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An Electronic Revenue Mobilization and Utilization System: Improving and Safeguarding the Tax for Development in the Builsa South District, Ghana

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Abstract

The study designs and implements an online electronic tax payment system, BSDARMS, for the Builsa South District of Ghana, enabling taxpayers to track revenue utilization. Using the iterative waterfall model, BSDARMS provides a user-friendly interface, secure taxpayer database, and facilitates online payments via SMS and USSD. The system addresses limited revenue collection personnel, motivating business registration and tax compliance to support budget targets and district development. Compared to KRA's ICT deployment, BSDARMS enhances operational efficiency by reducing administrative costs and revenue leakage. It aligns with Tanzania's LGRCIS system, ensuring reliable tax collection and notification mechanisms.

1. Introduction

The 1992 constitution of Ghana (Local Government Act 462 of 1993) established the metropolitans, municipals and districts across the country (1992 constitution of Ghana). This was done to create the decentralization of governance to encourage the lower-level participation. The MMDAs have been given the autonomy as institutions to carry out administrative, financial, and political functions for the overall development of their jurisdictions (George, 2022; Debrah & Owusu-Mensah, 2022; Fobih, 2020; Annan-Prah, 2019; Agyei, 2016). Revenue generation is one of the main functions of the state administration (Adu et al., 2020). Therefore, in order to ensure a sufficient revenue generation, the state administration has delegated its authority to the MMDAs to mobilize revenue. George (2022) postulates that in Ghana, most MMDAs rely on funds that are generated within their jurisdiction usually described as Internally Generated Funds (IGF). Some of these funds include fines, property rates, permits and among others used to cater for the people's developmental needs. The MMDAs still rely on the IGF to embark on some developmental projects despite the fact that central governments make a financial provision called District Assembly Common Fund (DACF) for them (Andani & Sanyare, 2022; Adamu, 2021;

Owusu-Amponsah, 2017; Ayikwei, 2016). Notwithstanding, the reliability of the DACF and other donations are doubtful hence the MMDAs do not have control over them (Maama & Marimuthu, 2021; Aborah-Osei, 2020; Boateng, 2014).

The MMDAs need to strengthen their domestic revenue mobilization mechanisms to create the fiscal space in order to meet the people's developmental needs within their jurisdictions with the intention of developing the state as a whole (Akorsu, 2015). Governments across the world, especially developing countries are gradually moving away from the manual means of collecting revenue by adopting Information and Communication Technologies (ICTs) which have become a game changer (Agyei-Ababio et al., 2023; Cueyt et al., 2016). According to Agyei-Ababio et al. (2023), when countries do their best in digital economy it will have a positive impact on society, institutions and organizations. This implies that MMDAs as institutions are not an exception to adopt digital means of mobilizing revenue to meet the people's developmental needs within their jurisdictions. Hence, this paper aims to design and implement an online electronic tax payment system for the Builsa South District of Ghana and also help taxpayers track the utilization of their revenue online by employing systems development research methodology called iterative waterfall model.

1.2 ICT Implementation and Tax Administration

1.2.1 Conceptual Overview of ICT Tools in Tax Administration

The integration of Information and Communication Technologies (ICTs) in public finance management has transformed traditional tax systems into more efficient, transparent, and inclusive platforms. Tools such as web-based portals, USSD technology, and SMS notifications have been widely adopted in both developed and developing economies to enhance tax compliance, broaden the tax base, and reduce administrative costs.

A web-based Tax Portal provides a centralized interface for registration, filing, and payment. It enables 24/7 access and can streamline taxpayer services. However, its effectiveness depends heavily on internet access, digital literacy, and system security (Wasao, 2014). Unstructured Supplementary Service Data (USSD) technology allows real-time communication over GSM networks without requiring internet connectivity. USSD is particularly relevant for low-income, unbanked populations in rural areas, making it a strategic tool for inclusive tax systems (Najib & Fahma, 2020). Despite its reach, USSD has limitations in interface complexity and security risk if not properly encrypted.

SMS Notifications are a lightweight, low-cost communication tool that keep taxpayers informed about due dates, payments, and receipts. They enhance compliance behavior by promoting reminders and confirmations. However, over-reliance on SMS alone may not be sufficient for more complex interactions.

1.2.2 Empirical Overview of ICT Tools in Tax Administration

Diffusion of innovation theory is applied to determine the advantages of implementing ICT in tax administration. Kairu et al. (2017) conducted a study to determine the effect of ICT deployment on the operational performance of Kenya Revenue Authority (KRA). The methodology employed is descriptive survey design. The paper reveals that the ICT implementation in KRA management information system is applicable with other systems and can be made to support the growth of the firm to enhance the performance of employees. There is an increase in access to information about best practice operation due to the adoption of ICT by KRA. The study further argues that ICT saves time for operations and also increase the accessibility of information by the public. Through the implementation of ICT, KRA is able to increase their level of transparency. However, the study indicates that the system has not contributed much in determining the performance of KRA because it is not user friendly and hence taxpayers are not motivated to use it in settling their tax obligation in Kenya.

It was realized that per the introduction of "Local Government Revenue Collection Information System (LGRCIS) in Arusha City Council, Tanzania", which is an integrated revenue collection system has provided an effective ground for collecting internal source revenue (Mccluskey & Doherty, 2018). The authors stated that there is a drastically reduction in revenue leakages and it also eliminates carbon paper under the LGRCIS, unlike under the manual system. The LGRCIS keeps an accurate revenue database to ensure that the tax bills and receipts issued through LGRCIS are more reliable than those issued previously through the manual system (Pellatt & Palfreman, 2023; Owens et al., 2019). The system also has the ability to detect tax defaulters and to take appropriate measures. However, the study could not point how taxpayers can access the usage of their tax by government through the LGRIS. Hence, taxpayers may not be willing to fulfil their tax obligations.

1.3 E-payment Systems and Revenue Collection

Kessy, (2019) carried out research about "the role of e-payment on revenue collection in Kinondoni Municipal, Dar es Salaam, Tanzania". Qualitative method was used to gather data from 77 respondents. The findings reveal that electronic-payment (e-payment) has increased tax compliance in the Kinondoni Municipal, Dar es Salaam,

Tanzania. It also indicates that e-payment has the ability to help tax administrator check revenue sources, and improve the financial accountability of the Municipal. Furthermore, the findings indicate that there is a linear relationship between e-payment and revenue collection as tax compliance is concerned (Okoye & Adesanya, 2021; Night & Bananuka, 2020). Notwithstanding the achievements pointed out in the study, poor connectivity, limited awareness, lack of technical assistance, poor experience of the technology by tax collectors, and unreliable power supply are stated as some of the challenges in Kinondoni Municipal, Dar es Salaam, Tanzania.

Chiamaka et al. (2021) investigated the "effect of electronic tax system on the internally generated revenue in the Nigerian emerging economy, using Ebonyi State board of internal revenue as the case in point". Quantitative cross-sectional survey was adopted as the methodology. The study reveals that among all the variables which include electronic tax registration, electronic filing of tax returns and electronic tax payments used in the research, the internally generated revenue in Ebonyi State and by extension, the Nigerian emerging economy is greatly affected by electronic tax registration and electronic filing of tax returns. The study further states that the implementation of the electronic tax has not brought much improvement to the Nigerian emerging economy. This is because the electronic system does not include functionalities such as Short Message Service (SMS) notification and Unstructured Supplementary Service Data (USSD) payment gateway to enable taxpayers who use electronic devices that do not support internet. Hence the electronic system that is employed is mainly internet based. It is suggested in the study that the Nigerian tax system should adopt a user- friendly electronic tax system to ease the electronic tax filing and payment system.

