

An Integrated Mobile Technology System to Aid Fees Payment in Tertiary Institutions

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Abstract:- Educational institutions in Ghana have many students who pay all types of fees through cash deposits, cheques or bank drafts to their institutions' accounts in their respective banks. These techniques for paying fees have not been productive enough, particularly during assessments when many students have topay fees to meet the prerequisites for registering for their semester courses. Students sometimes travel significant distances to respective bank offices to make payments; this problem is compounded by long queues and clog at banks where payments are made. This has consistently brought about students missing their deadlines to enrol for their semester courses. In default, a penalty is paid when the system is reopened after the deadlines. The purpose of this research is to design a system for paying fees online by students and their sponsors. The software was implemented by utilizing Android Studio for Android application development, Pay Switch for payment gateway, Application Program Interfaces (API) for getting information from the database and Visual Studio for creating API. Software testing was in addition to checking the module of the structure to guarantee that they are totally working and permitted users of the software to connect with it using test information. The results demonstrated that a lot of students were satisfied with the new system of paying fees online through mobile phones. The study recommends that institutions should adopt new mobile technologies to facilitate payment of fees.

Keywords:- Fees payment system, Mobile payment system, Pay Switch, traditional payment system.

I. INTRODUCTION

Technology has made everyday human activities more convenient in the twenty-first century, and it continues to look for methods to improve living conditions. When it comes to the innovation and advancement of new technology, the subject of payment for products and services has not been overlooked. The need for easy and convenient payment systems have brought about innovations and the use of mobile payment technology.

On the term "mobile payment", Stamatis and Fraunhofer (2004) opine that it is an arrangement in which a

cell phone is used to start, initiate, and confirm a money transfer or transaction. Similarly, Ghezzi et al. (2010) define mobile payment as a means of making a payment using a mobile phone, such as a cell phone, PDA, or any other remote-enabled device to safely handle a money-related transaction via an adaptable framework or through methods for various remote headways (NFC, Bluetooth, RFID, etc.). In a similar vein, Dahlberg et al. (2008) see mobile payment as an instalment for products, administrations, and bills with a cell phone exploiting remote and other correspondence advancements.

Mobile payment technology, which was first adopted by a small number of Asian countries such as Japan, Indonesia, and South Korea, has since spread to Europe, North America, South America, and Africa (Hayashi, 2012; Prime Indexes, 2018). Mobile payment is utilized for a wide range of activities in advanced countries such as the United States of America, Japan, and several European countries, including the purchase of airline tickets, football match tickets, online shopping, bill payment, and so on. Jan and Yves (2007).

Mobile payment technology has benefited from the advancement and spread of mobile network operators, banks, smart phone manufacturers, and numerous internet services. Ghana, being a developing country looking to benefit from global technology, adopted it in a variety of ways in the early 2000s, the most common of which was mobile money (Nonor, 2009).

Ghana's banking sector, in collaboration with the network communication industry, is always working to develop mobile payment systems, based on the growing use of smart phones and other Mobile Devices (MD). Similarly, in the educational sector, a number of tertiary institutions have adopted mobile payment technologies and are working hard to make financial transaction processes as simple as possible (MPT). Different mobile payment systems have already been introduced to eradicate troubles that accompany traditional payment methods.

Despite the advancement in technology, most students in Ghana still go through many atrocities to pay fees. Some students have to travel from one town to another just to pay their fees into a given account at a specified bank. Others have to spend hours in queues before they can make

payments. Such situations sometimes make some students fall under the mercy of thieves and fraudulent people who take their monies away. The sad reality is that some students miss out on academic registrations and other rights as students because their payment couldn't reflect on time (Osei, 2012).

In most current fees payment systems, it takes time for payments to reflect and allow students to do various registrations if it is attached to fees payment. Though some mobile payment technology has been introduced in tertiary schools in Ghana, the technology users continue to face challenges such as long waiting, internet jamming, network failures, and mobile wallet problems (Dahlberg, Mallat, Oorni, 2003; Osei, 2012).

This study attempts to examine present payment frameworks in order to identify their pitfalls in light of making relentless efforts to deliver a sustainable solution to the problems left unaddressed. Besides, a new system addressing the pitfalls identified in this study will be developed to facilitate fee payment, especially in tertiary institutions.

The use of a cell phone to conduct a payment exchange in which money or resources are sent from a payer to a collector through a middle party or directly without a representative is known as mobile payment. (Mallat, 2007). Also, it is utilized as the crossing point of both banking and telecommunications services. As indicated by Zutt (2010), mobile payment includes an electronic cash account that can be gotten to by means of mobile phone. Because of the all-encompassing nature of this definition, one should note that there is a clear difference between mobile payments and portable banking.

On a cell phone, mobile payments are completed with a flexible Visa or an adaptable wallet (Dahlberg, Mallat, Ondrus, and Zmijewska, 2008). Payments become simpler, more secure, and quicker with mobile payment (Dahlberg, Mallat, Oorni, 2003).

Mallat, (2007) stated that the across the board utilization of mobile devices and its never-ending vicinity to the clients make them appropriate for mobile payment situations without the requirement for a physical wallet. Undoubtedly, the introduction of the mobile payment service promises to fill the vacuum left by the traditional payment methods. Mobile payment is strategically in emerging economies to empower people and businesses without bank accounts to easily carry out financial transactions. Because of its vital role in accelerating economic development, mobile payment technology is critical in the development agenda (Chou, Lee & Chung, 2004; International Telecommunication Union, 2013).

The existing payment systems in Ghana can be classified into two categories namely: traditional payment system (TPS), and mobile payment system. The traditional payment follows a rigid regime where people have to physically carry cash from wherever they are to the point of transaction. Then again, the mobile payment system is an improvement on the TPS; physical cash is converted into

electronic form. Once it is in electronic form, it can be used to transact business irrespective of the location of business or type of business.

