However, to carry out these duties effectively, they need adequate financial resources [4]. Despite having various local revenue sources, such as fees, property rates, tolls, and court charges, MMDAs, including the Kassena-Nankana Municipal Assembly (KNMA), face challenges in mobilizing and maximizing their Internally Generated Funds (IGF) due to inadequate revenue collection strategies and techniques [5].

Prior to the use of the dLRev system, District assemblies, including KNMA, relied on a manual process, involving hand-written bills and lacking some computerization. Additionally, the absence of accurate taxpayer data posed a significant challenge to revenue collectors in distributing bills effectively. Also, MMDAs faced various challenges, such as revenue leakage and non-compliance among others [6,7].

While the research conducted by the GovID program and the Copenhagen Consensus Centre in 2020 on some MMDAs indicated improvement in revenue mobilization processes after implementing the DLRev system, which indeed is supported by the auditor general report for 2020, some problems of the MMDAs still persisted. According to the Auditor-General's Report of 2022, the total salaries paid to 129 revenue collectors in 22 MMDAs in Ghana amounted to GH¢2.4 million. However, the assemblies managed to collect only GH¢1.3 million in revenue, resulting in a significant shortfall of approximately GH¢1.5 million. The report attributes this discrepancy to a variety of factors, including non-compliance with financial regulations, the reluctance of business operators to fulfil their levy obligations, and a lack of effective control mechanisms to prevent financial losses.

In the case of the KNMA, the Auditor-General's Report for 2021 highlighted instances where certain revenue collectors were unable to

account for some of the revenue, they were responsible for, while other revenue went uncollected. Furthermore, there was a noticeable decrease in internally generated funds (IGF) for the year 2021 in comparison to the revenue generated in 2020.

Again, the DlRev system currently in used by MMDAs relied on tax collectors to distribute printed bills and also collect tax, leading to no improvement in revenue processing time. Moreover, the system focused only on property rates and business operating permits, limiting its capacity to fully optimize revenue mobilization opportunities. It is therefore not surprising that this research revealed persistent issues with manual processes, non-compliance, and a significant untapped opportunity to maximize revenue in KNMA [6].

In light of the persisting challenges, the current research has developed and implemented an electronic management system for revenue mobilization in the Kassena-Nankana Municipal Assembly,. The findings of this research have shed light on the advantages of implementing electronic systems for revenue generation. The research has provided policymakers and revenue authorities with evidence-based recommendations and best practices. It has also contributed to support the notion that there exists a positive correlation between ICT and revenue mobilization.

1.1 Related Works

An e-payment system is a method of making payment or conducting transactions for goods and services on an electronic environment without the need to use cash or check. It is also known as an online payment system and encompasses various forms such as credit cards, virtual cards, mail orders, e-wallets, mobile payments, crypto currencies, etc.

Electronic Payment System (EPS) can also be said to be a type of digital payment that involves the transfer of money or digital currency from one (digital) account to another using electronic payment technologies [8] A number of studies have been conducted on electronic and mobile payment tools both within Ghana and internationally which have proven to be efficient for revenue mobilization.

According to the World Bank [9] electronic payment systems were among the key factors that improved tax compliance and administration in seven low-income countries, including Ghana.

Agyapong and Agyapong [10] investigated revenue mobilization options for Ghanaian local governments and proposed the use of electronic payment systems, such as mobile money platforms and digital wallets, to improve revenue collection and management.

Visconti-Caparrós and Campos-Blázquez [8] conducted a literature review on electronic payment systems, emphasizing their positive effects on improving the quality and performance of local government revenue.

Chepkoech et al. [11] conducted a study on the impact of e-payment systems on sustainable revenue collection within the Nairobi City County Government. Their findings indicated a positive influence on tax compliance, effective monitoring of revenue sources, and improved financial reporting. Similarly, Mwaura (2019) investigated the effects of a municipal billing system on revenue collection in the Tshwane Metropolitan Municipality, South Africa. The study revealed that the system contributed to enhanced revenue collection by minimizing errors and delays, bolstering security and transparency, and facilitating verification and enforcement processes.