Sani et al. (2021) examine the use of information and communication technology to influence tax administration and tax compliance in Nigeria using a case-based approach. It is stated that the Nigeria tax system has not been able to perform up to expectation as a result of lack of stewardship among taxpayers, complex tax payment methods, lack of technical experience and poor database record keeping. The study indicates that investors can now pay their taxes to the governments through convenient and transparent electronic tax payment platforms, and tax authorities will be able to easily share information on a tax payer. This implies that the use of ICT in tax administration has typically increased the degree of tax compliance in Nigeria. While there are certain drawbacks such as system compatibility and automation, the benefits of using ICT in tax administration outweigh the challenges.

1.4 USSD Payment Systems and Financial Inclusion

Najib and Fahma, (2020) carried out a study about the adoption of digital payment in Indonesia. They employed Structural Equation Modelling with Partial Least Square (SEM-PLS) to test the hypotheses. The study established that the perception to use the digital payment relies on factors such as the ease of usage, its usefulness, attitude towards it and trust. However, the system has not considered the motivation by the competitors and customer pressure. The users of this technology are not also able to receive their money back in the cause of transaction failure when there is unstable digital connection. Also, Mallik & Twagirumukiza (2020) developed an application called "USSD Digital Wallet" using the agile approach in software development. This application was piloted on Africa Talking USSD simulator. With the help of this application the unbanked population in the underdeveloped countries was connected to bank and those already banking improved in their banking activities. It is stated in the findings that the implementation of the application has created convenience and financial security among the unbanked population in the underdeveloped countries. Nevertheless, a challenge on the use of this application is the digital illiteracy where many of the people in the underdeveloped countries do not have the basic skills to operate the digital devices (Azaare et al., 2024; Tiika et al., 2024; Jamil, 2021; Blažič & Blažič, 2020). Another challenge is the poor connectivity in developing countries. The application was piloted in some few countries and therefore may not work effectively when it is deployed to other parts of the African continent.

1.5 Online Accountability and Tax Compliance

This study is carried out from the perspective of the Technology Acceptance Model (TAM) and Game Theory Model of Equilibrium in Tax Compliance. According to Kiprono et al. (2023), many countries are now driving towards the introduction of electronic online filing of taxes by which the study was conducted in Kenya using positivist research paradigm and explanatory research design on an integrated tax system known as iTax system. The study was based on the Technology Acceptance Model (TAM) Theory and Game Theory Model of Equilibrium in Tax Compliance theory which determine the relationship between online tax system and tax compliance among online traders in Uasin Gishu in Kenya. It is indicated in the study that, there was low level of tax compliance as well as low level of perceived iTax security concerns and tax system stability. It established a positive correlation between perceived iTax security and perceived tax system stability with tax compliance which is indicated by the multiple linear regression coefficient (R2=0.863, <0.001). The researchers concluded that perceived security risks concerns and perceived tax system stability affect tax compliance among online traders in Uasin Gishu County. Based on the findings, they suggested that policy makers should consider the behaviour and interest of the potential iTax users to implement the electronic tax system.

Dedhia & Mair, (2023) carried out a research on the revenue usage tracking which they termed as TraceX was an application built over the blockchain technology. The findings of their study show that the TraceX application allows the taxpayers to make payment of their taxes online and also monitor how the tax authorities are using their taxes. The government can monitor the revenue usage by the various decentralized institutions. Upon the implementation of the blockchain- based tax tracking application in India, there is an increase in transparency, accuracy and efficiency, while it also reduced costs and fraud related activities in taxation and also creates a positive perception of taxpayers towards taxation (Adelekan et al., 2024; Pitić et al., 2019). A challenge in this study is that the TraceX application was developed over the blockchain technology which is more complex than other technologies used in system development. The application was developed and implemented in India and not in Africa and so Ghana as an African country still faces the problem of online revenue usage tracking.

Saptono et al. (2023) conducted a study on "quality of e-tax system and tax compliance intention". A cross-sectional survey method was used as the methodology to gather data for the research. The findings show that participants perceived service quality of electronic-filing services and perceptions of reduced compliance costs have a positive influence on users' willingness to comply with tax regulation. This implies that taxpayers are willing to comply with the tax directive if cost of compliance is reduced. However, the study points at the quality of electronic-filing and cost of compliance as the only factors influencing tax compliance but does not look at the motivation behind the tax usage accountability by authorities. It is more appropriate for the taxpayers within the local government jurisdictions to be informed on the financial plans of the district assemblies. This implies that they should have that right to access financial activities of the district assemblies. According to Nyiri, (2015) "The people who are taxed should know how their money is being used. Indeed, they have a right to demand for services from the government." Many district assemblies do not give attention to tax accountability hence encounter much tax evasion which makes them unable to meet their annual revenue targets (Addo, 2016; Fjeldstad, 2014).

1.6 Challenges and Innovations in Revenue Mobilization

It is revealed in the literature that some countries in the world have implemented electronic ways of mobilizing revenue. These electronic mobilization systems used by these countries have helped them to improve in their tax collection system. However, some few MMDAs excluding the Builsa South district assembly in Ghana have also adopted these electronic systems. Some of the major lapses identified in the electronic revenue mobilization systems used in Ghana as indicated in literature include the absence of SMS notification prompt, USSD payment gateway and ability of taxpayers to access the district budgets with their smart devices. Therefore, this study adopts iterative waterfall models which carries some benefits in software development including simplicity, feedback path and cost-effective (Al-Ashmoery et al, 2023; Flora & Chande, 2014; Moniruzzaman & Hossain, 2013; Bird, 2010) to design and implement an electronic revenue mobilization system that allow taxpayers to get SMS prompt, make payment via USSD and track the utilization of revenue of the Builsa South district assembly.

2. Methods and Materials

In this section, techniques and tools used in building the system are discussed. The information about the purpose of the study is also obtained and analyzed here. The systems development research methodology and iterative waterfall model of software development are employed in this paper because they emphasize on initial implementation, simplification and increasing system complexity as core functionality is updated until the desired final system is realized (Ali et al., 2024; Olorunshola & Ogwueleka, 2022; Cosmas et al., 2018; Venable eta al., 2017; Charanpreet & Vijay, 2015; Mahadevan et al., 2015; Stober & Hansmann, 2010, Nunamaker et al., 1990).

The systems development research methodology has five steps that the intended system development goes through which include constructing a conceptual framework, developing a system architecture, analyzing and designing the system, building the system, observe and evaluate the system (Venable et al., 2017). In the iterative waterfall model the software development is carried out in cyclical order so that all the steps repeated after one another. In the first place the software is developed on a small scale which follows all the steps sequentially. More features and modules are designed, tested, and applied to project next iteration. It is expected that every new iteration has more features than the previous iteration (Gharajeh, 2019). The software development is divided into certain stages such as feasibility study, requirements gathering, design, implementation, and testing as shown in Figure 1.