This system also gives users more flexibility and ease when conducting business. However, Long queues, theft, and robbery and travelling cost remain as challenges encountered by students and institutions in making payments (Osei, 2012).

These mentioned challenges may be solved if there is a levelled ground that links all the telecoms operating mobile money payment systems. That is to say that a system that will interconnect the various mobile networks and the traditional banking system is highly needed. Therefore, this study focuses on creating a single secured platform that will interconnect all the multiple telecoms operating mobile money payment systems and the traditional banking in Ghana and allow for quick e-cash transfers across many networks. The new platform also aims to make transfer procedures as fast and secure as possible in order to facilitate payment.

A. Theoretical framework

The Financial Innovation theory proposed by Nightingale and Spears (2010) provides the theoretical frameworks for this research. The financial innovation theory is a process carried out by an institution that involves creating, promoting, and adopting new products, platforms, and technologies that introduce new or different ways of carrying out a financial activity (Nightingale and Spears 2010).

According to (Tufano 2003), financial innovation incorporates, however, not restricted to decrease in exchange cost, moving and sharing of dangers, liquidity the executives and upgrade, improving credit age and accessibility, resource and obligation the board and protection. It was further put into four primary builds by Llewellyn (1992). These include defensive, aggressive, responsive, and protective. Defensive is receptive to the government's guidelines and approach and other budgetary establishments like the national bank. Aggressive, on the other requires making new budgetary items that money related organizations accept can be effectively advanced and sold. When a financial institution creates a new instrument or service request in response to a change in a customer's portfolio, this is referred to as responsive. Finally, when establishments' portfolio imperatives force them to acquire new technologies or instruments, they must be defensive. However, as Torkelli (2014) pointed out, financial innovation has unique characteristics that must be considered if development forms techniques are to be properly designed, managed, and implemented. People, budgetary and non-monetary structures, government, markets and trades, and innovation-related organizations are all part of Financial Innovation.

The financial innovation model is relevant to this research because it involves the use of technology to introduce new ways or changes in financial transactions which is the focus of this research.

B. Mobile Payment System

Mobile Payment Technology is viewed by different scholars from various perspectives. According to Regina et al. (2015), mobile payment service (MPS) entails the use of cell phones, such as a mobile phone, PDA, or wireless tablet, that are connected to a mobile telecommunication network to initiate an exchange, such as a buy solicitation, and to complete an exchange by approving payments for the trading of goods and services. Hoofnagle et al. (2012) took a similar approach, seeing it as payments done using remote devices such as mobile phones and smartphones. Vassiliou(2004) defines it as a method in which a cell phone is utilized to complete a transaction payment. It is where mobile phone is used to affirm a cash move or a transaction (Stamatis and Fraunhofer, 2004).

According to Ghezzi et al. (2010), mobile payment refers to a transaction that is coordinated using a mobile device (cell phone, PDA, or any other remote enabled device) to safely set up a budgetary trade via a portable system or by ways for various remote innovations (NFC, Bluetooth, RFID, etc.). Dahlberg et al., (2008) consider mobile instalment to be the payment of things, administrations, and bills using a mobile phone and other communication push. Furthermore, Jan and Yves (2007) defined mobile instalments as remote financial motivation trades beginning with one assembly and progressing to the next using a mobile device whose physical structure can transform from a cell phone to any remote engaged device (for example, a PDA, PC, keyring, or watch) that can securely handle a cash related trade over a remote system.

The customer, the seller, the dealer's money-related organization (acquirer), and the customer's monetary

foundation-Issuer are the four basic bodies that make up the mobile payment system (Isaac and Zeadally, 2014). Mobile phone administrators use wired, wireless, or cell correspondence innovations such as General Packet Radio Service (GPRS), Enhanced Data Rates for Global System for Mobile interchanges (GSM) Evolution, High-Speed Downlink Packet Access (HSDPA), and other advancements to make connections that connect the issuer and the acquirer (Isaac et al., 2010).

In a broader sense, a mobile payment system may also include a dealer and a payment gateway as auxiliary components that provide intermediary services for payment clearance between the acquirer and the issuer on the system. The client (payer) and the merchant (payee), who execute with one another via the mobile payment procedure, are the fundamental gatherings in the mobile payment conspire, according to Stamatis and Fraunhofer's work Mobile Payment: an excursion through existing methodology and normalization activities (2004). The procedure involves mobile network operators (MNOs), financial sector institutions (such as banks, credit card organizations, and payment processors), the government (legislative and regulatory requirements), and device, software, and service suppliers (Stamatis and Fraunhofer, 2004).

Furthermore, telecommunications (telcos) will provide mobile money via telecommunications companies' cell phones. Telcos also serve as a conduit between banks and mobile money suppliers, offering services such as converting electronic currency to physical cash and physical cash to electronic cash (CGAP, 2009).

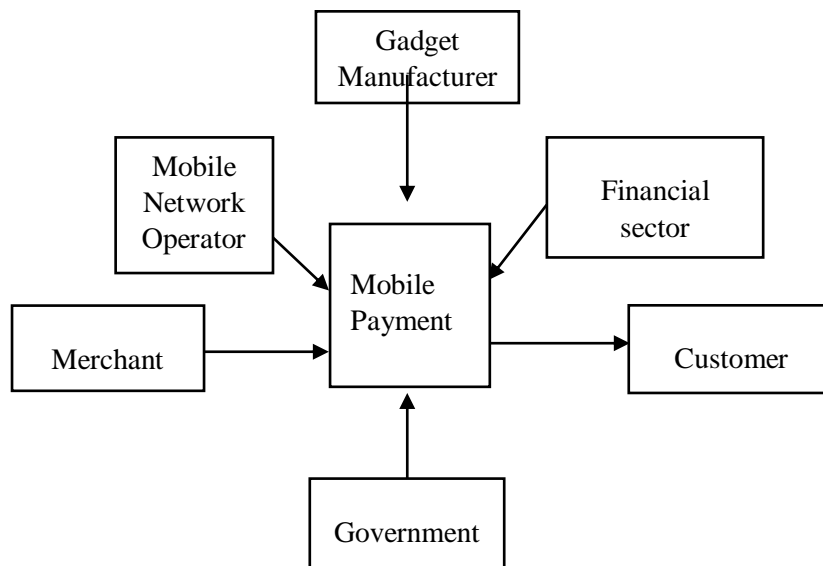


Fig. 1: Players of Mobile Payment

Source: Stamatis and Faunhofer (2004) (Edited).