Additionally, UNCDF [12] documented the implementation of the Integrated Revenue Administration System (IRAS) in local governments across Uganda. The report demonstrated that the IRAS significantly increased revenue collection by facilitating online processes such as registration, assessment, payment, billing, and reporting of local revenue sources.

Mwakatobe et al. [13] evaluated the revolutionization of revenue collection with Government E-Payment Gateway System in Tanzania and indicated that the use of the system increased revenue collection by reducing the cost associated with revenue collection, sealing corruption loopholes, and enhancing taxpayer satisfaction.

Pomeranz et al. [14] found that financial incentives increased the adoption of electronic payment technology and reduced income tax evasion by firms in Uruguay. Similarly,

Nkrumah et al. [15] suggested that electronic payment systems could improve local revenue

mobilization and composite budget implementation in Ghana by reducing leakages and enhancing transparency. Moreover.

Cisse et al. [16] showed that electronic invoicing increased VAT compliance and revenue in Senegal by facilitating the verification of transactions and reducing the scope for fraud. These studies provide evidence that electronic payment systems can have positive effects on tax compliance and revenue collection in developing countries, but also highlight the challenges and limitations of implementing such systems in different contexts.

Maisiba and Atambo [17] conducted a study on the Effect of Electronic-Tax System on the Income Collection Efficiency of Kenya Revenue Authority, focusing on the Uasin Gishu county KRA office. The study demonstrated the efficiency of the electronic tax system (Etax) in enhancing revenue collection and sealing corruption loopholes. The technology enabled taxpayers to fill returns online using mobile phones, resulting in positive improvements in revenue collection and service delivery.

According Roger [18] it was observed that digital tax administration has reduced tax evasion and tax avoidance in Rwanda in the last three years.

Maina [19] suggest that online tax administration systems have increased revenue generation and resulted in notable success in filing returns, remitting payments, applying for tax refunds, lodging tax objections, applying for tax waivers, and requesting tax compliance certificates in Kenya.

In 2013, the Accra Metropolitan Assembly extended the use of Point of Sale devices to cover all revenue collection in all sections of the AMA. They experienced a 10.3% increase in IGF in the following financial year [20].

Governance for Inclusive Development program (GovID) and the Copenhagen Consensus Center carried out a cost-benefit analysis of the dLRev revenue management software implementation in Ghana's nine MMDAs. Before the introduction of dLRev, most assemblies issued demand notices manually to clients for the payment of the rates, rents and other bills. The majority of these were not computerized but hand-written bills. As most buildings were not numbered, even the distribution of the bills posed a major challenge to the MMDA's revenue collectors [6].

This and many more challenges faced the MMDAs caused a lot of leakages. The implementation of the system has been successful as it improved the revenue generation process and revenue itself. According to the research, the year after dLRev was implemented, revenue collected at a weighted average growth rate of 54%.However, there are some limitations in this research that need further study in this area. The research was conducted in only nine MMDAs excluding KNMA which might not necessarily be applicable with the same results. Furthermore, the system is only limited to collection of property tax and business operating permits. The system also relies much on tax collectors in distribution of bills and collection of revenue [6].

The present study has led to the development and implementation of an electronic system tailored to meet the specific requirements and expectations of the KNMA. While previous studies have provided valuable insights, it's essential to recognize that the context of other country, s revenue collection system and the context in some district in Ghana might differ from that of KNMA. Therefore, this study examined the impact of the electronic system within the unique setting of KNMA, accounting for any distinctive challenges and opportunities for revenue enhancement. By leveraging technology and automation, this study has contributed to more effective revenue collection practices and boosted financial sustainability within KNMA.

2. METHODS

The research utilized the iterative waterfall model, which emphasizes initial implementation simplification and increasing system complexity as core functionality is updated until the desired final system is realized.

The iterative method, also known as iterative development or iterative design, emphasizes the repetition of a cyclical process during system development. It entails dividing the development process into smaller iterations or cycles, with each iteration concentrating on specific duties, such as requirements gathering, design, implementation, and testing.