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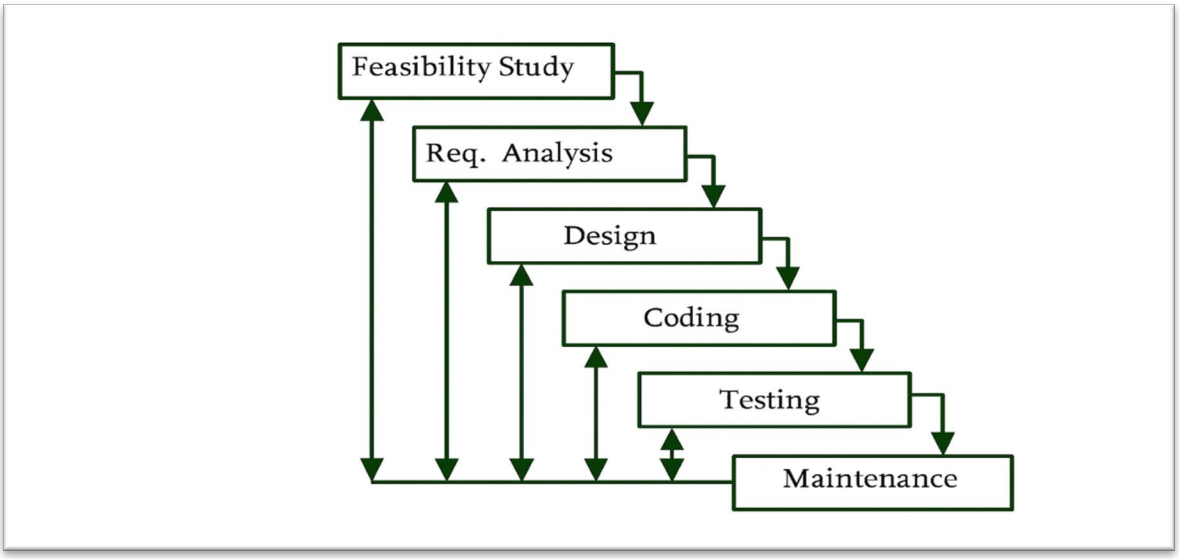

Fig. 1 *Iterative waterfall model*

2.1 Feasibility Study and System Requirements Gathering

Oral interaction with key stakeholders of the Builsa south district assembly was carried out to check on how possible it is for the district assembly to implement the intended system before the interview was administered to gather the system requirements. Some of the system requirements gathered include the ability of the system to notify tax payers when the time is due for tax payment, integration of USSD payment, the ability to register taxpayer, the taxpayer liberty to view the district budget online and among others.

2.2 Study Population and Sampling Techniques

The study targeted the staff of the BSDA and the taxpayers who pay tax to the assembly directly. Purposive sampling technique was adopted to sample the district assembly staff. This technique was used because the researchers needed specific information about tax collection in the district assembly which cannot be accurately provided by any other officer who is not directly involved in revenue generation in the assembly. Hence, this influenced the use of purposive sampling for selecting the district assembly workers for the study. With this technique, six (6) of the district assembly workers including, the Finance Officer, Revenue Officer, District Accountant, Internal Auditor, District Deputy Budget Analyst and Revenue Collector were interviewed. These officials were asked to provide responses on the functionalities of the proposed Electronic Revenue Mobilization and Utilization system.

On the contrary, convenient sampling technique was used to sample the taxpayers. Initially, simple random sampling was adopted but later realized that, a lot of the interviewees were not ready to respond hence this made the researchers to resort to the use of convenient sampling. Eventually, thirty (30) taxpayers in the district were interviewed to help attain the goal of this study.

2.3 Sampling Size

In all, thirty-six (36) respondents were selected as the sampling size for this study consisting of six (6) BSDA staff and thirty (30) taxpayers in the district. The caliber of the 6 district staff selected as indicated in section 2.2 was based on the fact they are the core actors in the district revenue collection. The researchers chose thirty (30) taxpayers because of following reasons: The district assembly did not have records on total number of taxpayers in the district as at the time this study was conducted. The assembly does not also have enough revenue collectors and the few are temporary staff. Most of the business owners did not agree to answer the interview questions. Though the researchers explained into details the purpose of the interview but they still stood by their decision not to be interviewed. The reason most of them gave was based on the fact that one politician has been talking about digitalization so they thought it was a way of introducing a new tax. Also, they complained that, the government introduced a lot of taxes in the year of this study which caused fear and panic. Consequently, from 1st March, 2024 to 15 May, 2024 the researchers were able to reach out to 30 taxpayers in the district.

2.4 Online Payment and Revenue Tracking Flowcharts

From Figure 2, when the user clicks on the system website, it requests for the user credentials. When the user enters the username and password as the credentials, the system checks to see if they are found in the database with the correct system user. If the username and password are correct the system displays the payment, report, taxpayers' list and other menus. If the credentials are wrong the system returns an error message as 'an invalid username or password' in which it allows the user to enter the credentials again. When the credentials are confirmed to be correct, the system allows the taxpayer to make payment by prompting him or her to enter the full name, amount to be paid, phone number and the Tax Identification Number (TIN). One Time Password (OTP) is sent to the taxpayer if he is a first time user. He enters the mobile money pincode to confirm the payment. The system sends a notification to the taxpayer to acknowledge payment received.

From Figure 3 on the other hand, when the user launches the system website, the first page requests for the user credentials. When the user enters the username and password as the credentials, the system checks to see if they are found in the database with the correct system user. If the username and password are correct the system displays the payment, report, taxpayers' list and other menus. If the credentials are wrong the system returns an error message as 'an invalid username or password' in which it allows the user to enter the credentials again. If the report is available the system permits the taxpayer to view it. If the district assembly has not uploaded the budget report the taxpayer can quit at that stage. This model permits the taxpayer to make suggestions about the report as feedback if there is any. If the taxpayer is satisfied with the budget report, then he or she can log out of the system.