A merchant, sometimes known as an agent, is a person who is permitted to register consumers for mobile money services. The agent also uses the mobile money platform to receive delivery of disbursement for products and services,

as well as cashing in and cashing out to customers. The customer, on the other hand, is someone who has opened an e-cash account, either at home or at a non-business location, and who does not have access to e-cash items and services such as money in and money out, reserve funds, and bill

payment, among other things (Njenga, 2009; Harris, Guru, & Avvari, 2011).

The mobile network operator is another important participant in the mobile installation. Ghana as a nation has different mobile network operators. These include MTN Ghana, Vodafone Ghana, and Airtel Tigo Ghana. All mobile networks operate mobile money, and individuals decide the kind of network to join. There is competition among mobile network operators and each trying to impress its customers to stay on the network (Oodan, 2014).

The government, as a player of the mobile money payment, supports the operations of the network operators and has policies for them to follow. The legislature has provided the mobile money interoperability framework for their operations. The framework is to do away with the troubles and burdens that happen doing transfer over the different mobile money networks in the nation (myjoyonline report, 2018).

The financial sector also works hand in hand with mobile money network operators. The financial sector is the regulatory body that regulates how the mobile network operators should operate and sets of guidelines to be followed. The financial sector regulates income flows in the mobile money sector. This body is essential because they monitor how all the network operators function and ensure they follow the guidelines set for operations.

The device manufacturers also play a significant part in the mobile money payment system. The manufacturer has designed the devices for easy use that has supported mobile money operations. Individual phones support one or more networks that aid the subscription of mobile money accounts by the individuals. The individual with two (2) mobile networks can decide to join both networks and use their mobile money platforms, such as MTN and Vodafone. The manufacturers also design the phones nicely to attract customers (Charle Golvin, 2007).

The success of Mobile Payment Technology partly rests on the availability of mobile devices. Boyd and Jacob (2007) stated that "Mobile offers the most widespread and inclusive means of accessing the internet and digital technologies, which are vital to the Ghanaian economy and its growth in an increasingly connected world". Mobile

phone penetration key to Ghana's digital transformation - GSMA report", 2017). Mobile devices are the tools for carrying out mobile payments. The important role that mobile devices play in MPS draws out the need to explore their existence in Ghana as far as the success of the MPS is desired in the Ghanaian economy. The class of cell phones may fuse cell phones, tablets, and individual electronic associates.

C. Research Objectives

The study is intended to achieve the following.

- To find out the level of awareness and acceptance of mobile payment systems.
- To allow students to pay fees using mobile money into their respective school bank accounts.
- Create a mobile single-window application that allows students to pay their school fees.

II. METHODS

This study adopted design science research. Design science research focuses on the creation of artefacts. It entails the creation of new artefacts with the goal of addressing humanity's needs. Because this study aims to create a payment-facilitating artefact, design science research is the best method to use. The design science approach outlines the procedures required to create a product in line with the study's goals. To put it plainly, the structure science procedure makes and assesses IT artifacts planned to work out recognized issues (Hevner et al., 2004). This method entails eliciting information from multiple end-users, which leads to the creation of the necessary documentation. This document also lays the groundwork for the creation of a complete payment system technological architecture.

The design science process paradigm is depicted in Figure 2. It describes the flow of knowledge and processes involved in creating an effective design that is in line with the research's goal. The following are some of the tools needed to meet the research's design goals:

- Android Studio is a tool for creating Android apps.
- PaySwitch for payment gateway
- Application Programme Interfaces (APIs) for fetching data from the database
- Visual Studio for developing APIs

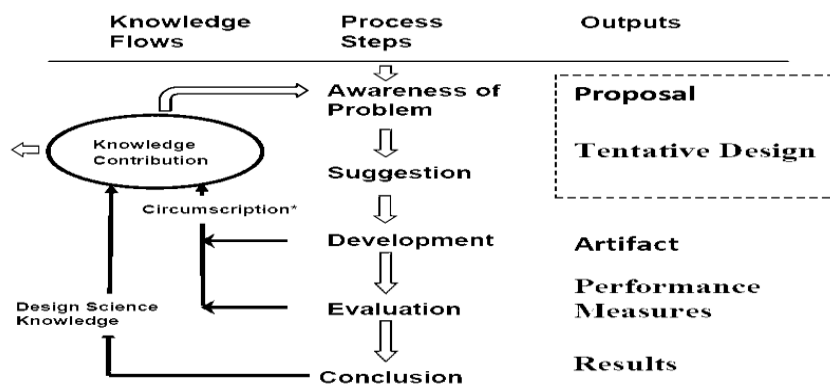


Fig. 2: Design Science Research Process Model

The study's participants are divided into three groups. Students and parents make up the first category, while institutional players such as school districts, churches, and companies make up the second. Finally, the mobile telecommunication service providers that operate mobile money services make up the third group. One hundred seventy-four (174) respondents were chosen via casual sampling.

The questionnaire was the primary tool for gathering information. According to Kumar (2005), a questionnaire is a written list of questions, the responses to which are

recorded by respondents. The questionnaire helps to obtain reliable information and eliminates biases and the influence of the researcher (Issaka et al, 2020).