2.1 System Design

The system design is the conceptualization, planning, and creation of the software system or application's structure, components, and

interactions. It involves translating the requirements garnered during the analysis phase into a detailed design that outlines the system's implementation and operations. The primary objective of system design is to create a blueprint or plan that directs the development of the system by the researcher in constructing a system that satisfies the specified requirements and objectives.

Flowcharts, data flow diagrams, and entity-relationship diagrams were employed by this research, among other techniques. These tools facilitated the depiction of the system's data flow and processes, thereby providing a transparent illustration of its operation and structure.

To initiate a payment, a taxpayer must first have registered in the system by system administrators and then provided a username, and a pre-generated password, which can be changed after the initial login. Subsequently, the taxpayer then navigates to the system's website using the URL www.knmatps.com, select the taxpayer option, and log in with their username and password. If the credentials are accurate, the system grants access; otherwise, an error message is sent.

Once inside, the taxpayer can make payments for properties assigned to their name by selecting the desired property from the provided list. The payment process involves specifying the payment type and mobile money phone number for MoMo payments, followed by entering the payment amount. The system then prompts the taxpayer to input their mobile money PIN for authorization.

Upon correct entry of the PIN, the system displays a success message confirming the payment. Furthermore, the taxpayer receives an SMS from KNMA verifying the payment transaction. However, if the entered PIN is incorrect, an error notification is displayed, indicating an incorrect PIN entry. The user is then sent back to the start of a new session. See Fig. 2.

The system administrators and tax collectors are also users of the system with a slightly modified data flow.

3. RESULTS

During the implementation phase, the envisioned system is brought to life and the proposed design is transformed into a functional reality. This phase concentrates on the design and implementation of the system's interfaces, which play a crucial role in facilitating user interactions.