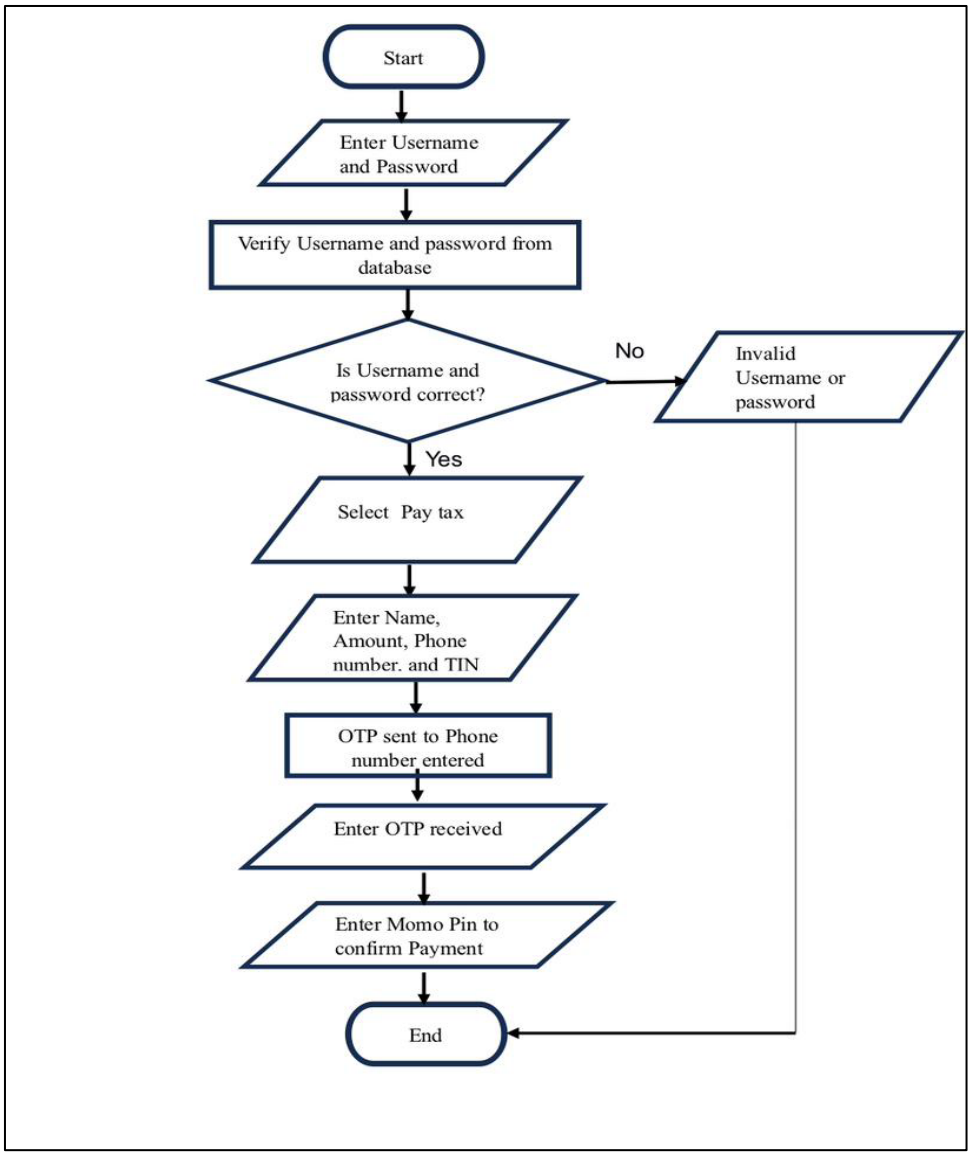

Fig. 2 *Online payment flowchart*

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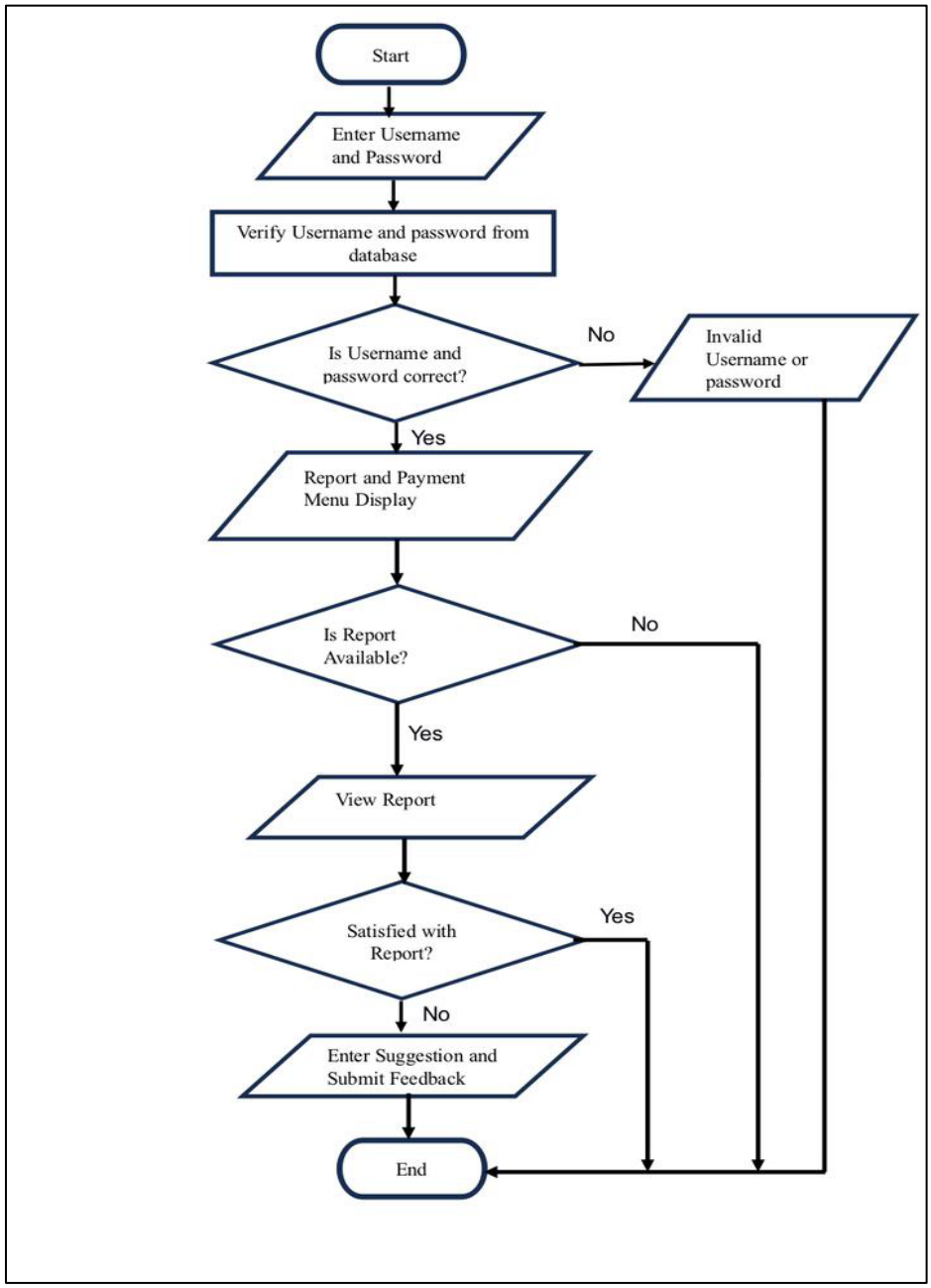

Fig. 3 *Revenue tracking flowchart*

3. Results and Discussion

In this section, data gathered from respondents on the system requirements is analyze and presented. Also, following the online Payment and Revenue Tracking Flowcharts shown in Figure 2 and 3, the system's functionalities and capabilities are discussed, among some which include its being user friendly and can run on several devices such as desktops, laptops and mobile phones.

3.1 System Requirements

From Table 1, twenty-four (24) respondents representing 66.7% of the total respondents were males and twelve (12) respondents representing 33.3% were females. Twelve (12) respondents representing 33.3% of the total respondents fell between the age ranges of 20-30 years. Seventeen (17) respondents (47.2% of the total respondents) were between the age of 31-40 years. 19.4% of the respondents with frequency of seven (7) fell within the age of 41-50 years and no respondent fell between the age range of 51-59 years or 60 years and above. This implies that most of the respondents were within the age of 31-40 years. The second majority were within 20-30 years.

Table 1 further indicates that, only one (1) staff representing 16.7% indicated SHS or O Level as the educational qualification as well as HND and 4 staff representing 66.7% of the respondent's indicated degree as their educational qualification. The data shows that majority of the key stakeholders in revenue generation in the district assembly are university graduates. It further shows that eleven (11) respondents as taxpayers representing 36.7 of the taxpayers interviewed completed SHS or O Level as their highest education, as well as the same number of the respondents had degree. Three (3) respondents out of the thirty (30) taxpayers contacted in the district had diploma as the highest level of their education representing 10% and finally, five (5) respondents out the taxpayers contacted representing 16.7% did not have any education background.