III. RESULTS

Data were analyzed using tables and figures. The findings from the data analysis served as the basis for the development of a new mobile payment system (MPS). The research sought to find out the awareness status of the respondent on the use of MPS, and their responses are analyzed in figure 3.

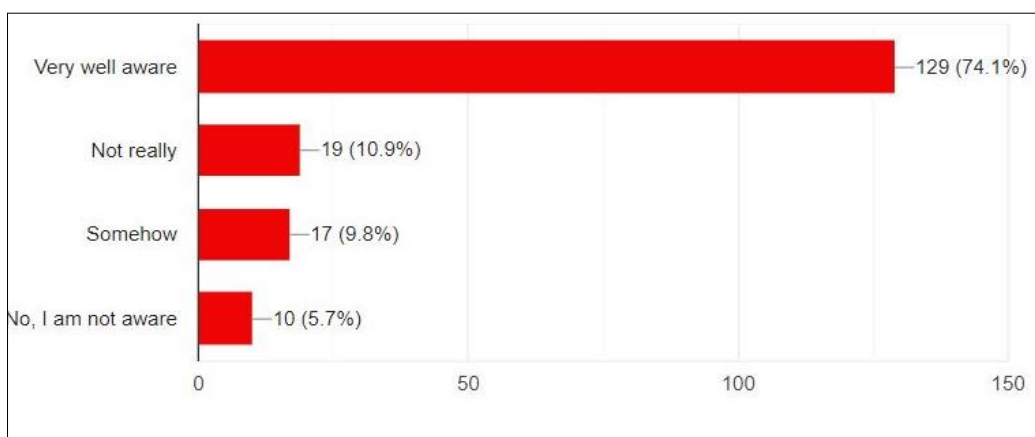


Fig. 3: Mobile payment system awareness

Figure 4 shows the awareness status of respondents on MPS. Out of the 174 respondents, 129 (74.1%) were very well aware of MPS, while only 10, representing 5.7%, were unaware of MPS. This shows that most of the respondents

are aware of MPS. These agreed with GSMA report (2017) when they indicated that mobile phones for diverse activities are widespread in Ghana.

| Usage | Count |
|--|------------|
| Online Purchase, Transfer Money | 1 |
| Pay bills, Transfer Money | 2 |
| Top-up Credits | 14 |
| Top-up Credits, Online Purchase | 2 |
| Top-up Credits, Online Purchase, Pay bills, Transfer Money | 37 |
| Top-up Credits, Online Purchase, Transfer Money | 36 |
| Top-up Credits, Pay bills | 1 |
| Top-up Credits, Pay bills, Transfer Money | 15 |
| Top-up Credits, Transfer Money | 55 |
| Transfer Money | 11 |
| Grand Total | 174 |

Table 1: Mobile Payment System Usage

The table above displays the different ways that the respondents use MPS. The respondents indicated that they use MPS for Top-up Credits, Online purchases, Pay bills, Transfer money or a combination of these services. It can be inferred from the table that the majority use MPS just to Top-up credit and transfer money. However, only 9.2% of

the total sample used MPS for payment of school fees. These shows that respondents use MPS for diverse transactions because Payments through MPS become more straightforward, more secure, convenient and quicker (Dahlberg, Mallat, Oorni, 2003; Frederick, 2018).

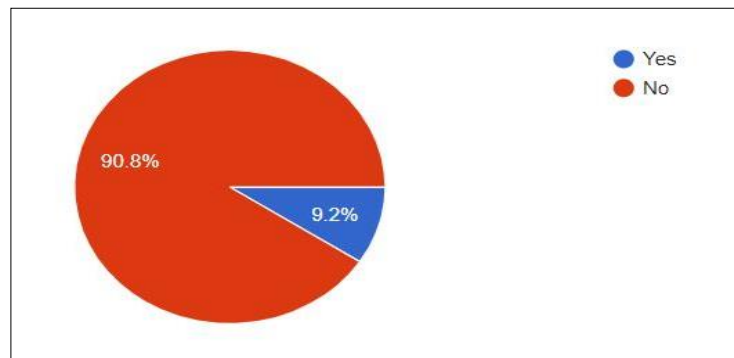


Fig. 4: Mobile payment system usage

It is important to note that even though most of the respondents (90.8%) have not used MPS to pay fees, the majority of them (78.2%) indicated that they have the desire

to use MPS to pay their school fees. Their desire to MPS might be because it is simpler, more secure, and quicker (Dahlberg, Mallat, Oorni, 2003).

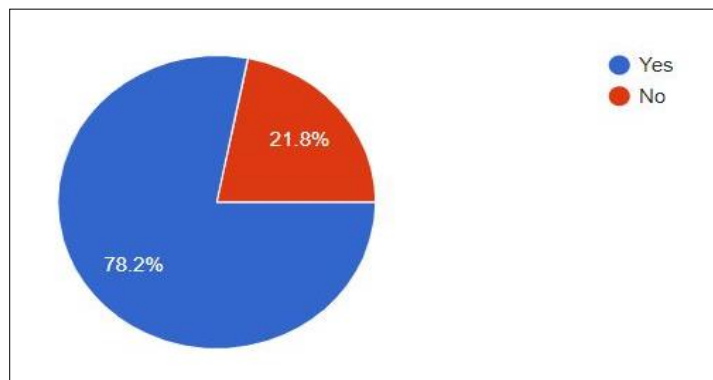


Fig. 5: Desire to use MPS for fees payment

Out of the total sample, 78.2 wish to use MPS to make fees payment, only 21.8% do not desire the MPS to pay school fees. This shows a high level of acceptability in the usage of MPS in paying fees. Respondents in charge of collecting fees in the various educational institutions were asked to indicate their preference system for managing payments, and their responses are displayed in figure 6.

