

Development Of A Multilingual System To Improved Automated Teller Machine Functionalities In Uganda

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Abstract— This paper presented a new multilingual language for Automated Teller Machine (ATM) in Uganda which serves as an extension to the existing Languages. The existing ATMs have only English, Kiswahili and Luganda as the only available languages. Hence, findings revealed that there are still some prevalent languages e.g. Ateso language that are widely spoken among the people of Uganda which the present ATMs in the country have not captured. The objective of this paper was to propose the integration of the new language (Ateso language) to the existing languages. In this paper, a new language was adopted when it was realized that some people especially in the Buganda region could not manage to interact with the ATMs because they were illiterate. The developed multilingual system prototype was tested using some empirical data and was found to successfully imitate ATM transactions in the local Uganda languages. The results of the study supported the positive impacts on customers that reside in the rural areas since its improved interaction of more users on the ATMs. This paper demonstrated the use of Ateso language for different transactions on the ATM system. The implementation by the banking institutions can aid the ATM users to make more flexible decisions on the usage of the ATM machines.

Keywords— Automated Teller Machine, Multi-lingual and Unified Modelling Language.

I. INTRODUCTION

Initially when Uganda just adopted the automated teller machine (ATM) technology, the ATMs could operate using only two languages which is the English language and Kiswahili. Later as time went on, the banking sector realized that some people especially in the Buganda region could not manage to interact with the ATMs because they were illiterate. This later led to the introduction of another language to the ATMs in order to enhance the use of the ATMs.

The official language in Uganda is English. However, an average percentage of about 27.5% of the country's population does not understand English [1]. Furthermore, Ugandans prefer to communicate using their native languages or in one of the three dominant languages. Uganda is not the only country with many tribes and languages in the world. There is diversity of languages and cultures in many countries in the world. This is a pertinent contextual issue that should be taken into consideration during technology development in

order to facilitate the adoption and good usage of any technology.

In order to extend the banking services with the aid of the ATMs to most people in the country, there is need for the adoption of multi-lingual ATMs that use languages that can be interpreted by most people including those in rural areas. The existing ATMs use only English, Kiswahili and Luganda which some people cannot read and/or speak so this led to the inability to operate it [2].

Currently most ATMs in Uganda operate using only English and Luganda languages. Uganda has 56 different tribes, using different languages, with the major ones being English, Kiswahili, Luganda, Ateso, Runyankole, Acholi etc. Most of the people who come from Eastern Uganda do not speak Luganda but are well conversant with Ateso. Since the banking sector covers many parts of the country including Teso region, and because of the population of the Teso, there is need to extend banking services to them in a language that can be best interpreted by the locals in the area.

According to the ATM Industry Association (ATMIA), the number of ATMs worldwide in use was projected to be 2,249,497 as at the end of 2010 and it was predicted to be 3,195,880 at the end of 2016 [3]. ATMs are economical and efficient means of higher productivity as they yield greater productivity compared to human tellers. ATM makes an average of 6,400 transactions as compared to human teller with an average of 4,300 transactions. ATM is not affected by human fatigue as ATM continues to operate when human tellers have stopped working [4]. Barclays bank installed the first ATM in UK, and ever since, most banks in the world have embraced and installed ATM. Standard Chartered was the first bank to install an ATM in Uganda [4]. With all the advantages of ATM, there are still some disadvantages, such as long queues, card retention, little or no knowledge of how to operate an ATM machine, fraudulent transactions are easy to make, limited language in accessing the machine.

ATM installations are categorized into two, namely On-premise and Off-premise. The On-premise ATMs machines are more innovative, more expensive and can perform more than one function which makes it to have the abilities to be able to complement the capabilities of a bank's branch. The Off-premise ATMs machines are inexpensive and cannot perform more than one function at a time and they are mostly needed to dispense cash by financial institutions [5].

The banking sector in Uganda is growing increasingly high and the demand to provide flexible and improved services is also increasingly high. Currently Uganda is housing over 25 Banks including Microfinance institutions that offer banking solutions to Ugandans, there has been a steep growth in the number of ATMs from only one in 1997 to about 250 currently, with the number projected to grow as banks roll-out more branches and off-side ATMs currently thought to have risen to over 500 as of today both onsite and offsite locations.