Table 1 *Demographic data of the respondents*

Responses	Frequency	Percentage (%)
Gender:		
Male	24	66.7
Female	12	33.3
Total	**36**	**100**
Age Range:		
20–30 years	12	33.3
31–40 years	17	47.2
41–50 years	7	19.4
51–59 years	0	0
60 years and above	0	0
Total	**36**	**100**
Educational Level (District Assembly Staff):		
SHS/O Level	1	16.7
Diploma	0	0
HND	1	16.7
Degree	4	66.7
Total	**6**	**100**
Educational Level (Taxpayers):		
SHS/O Level	11	36.7
Diploma	3	10.0
HND	0	0
Degree	11	36.7
None	5	16.7
Total	**30**	**100**

From Table 2, thirty-five (35) respondents representing 97.2% of the total number of respondents indicated that the district assembly is using manual means of collecting revenue while only one (1) respondent indicated that the assembly is using electronic means to collect revenue. This implies that the assembly sorely relies on a manual means to collect revenue. Therein, all the staff interviewed representing 100% of the six (6) respondents indicated that there are challenges with the manual means of collecting taxes in the district. Also, twenty-two (22) taxpayers contacted representing 73.3% of the respondents indicated that there are challenges with the manual means of paying taxes. 8 respondents representing 26.7% of the respondents said they have not seen any challenge with the current mode of collecting taxes.

Further on Table 2, illustrates that all the staff (100%) contacted indicated that the district assembly has not adopted any electronic system in mobilizing revenue in the district. This means that since the assembly started operation, it has not made any attempt to adopt any electronic system of mobilizing taxes. Therein, Thirty-five (35) respondents (taxpayers) representing 97.2% agreed that the district assembly should implement the electronic system of collecting taxes. Only one (1) taxpayer representing 2.8% feels that the district assembly should continue with manual means of collecting taxes in the district. Consequently, in Table 2, all the taxpayers interviewed indicated that they want to be notified by the system when the time is due for them to pay their taxes and also after payment through SMS. They raised the concern that most of them uses simple mobile phones which do not support internet and so may not be able to access email messages.

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Table 2 *Mode of revenue payment and collection by the district assembly*

Responses	Frequency	Percentage (%)
Mode:		
Manual	35	97.2
Electronic	1	2.8
Total	36	100
Manual Revenue Collection Challenges (Assembly Staff):		
Yes	6	100
No	0	0
Total	6	100
Manual Revenue Challenges (Taxpayers):		
Yes	22	73.3
No	8	26.7
Total	30	100
Adoption of Electronic System by Assembly before the Study:		
Yes	0	0
No	6	100
Total	6	100
Implementation of the Revenue Mobilization and Utilization System:		
Yes	35	97.2
No	1	2.8
Total	36	100
SMS Notification:		
Yes	30	100
No	0	0
Total	30	100

Moving forward on revenue transparency and accountability, the data presented in Table 3 shows that all the thirty (30) taxpayers contacted wish the system allows them track the usage of taxes they pay to the assembly. Also, on the question of whether taxpayers will like to make suggestions to the district assembly on the pressing needs in their locations, twenty-seven (27) of them representing 90% said they would like such functionality of the system while only three (3) of them representing 10% said it is not necessary for the system to have such functionality. Besides, all the thirty (30) taxpayers contacted in the district agreed that if the system allows them to track the usage of their taxes, it will improve transparency and accountability as illustrated on Table 3. Moreover, in Table 3, the thirty (30) taxpayers were asked to indicate whether tax transparency and accountability will motivate them to pay their taxes regularly and unsurprisingly, all them strongly agreed that when the assembly is transparent in using the revenue collected, it will motivate them to pay taxes.

Table 3 *Improvement in revenue transparency and accountability by the system*

Responses	Frequency	Percentage (%)
Revenue Usage Tracking by Taxpayers through the System:		
Yes	30	100
No	0	0
Total	30	100
Suggestions by Taxpayers through the System:		
Yes	27	90
No	3	10
Total	30	100
Revenue Transparency and Accountability:		
Yes	30	100
No	0	0
Total	30	100
Impact of Revenue Transparency and Accountability on Tax Payment:		
Yes	30	100
No	0	0
Total	30	100

3.2 Components of BSDARMS

In this section, we employed the Iterative water fall model guided by the study's flowcharts, to develop the Online Revenue Payment and Tracking systems required by targeted users as broken down with the components below;

3.1.1 Landing Page

From Figure 4, the URL; http://builsa-south-district-assembly.com/ is the system website when clicked on will take the user to the landing page. This page displays two main menus which are the admin login and taxpayer login. The user chooses to click on admin login as an administrator which takes him or her to the administrator's homepage. If the user clinks on the taxpayer's login, it takes him or her to the taxpayer homepage.

Fig. 4 *General login page*

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3.1.2 Administrator's Login Page

In the system administrator login page, buttons such as username, password, login, sign up and forgot password are displayed as shown in Figure 5. The administrator enters the correct registered credentials to log into the system. If the administrator's credentials are not registered, he chooses to sign up to register them. The administrator is taken to administrator's homepage if he enters the correct credentials. The system allows the user to recover password if he forgets the correct password. The administrator can also choose to exit if he is not willing to interact with the system.

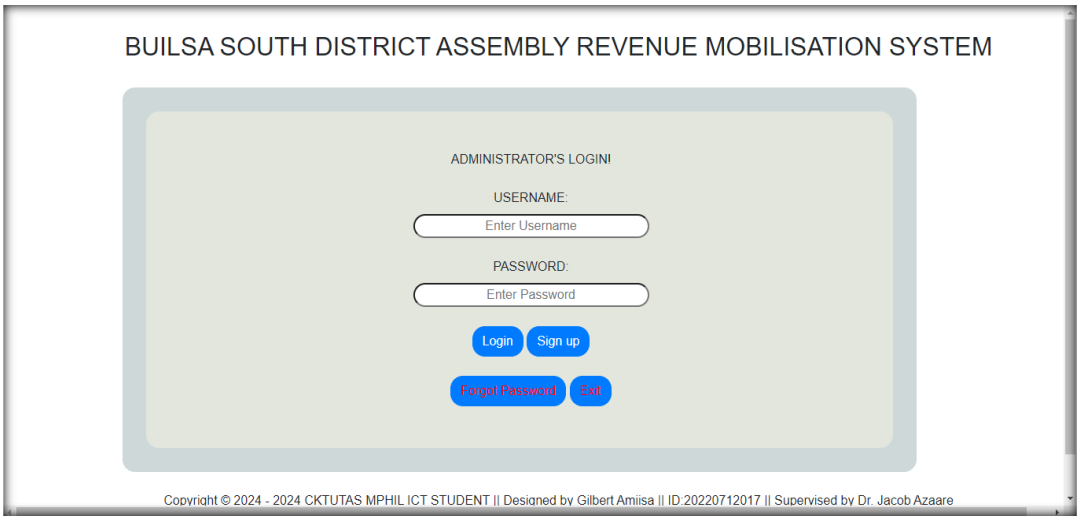

Fig. 5 *Administrator's login*

3.1.3 Admin Homepage

This is the interface that the system administrator is taken to if he enters the correct login credential. The BSDAMS welcomes the administrator with this interface which contains menus such as home, staff, report, taxpayers and logout. When the administrator chooses to click on the staff menu it takes him to the staff registration menu. Clicking on either the report or taxpayer menu will take him to their interfaces respectively. The administrator can also logout if he chooses to do so. These menus are displayed in Figure 6 below.