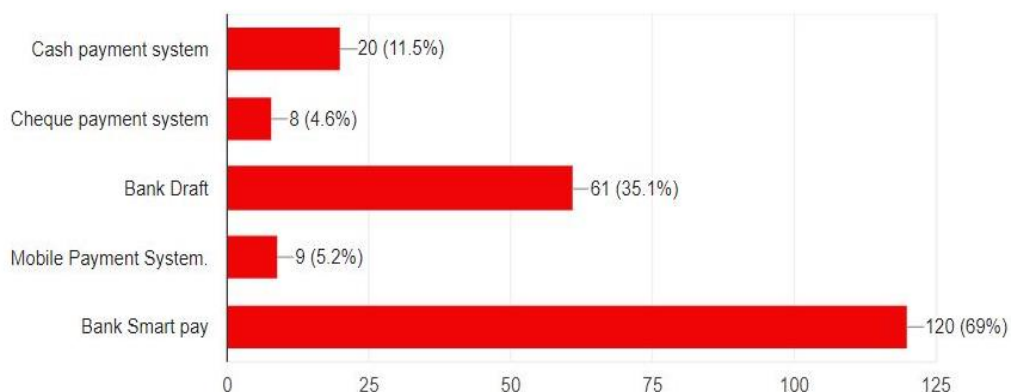


Fig. 6: Payment preference by institutions

Figure 6 shows that only 9(5.2%) of the respondents indicated that their institutions prefer MPS as a payment method. It could be observed that 69% of the institutions preferred bank smart pay. These may be since the institutions do not trust the current MPS in Ghana. It might also result from challenges such as internet jamming, network failures, and mobile wallet problems (Dahlberg, Mallat, Oorni, 2003; Osei, 2012). It is, however, surprised

that as high as 20% of the respondents still want payment of fees through cash with the advancement of technology.

It is surprised to note that most respondents accept the use of MPS payment method for fee payment. The chart below buttresses this statement.

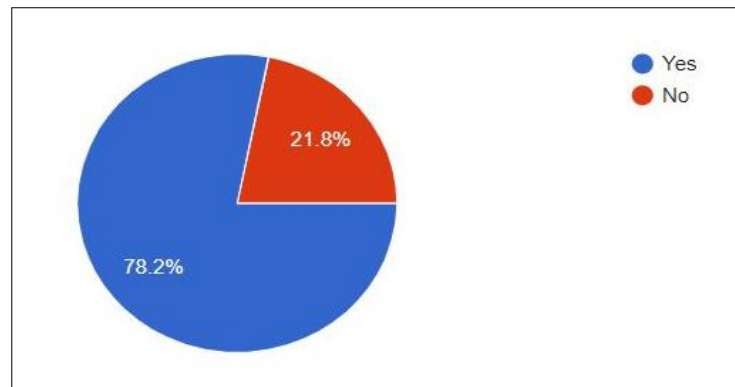


Fig. 7: Payment preference by institutions

78% of the respondents prefer their institutions to use or accept MPS payment methods for fees payment.

In summary, the analysis of the collected data reveals less usage of the MPS payment method for fees payment. Whilst clients wish to use MPS, and institutions have less trust in it hence do not accept it wholly. One way to solve this problem is to develop a more secured MPS and a comfortable graphical user interface for both the institutions and the clients.

The remaining part of this section concentrates on the system analysis and design of the proposed MPS.

a) System Model

The design research is divided into two (2) components in this section. The first section covers the implementation of the system's concept as well as a variety of concerns. The second section also covers the testing and evaluation of the developed artefact. There are four basic process models in the fees payment system. The process model for paying fees into a bank account, the user to the vendor to the telecommunication process model, the user to the bank via the system process model, the banks to the institution process model, and the user to bank through the system process model. The process models are depicted in the diagram below.