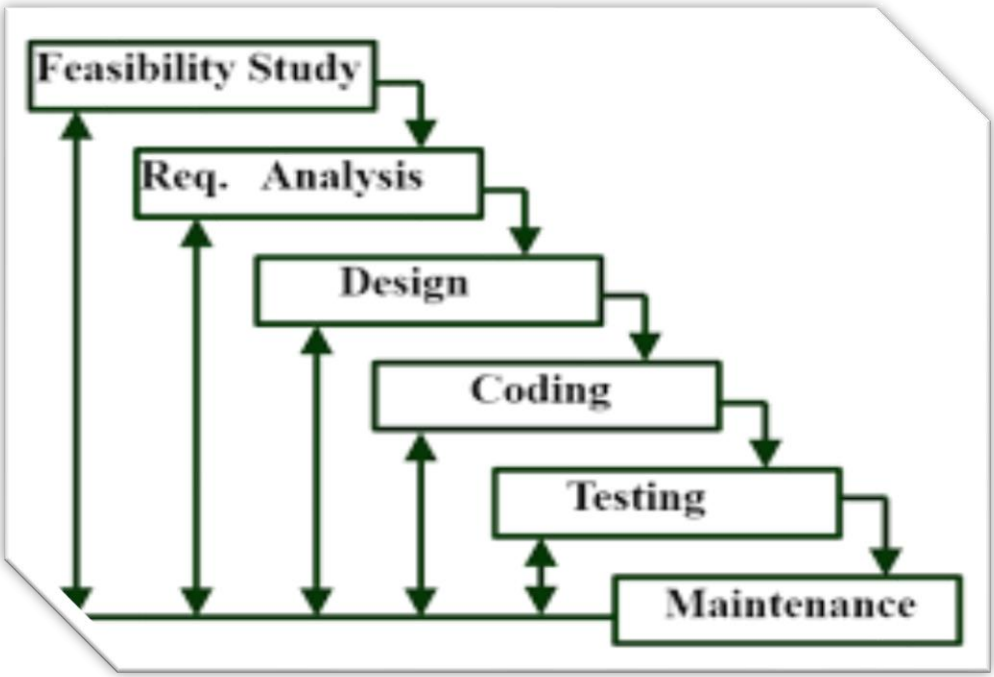

Fig. 1. Iterative waterfall model

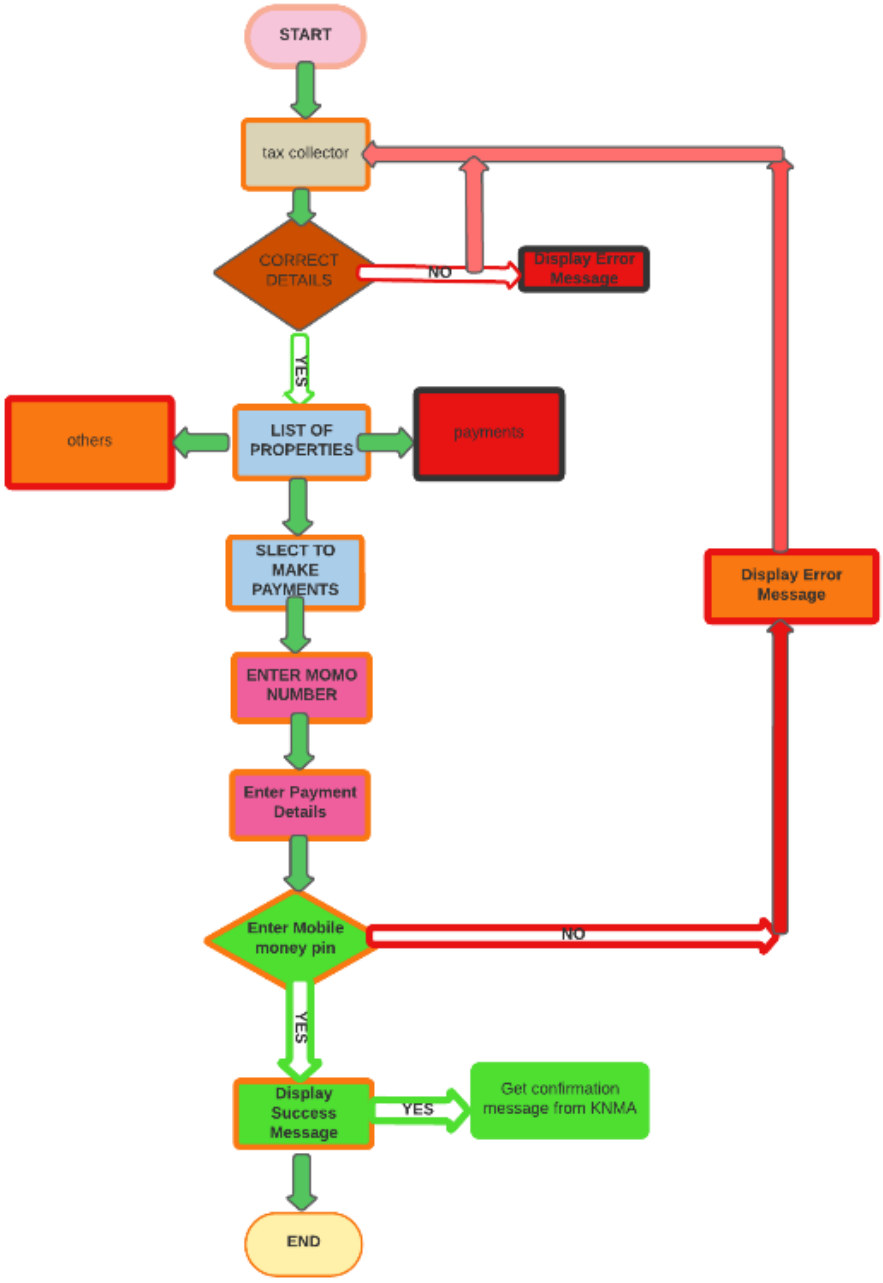

Fig. 2. Client (Taxpayer) data flow

When the system is operational, users are greeted by an intuitive interface that facilitates a seamless experience. The interface is intuitive and visually appealing, allowing users to navigate and interact with the system without difficulty. Through well-designed displays and menus, users can efficiently access a variety of functionalities and complete tasks.