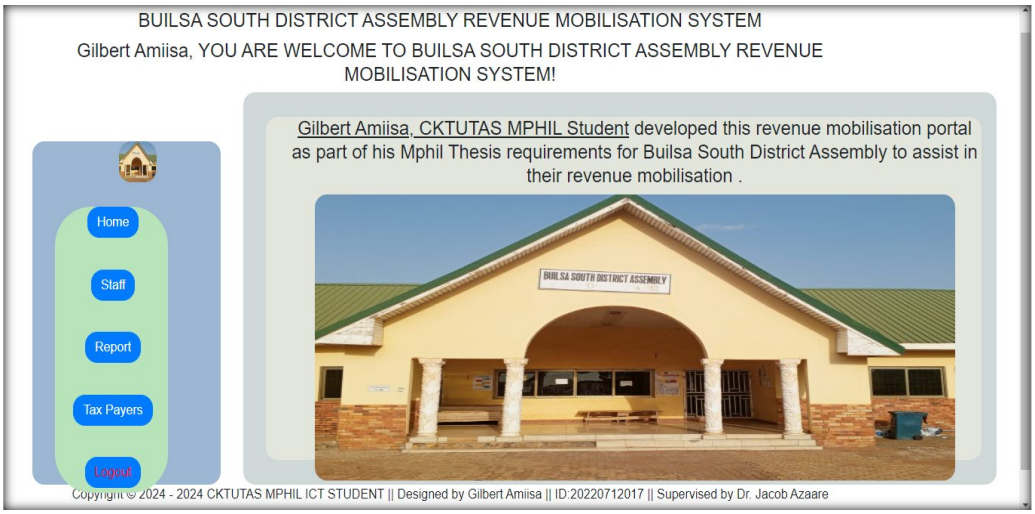

Fig. 6 *Admin homepage*

3.2.4 Upload Report Page

The administrator or staff clicks on the report menu to upload the district assembly annual budget as the report. The buttons contained in this page include report reference, title of the report, report description and file of report. The administrator or staff plays the following roles in the report page. Upload report: The system allows the administrator or staff to enter the details of the annual budget of the assembly when the correct details are keyed in, the user clicks on upload report details to complete the report upload. Report view: The administrator or the

staff is able to view the uploaded report. The report is automatically downloaded as a PDF file. Update report: The system permits the administrator or taxpayer to make changes to the report when there is the need. Delete: This category of the system users are allowed to delete reports on the system if those reports are not of relevance. All these functionalities of the system are illustrated in Figure 7.

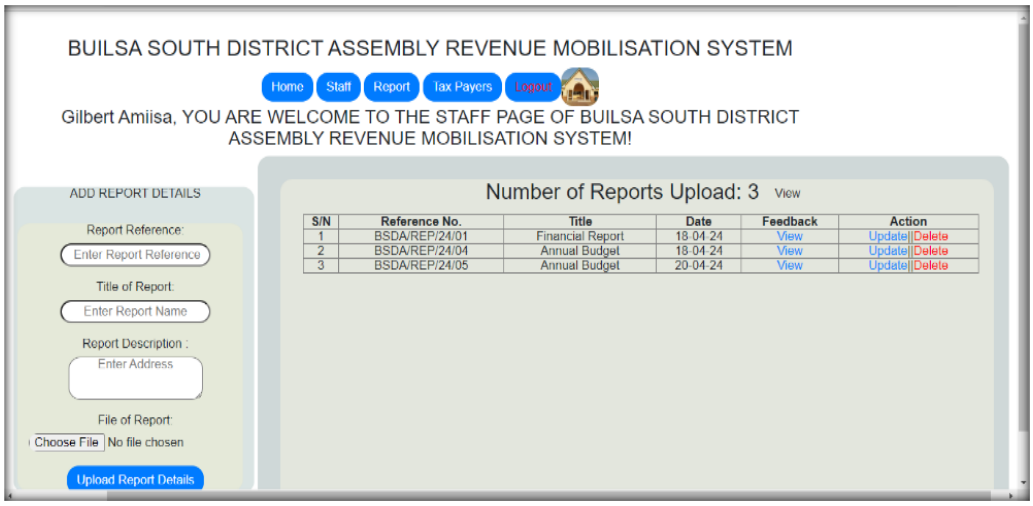

Fig. 7 *Report upload*

3.2.5 Taxpayer Login Page

The taxpayer login page contains buttons such as username, password, login, sign up and forgot password which are displayed as shown in Figure 8. The taxpayer enters the correct registered credentials to log into the system. If the taxpayer's credentials are not registered, he or she chooses to sign up to register them. The taxpayer is taken to taxpayer's homepage if he or she enters the correct credentials. The system allows the user to recover password if he or she forgets the correct password. The taxpayer can also choose to exit if he or she is not willing to interact with the system.

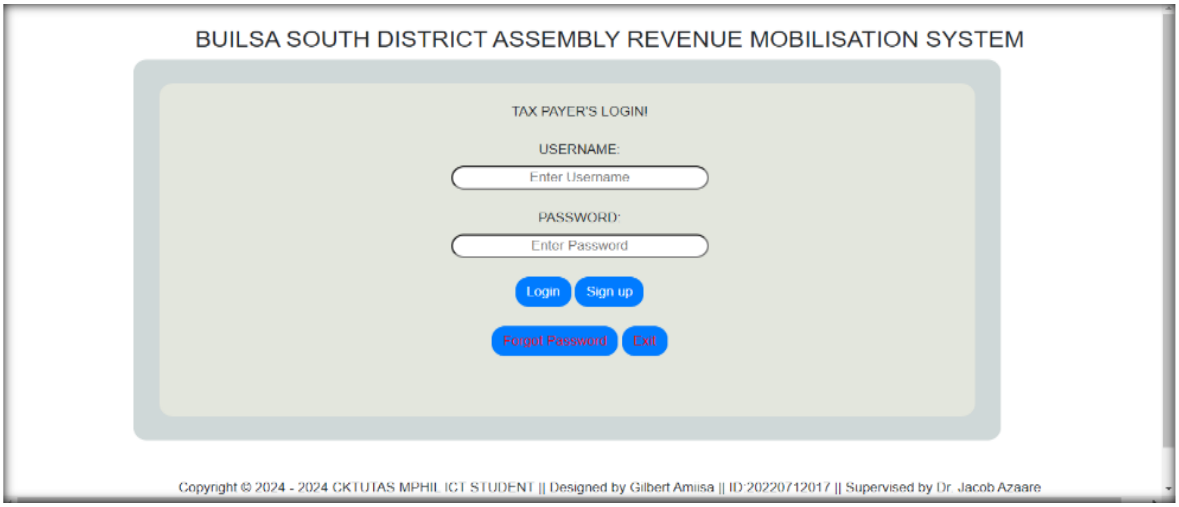

Fig. 8 *Taxpayer login*

3.2.6 Taxpayer Homepage

The taxpayer homepage displays the details of a registered taxpayer. Some of the details displayed include the TIN, the full name, gender, name of business, telephone number and among others. They can choose to make payment at the homepage as well as update their profile photo as shown in Figure 9.