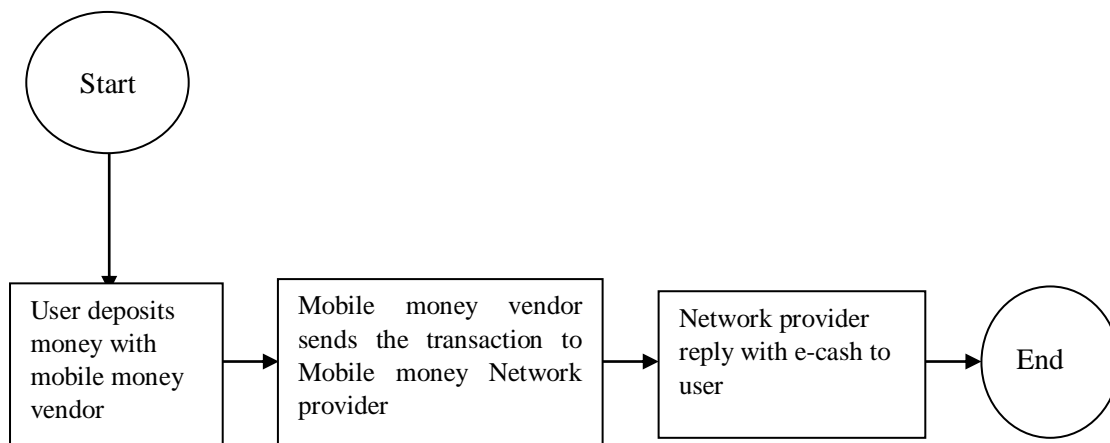


Fig. 8: The User to the vendor to the telecommunication process model

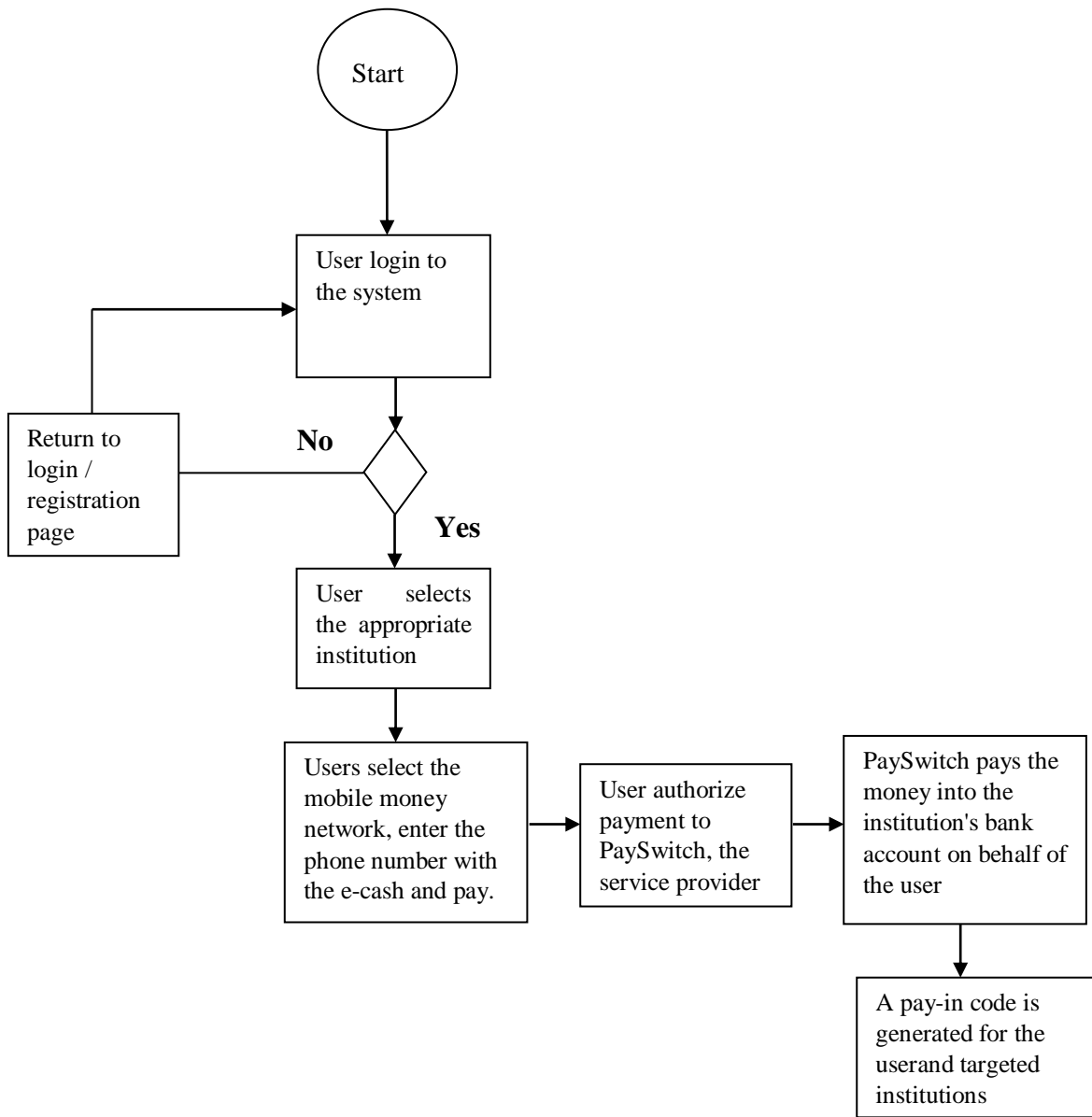


Fig. 9: User to bank through the system process mode

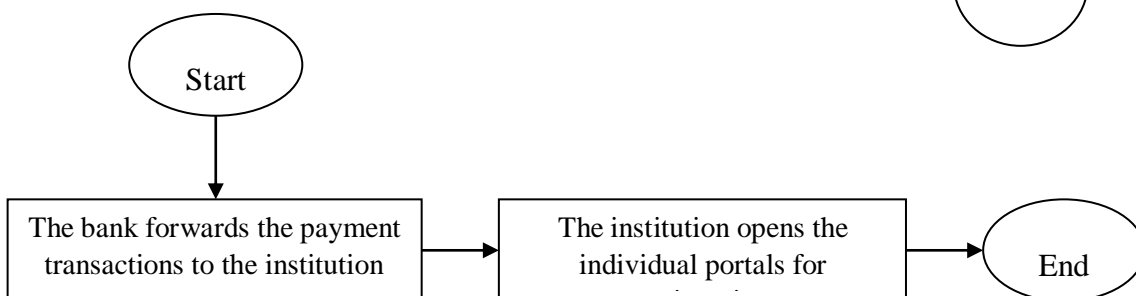


Fig. 10: Bank to the Institution process model

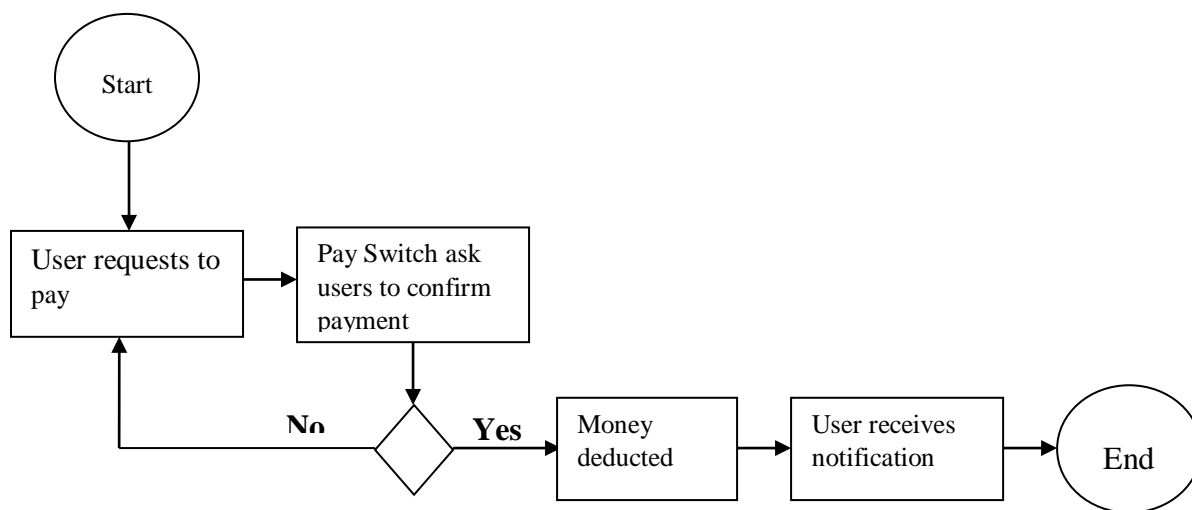


Fig. 11: A process model for paying fees into a bank account

a. SchPay Home Page

SchPay is the name of the fees payment mechanism. Users can find their tertiary institutions, such as universities, technical universities, and education colleges, on the SchPay main page. The user then moves on to the following page, where they choose the right school, such as Gimpa. The SchPay home page also has tabs (links, news) that provide access to information.

b. Verification Page

Before moving on to the following page, individuals can prove their identity on the verification page. Any data entered that is not in the database for verification would be rejected by the system. This is to verify that those who utilize the system are qualified to do so.