The implemented system features a streamlined and responsive layout that adapts to various screen resolutions and device types. Accessible via desktop computers, laptops, tablets, and smartphones.

The interfaces of the system include interactive elements and controls, enabling users to input data, select options, and execute desired actions. The Fig. 3,4,5 and 6 bellow are ssample screenshots of the system.

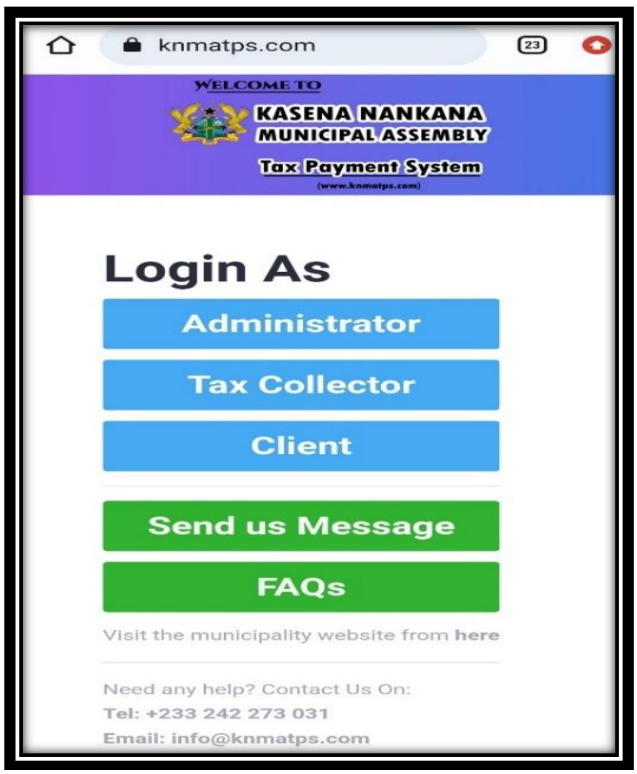

Fig. 3. Login interfasce

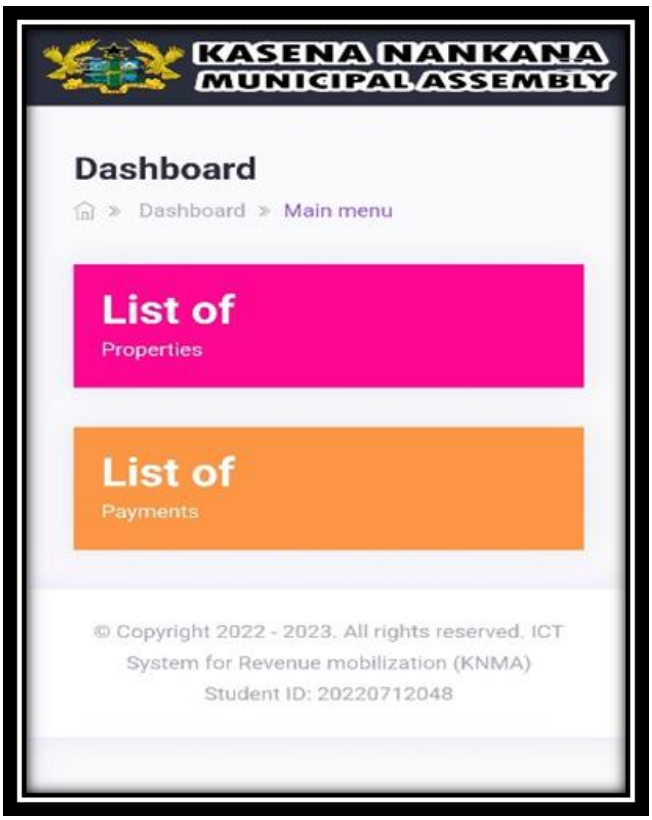

Fig. 4. Client dashboard

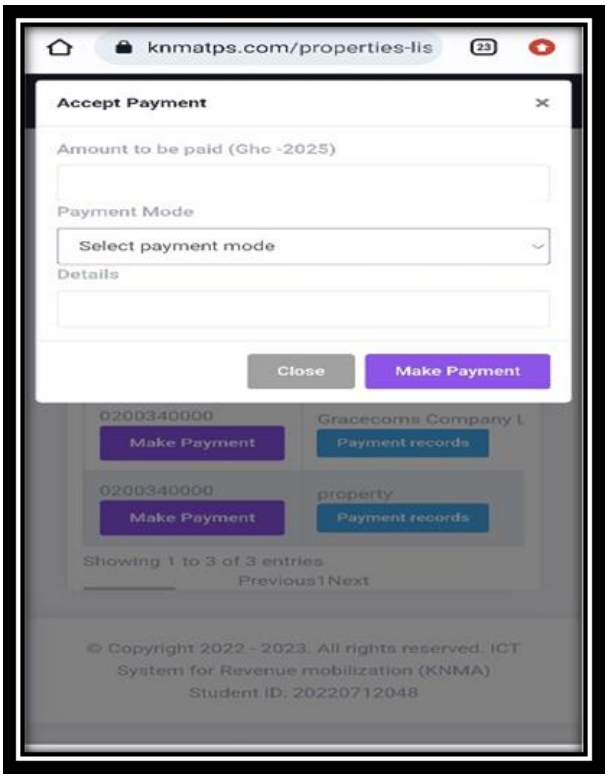

Fig. 5. Make payment

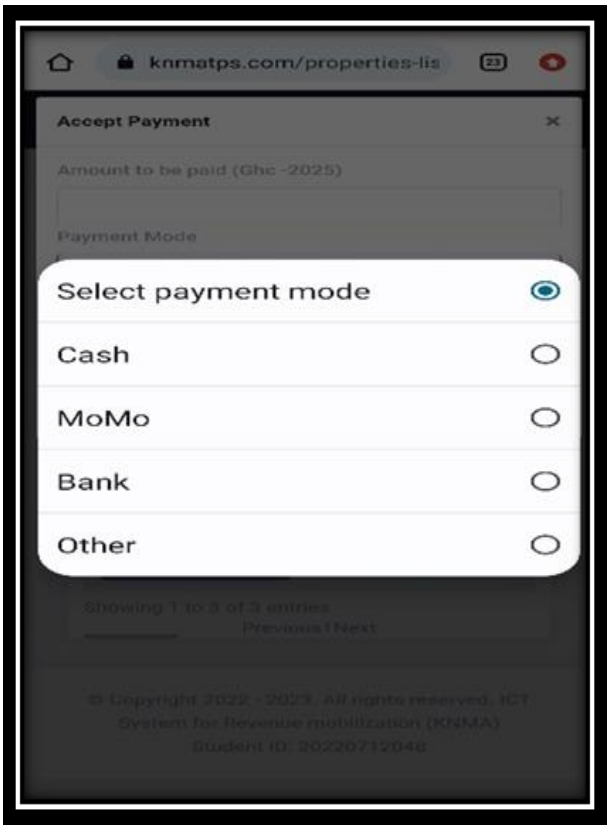

Fig. 6. Payment option

4. CONCLUSION

This research has successfully explored and investigated electronic systems leading to the development and implementation of an electronic management system for revenue mobilization in the Kassena-Nankana municipal assembly, referred to as KNMATPS. The implementation of this electronic system has proven to be effective in enhancing the assembly's revenue collection and financial performance.

It has been observed that, the success of the system is largely attributable to the following factors.

1. The ability of taxpayers to make payment by themselves from anywhere using their phones
2. The opportunity to pay tax in instalment.

5. RECOMMENDATIONS

1. The study recommends that, KNMA should adopt an E-payment system that enables taxpayers to make payments from anywhere through mobile devices in a secure and convenient manner. This will significantly reduce its reliance on tax collectors, on cash transactions and manual processes, and will result in a significant improvement in the revenue collection process and revenue itself.
2. The KNMA can implement targeted taxpayer incentives to encourage tax compliance and adoption of the E-payment system
3 The KNMA should establish a feedback mechanism that allows taxpayers to provide suggestions, identify issues, and provide feedback on their experiences with the electronic payment system.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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