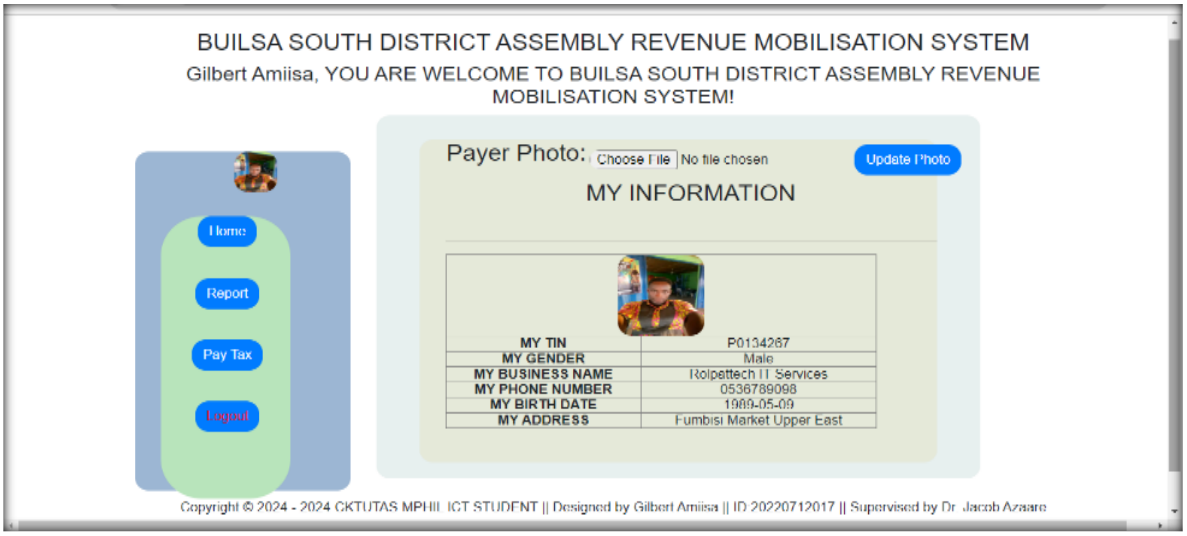

Fig. 9 *Taxpayer homepage*

3.2.7 Taxpayer Report View Page

In this page, the taxpayer is allowed to view the annual budget reports uploaded by the BSDA onto the system. When the taxpayer clicks on report in the taxpayer homepage, another login page called view page where he or she can view the budget reports and make suggestions is opened. When the taxpayer clicks on view, the report is automatically downloaded as a PDF file. If the taxpayer chooses to make suggestions about the report, he or she can click feedback as shown in Figure 10.

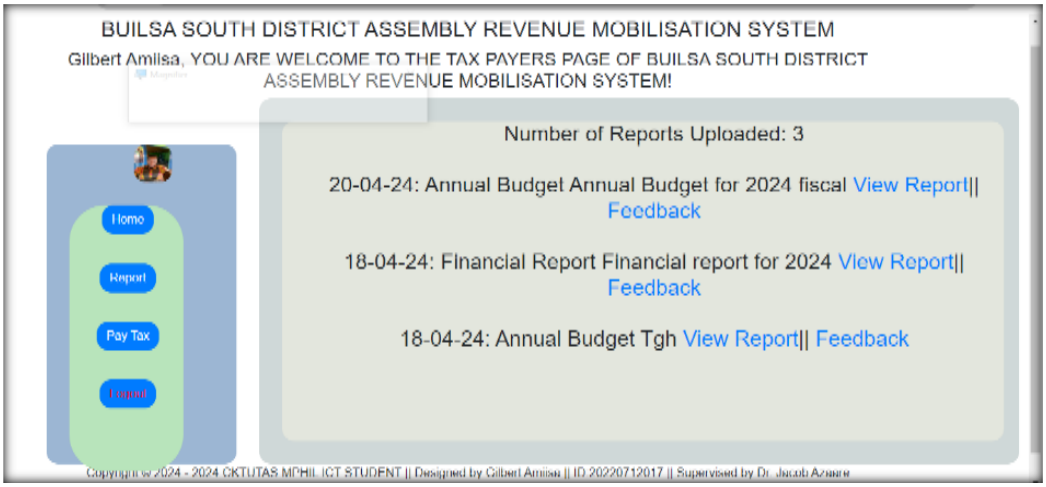

Fig. 10 *Taxpayer report view*

3.2.8 Taxpayer Suggestion Page

From Figure 11, the taxpayer suggestion page contains the report feedback details which include the report reference, title of the report and textbox. The taxpayer after viewing the activities and items captured in the annual budget report may want to make a suggestion on some pressing issues within the Builsa south district. The BSDARMS allows the taxpayer to make that suggestion in the textbox provided in the suggestion page as indicated in Figure 11 and clicks on the submit feedback button to complete the process.

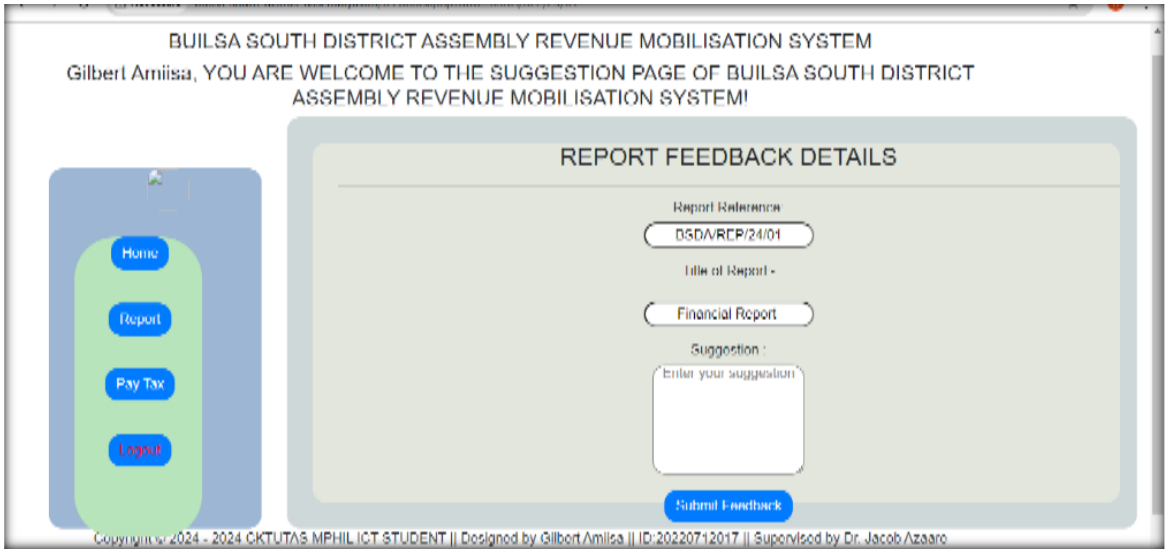

Fig. 11 *Taxpayer suggestion box*

3.2 USSD Payment

The BSDARMS allows taxpayers who are registered on the system to make payment at their comfortable zone by just dialing the short pin code *920*142# with any kind of phone whether a smart or a simple keypad phone. This opens a pop-up menu where the taxpayer is given two options in which the user can make tax payment or check the amount of tax due him or her as shown in Figure 12. When the user chooses an option, the system asks him/her to enter the correct TIN and amount due to make payment via his mobile money wallet where a prompt would be displayed on his or her mobile phone requiring him or her to enter the mobile money wallet pin code to complete the transaction. However, a situation where the taxpayer enters a wrong TIN, the system detects it as invalid pin and allows him/her to reenter the pin. The taxpayer can also cancel the process after dialing the short code *920*142# if he or she is not willing to continue as illustrated in Figure 12.