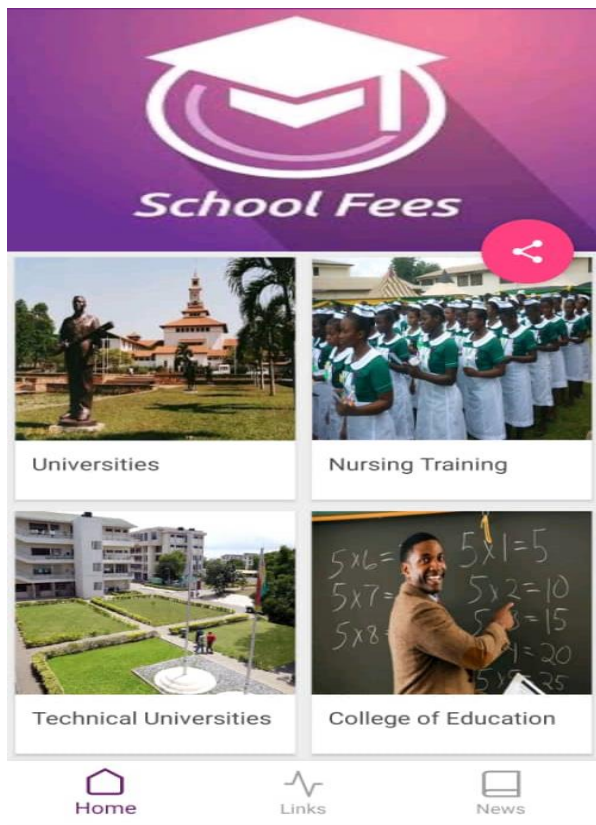


Fig. 12: An image of SchPay Home page

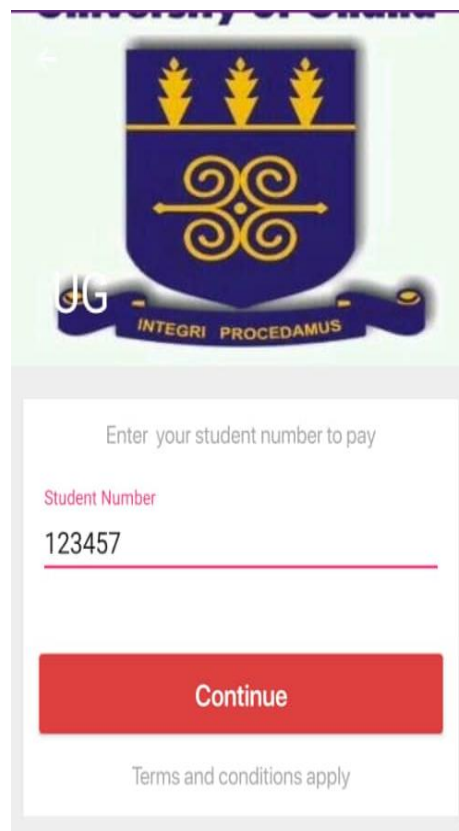


Fig. 13: An image of Verification page

c. Institution Page

The institution page is a user interface that allows them to choose the proper university or institution. This page enables the user to select the exact institution to which they belong and wish to make a payment.



Fig. 14: An image of the Institution page

d. Payment Page

The name of the user making the payment, the ID number, the program of study, the level, and the amount owed are all displayed on this screen. It features a column where the user can type in their preferred payment amount.

inputs the payment information, such as the network, phone number, or card number, and proceeds to pay.

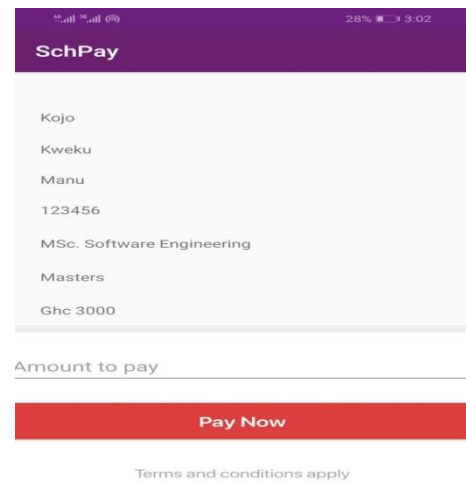


Fig. 16: An image of the Transaction page

f. Authorization Page

The authorization interface prompts the user to authorize payment by entering the mobile money PIN to deduct the amount entered in the transaction page from the PaySwitch account.

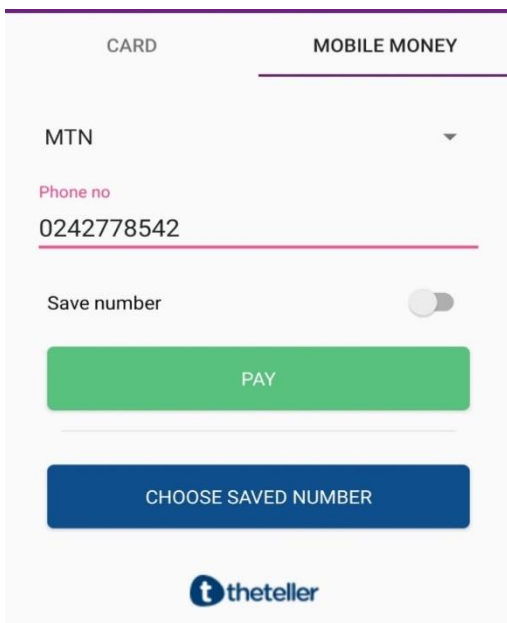


Fig. 15: An image of the Payment page

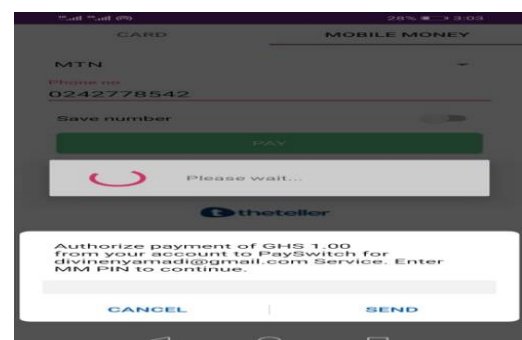


Fig. 17: An image of Authorization page

e. Transaction Page

PaySwitch is the service provider on the transaction interface. The user can pick between mobile money and card as a payment method on the screen. As a result, the user

g. Notification Page

A notification is a message that informs the payer of the transaction's status and encourages them to save the transaction receipt for future reference.

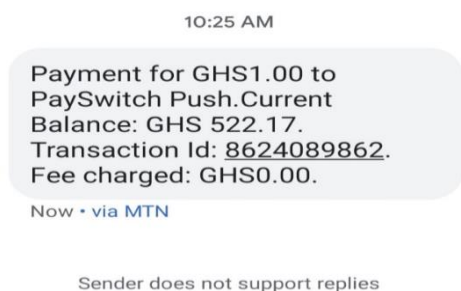


Fig. 18: An image of the Notification page

b) Implementation

The system was made possible by utilizing Android Studio to create an Android application. Because Android Studio was created exclusively for Android, it was utilized to speed up development and create the highest-quality app for all Android devices. In addition, PaySwitch was integrated into the system. The PaySwitch is a payment gateway that allows customers to make payments from their mobile money accounts as well as accept card payments.

Application program interfaces (APIs) were used to get data from the database and display it for users in the

system. By receiving requests and returning responses, APIs enable communication between applications and databases. The APIs in the system were created using Visual Studio. The tools and resources listed above were employed to implement the system in order to ensure a secure, convenient, and successful fee payment method.

After the framework had been properly coded, testing was carried out. Before incorporating any of the framework's modules, they were all double-checked to ensure that they were fully functional. This was accomplished by thoroughly inspecting each unit; each component was examined to ensure that it met the specifications and worked as expected. The completion of each individual unit provided a clear path for conducting integration testing. Diverse framework components were combined to form a comprehensive framework, with mix testing to ensure that the modules were compatible and could be coordinated to form a complete operational framework.

The system was assessed using the financial innovation framework, which offered recommendations for developing technology that allows users to pay school tuition using mobile money regardless of their location. The solution was evaluated based on the stated goals of creating a secure, convenient, and effective mobile single-window application platform for school fee collection. Table 2 shows the evaluation's findings.

| Requirements | Strongly Agree | Agree | Not Sure | Disagree | Strongly Disagree |
|---|----------------|-------|----------|----------|-------------------|
| The system verifies user input. | 25% | 75% | - | - | - |
| The system allows the selection of appropriate institutions for fees payment. | 35% | 63% | 2% | - | - |
| The system accepts data inputs. | 16% | 79% | 5% | - | - |
| The system allows mobile money payments on transactions. | 21% | 79% | - | - | - |
| Authorization is allowed in the system during payment. | 10% | 90% | - | - | - |
| The system provides proof of payment for each transaction. | 16% | 84% | - | - | - |
| The various interfaces are user friendly and easy to use. | 16% | 79% | - | - | - |

Table 2: Acceptability of the new mobile fee payment design

Table 2 shows that most of the respondents ranging from 63% to 90%, agreed to the various items implying that they have accepted the new model for payment of fees. It is only 5% and 2%, respectively, that the new system accepts data inputs and allows the selection of appropriate institutions for fees payment.

IV. CONCLUSION

The strong acceptance ratings support the notion that the software implementation successfully achieved the numerous research objectives. Previously, consumers had to travel a considerable distance to certain banks to deposit school fees into their institutions' bank accounts. However, with this new model, consumers can conveniently pay fees using mobile money, which people generally accept for making long-distance payments. The goal of this project was to create an online fee payment system. The SchPay model

was developed, tested, and evaluated with real clients. They can pay their fees using this online fee payment system.

V. RECOMMENDATION

- Educational institutions should take advantage of the new payment mode to make payment of fees easier and convenient to their students.
- A lot of training and sharpening efforts should be put in place so that the framework's clients have enough information.

- It is acknowledged that security poses a threat to all frameworks, and as a result, the most significant effort is dedicated to maintaining the security of online exchanges through the establishment of a robust security infrastructure.
- Governments and financial institutions should pass legislation and make agreements that encourage and facilitate online payments by country citizens.

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