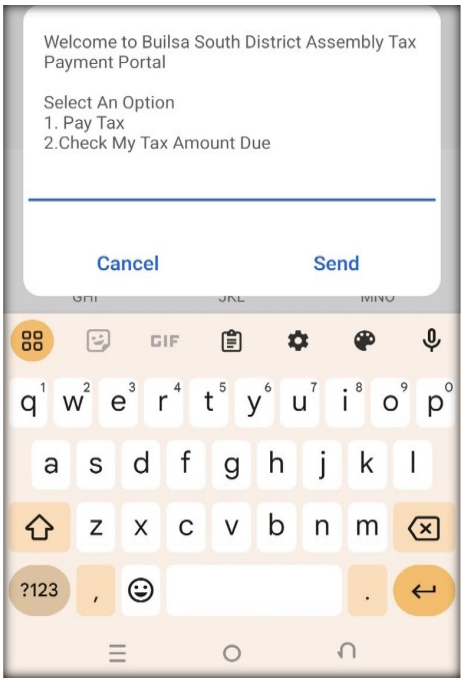

Fig. 12 *USSD payment process*

4. Discussion

This paper aims to design and implement an online electronic tax payment system for the Builsa South District of Ghana and to help taxpayers track the utilization of their revenue online by employing the iterative waterfall

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models. The developed system called BSDARMS is user friendly in which users just need to search for the URL and click on and they will have access to log in. The system helps the Builsa South district assembly to create a secured database for taxpayers within its jurisdiction. Interview with the district assembly revealed that most businesses and properties within the district are not registered at the assembly and so do not fulfill any local tax obligation. The reason for not making much effort to register these businesses is that, the assembly has a limited number of revenue collectors and the few that are available are temporal staff. The implementation of this system serves as a motivation to the assembly to register businesses and levy them to make a periodic payment as taxes to help meet its annual budget target which will push the district towards a rapid development. The electronic system would help the district assembly to cut down the cost involved in hiring the services of temporal revenue collectors as compared to the findings of Kairu et al. (2017) which state that the effect of ICT deployment on the operational performance of KRA has been the minimization of administrative cost. The management information system adopted by KRA was compatible with other systems and flexible in helping to improve the performance of employees but did not statistically add a significant contribution to the KRA revenue target since the system did not make it possible for taxpayers to redeem their tax obligation through it as compared to this study. The system developed in this study allows taxpayers to pay their taxes through it and monitor the activities of the district assembly.

BSDARMS has the potential to reduce revenue linkage in the revenue generation process since it eliminates the carbon paper and human face is also reduced. It is able to send notification to taxpayers via SMS and they are also able to make tax payment through USSD without necessarily going to the revenue collection points. This result is consistent with (Mccluskey & Doherty, 2018) in which LGRCIS was adopted by Arusha City in Tanzania to collect revenue. However, LGRCIS has the potential to issue receipts and bills to taxpayers in reliable manner than the manual system and also track tax defaulters.

Furthermore, this paper could help taxpayers to track the utilization of their revenue and generate reports of the annual budgets online which intends to improve transparency and accountability in the district assembly tax system. Perfectly, BSDARMS allows the taxpayers to access the annual budgets prepared and uploaded and also able to look at the activities outlined in the budgets in which transparency is enhanced. The taxpayers in the Builsa South district are able to hold tax authorities responsible for any financial mismanagement. This helps to build financial trust between taxpayers and the district assembly administration and the central government as a whole. This finding is in line with (Dedhia and Mair,2023), where taxpayers and central government are able to monitor the financial activities of the decentralized institutions.

Moreover, BSDARMS is a taxpayer inclusive platform where the taxpayer has the opportunity to communicate to the district assembly online. The system allows taxpayers who use smart phones or computers to make suggestions about the usage of taxes collected by the assembly where pressing needs in the various communities in the district are made known to the assembly without involving human movement. This helps to elevate tax compliance in the tax system as found in (Agyekum et al., 2023) where tax compliance depends on compliance cost, tax complexity, educational level, income level and tax usage. Generally, this study will help to improve transparency, accountability and tax compliance since the human interference is minimized hence, helps the district assembly stands the chance of meeting its revenue targets for developmental projects.

4.1 Comparative Analysis of BSDARMS, LGRCIS, and iTax Systems

To situate BSDARMS within the broader digital tax landscape, Table 4 provides a comparative analysis with Tanzania's Local Government Revenue Collection Information System (LGRCIS) and Kenya's iTax platform.

Table 4 *Comparative analysis of BSDARMS, LGRCIS and iTax systems*

Feature	BSDARMS	LGRCIS	iTax
Platform Type	Web-based and USSD-enabled system	Web-based municipal tax collection platform	National online tax system
Target Users	District-level taxpayers (individuals, small businesses).	Local taxpayers within municipal councils.	Individual and corporate taxpayers across the country.
Accessibility	Accessible via web browser and USSD for non-smartphone users.	Web-based; access limited to users with internet.	Internet access required; no USSD or offline support.
Payment Integration	Mobile money via USSD (*920*142#) and OTP confirmation.	Manual and some electronic payment integrations.	Bank, M-Pesa, card payments; no offline payment support.
Taxpayer Interaction	Taxpayers can access budget reports, provide feedback and suggestions.	Limited taxpayer engagement beyond compliance.	Provides tax return filing, payment history, status checks.
Transparency and Accountability	High: taxpayers can view uploaded district budgets and track tax usage	Moderate: helps prevent leakages but lacks visibility into revenue utilization	Low: limited insight into how taxes are used post-payment
Security Features	Login with OTP, future integration of encryption and role-based access planned.	Centralized access; security mechanisms not explicitly documented.	Password-protected accounts with secure data handling.
Offline/Unbanked Support	Yes – USSD support allows inclusion of users with basic phones.	No – Requires internet-enabled access.	No – Limited to internet users with banking access.
Revenue Usage Monitoring	Yes – taxpayers can view and assess how revenue is utilized	No – no public access to revenue allocation or usage	No – does not support revenue usage tracking
Unique Strengths	Transparency, taxpayer feedback, offline payment via USSD	Eliminates manual leakages, supports municipal internal control	Centralized control, automation of national tax processes

4.2 Security Analysis of BSDARMS

The Builsa South District Assembly Revenue Mobilization System (BSDARMS) is designed to handle sensitive taxpayer data and facilitate financial transactions through electronic means. Given the nature of this data, system security is a critical concern to ensure user trust, prevent fraud, and maintain data integrity. The security framework of BSDARMS can be examined through the two points below:

- Two-Factor Authentication (2FA) is implemented for payment processes using One-Time Passwords (OTP) sent via SMS.
- Role-based access control (RBAC) is enforced, ensuring that only authorized users (e.g., admin vs. taxpayer) can access certain system functionalities

4.1 Conclusion and Recommendations

This research has been successfully conducted based on the interaction the researchers had with the system users and the literature reviewed which led to the development and implementation of an electronic revenue mobilization and utilization system for revenue collection in the Builsa South District assembly of Ghana, known as BSDARMS. Through empirical evidence, the study has demonstrated a positive correlation between the system's implementation and revenue generation. Upon the implementation of the electronic system, there is the possibility that the assembly's revenue collection and financial performance would be enhanced. Additionally, this research will improve the transparency and accountability in the taxation processes in the district leading to the motivation of taxpayers to fulfil their tax obligations in the district. This will actually build and strengthen the trust between the district assembly and taxpayers in the district if implemented.

Furthermore, the significance of the study is seen in its contribution to the development and implementation of electronic revenue mobilization and utilization system. This significance is derived as a result of the combination of the benefits of USSD technology and tracking of tax usage. It also paves the way for increasing tax compliance rate and streamlining revenue mobilization processes. Through the trial of the system, conclusion can be drawn that this approach not only ensures greater revenue generation potential for the district assembly but

also fosters a more transparent and efficient revenue mobilisation process. The taxpayers are able to make electronic payment of their taxes and also track the usage of the taxes by BSDA, it is suggested that future researchers should consider developing a robust system which would permit an automatic deduction from the taxpayer's mobile money and bank accounts in case the taxpayer fails to pay his or her tax when due.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *A.G., J.A.;* ***data collection:*** *A.G.;* ***analysis and interpretation of results:*** *J.A., Z.W., G.M.E.;* ***draft manuscript preparation:*** *A.G., B.J.T. All authors reviewed the results and approved the final version of the manuscript.*

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