Components of the ATM system consist of the following devices: central processing unit (CPU) magnetic or chip card reader, keypad, secure crypto-processor, monitor like screen, touchscreen, camera such as webcam, printer and cash vault. The CPU that resides in the ATM machine is to regulate the graphical user interface and transaction devices. The magnetic or chip card reader is to recognize the customer debit/credit card inserted into the ATM machine. Secure crypto-processor is used for key generations and for security purpose on the ATM machines. The touchscreen is used to choose various aspects of the transaction on ATM machines.

Customers are recognized by putting or inserting an ATM card that has magnetic stripe or chips which entails the unique number and other safety features like CVVC OR CVV and expiration date. Verification is granted once the individual enters the Personal Identification Number (PIN). With the ATM, customers have access to credit card cash advance, cash withdrawals, buy prepaid airtime and also account details. When ATM withdrawals are to be made at a different location in other currency (i.e., when you want to withdraw South African rand from an account that contains Nigeria naira), the currency are exchanged at bank rates. Consequently, ATMs offers the most likely pocket friendly exchange rate for international travelers. ATMs are called different names in different countries e.g., in America, it is called Automated Banking Machine, in United Kingdom, it is called Automated Transaction Machine or Cash Point, Auto

Teller or Cash Machine in Scotland and Pass Machine in Ireland.

A multi-lingual system for ATM is a presentation of an ATM in multiple languages inside the banking enterprise. It's going to offer customers with the opportunity of selecting the language they are familiar with from the predefined languages for executing their transactions. That is unlike the present ATMs that communicate in English and Luganda languages. The prototype developed in this study takes into consideration the numerous stages of literacy of customers. Below are the users interface characteristics which might be improved to better meet user needs: ease of use, potential to make choices and simplicity of communication. A number of the user interface characteristics are not taken into consideration in the contemporary ATM systems. For this reason, the proposed system addresses the following that have been observed as the drawbacks of the present ATMs:

Co-official languages: variations in language are not considered in the present ATM applications. For instance, the ATM affords interplay well in the English and Luganda languages which makes it hard for non-English and non-Luganda speakers to use the ATM. Many banks do not put into consideration significant portions of their customers who would want to make use of their mother tongue or co-official language for their transactions.

Level of human computer interaction: Present ATMs offer a restrained degree of interactivity. The ATM is meant to guide the customer in the course of his or her period of use. For instance, while the ATM has difficulty with a customer's debit/credit card, it alerts the customer about the mistake which had occurred and directs him or her to the proper helpdesk for rectification.

Multinational Status: A bank that carries out its operations in more than one country is likely to have a linguistically varied staffs and customers. This is always a common scenario in East Africa community ATM machines where 3 languages (French, Swahili and English) are commonly spoken and used for business transactions. For this reason, at times the banks order internal unit/department to ensure that there is a defined policy on the language for business transactions in different departments/units as the need arises to boost the relationship of the banks and their customers.



Fig. 1 Sample of ATM card



Fig. 2 ATM machine

This study was born out of regular experience of frustrations expressed by rural customers while using ATMs. The main difficulty with the presently designed ATMs is that an extensive-spectrum of users no longer contains themselves in figuring out the user necessities of ATMs. The key persons who determined the user requirements had been financial institution workforce [6]. Consequently, a review of the literature shows the want for multi-lingual ATMs. Our findings also revealed that most of the existing ATM machines are commonly design base on the use of monolingual or bilingual implementations which are often difficult to migrate to a multilingual model.

This study provides a conceptualization that is a first step within the actualization of a user friendly ATM for rural customers in Africa and other growing regions of the world.

The rest of the paper is organized in different sections: Related works are presented in Section 2. The conceptual design of the proposed multi-lingual ATM software system is presented in Section 3. System implementation is presented in Section 4 and concluding remarks are made in Section 5.

II. REVIEW OF RELATED WORKS

Automated transaction technology (ATT) is an emerging era that supports online and real-time business transactions each locally and throughout the globe. ATM is one in every of the goods of ATT. ATMs are banking terminals that offer customers with 24-hour deposit-and-withdrawal services; a special-purpose tool linked to the bank's computer systems. In [7], the ATM usability standards under had been diagnosed: effectiveness, performance, satisfaction and error. The criteria cited above have been evaluated towards profession categories. The consequences imply that agriculturists (most of whom are rural customers of the banks) could not have interaction very well with the ATMs. It need to be noted that innovation, ease of use, overall performance and effort expectancies are key issues in technology development, adoption and usage [8][9]. Addition of multi-lingual features to the current ATM technology would most likely enrich the functionalities of the system, and consequently provide services to users with minimum pressure. It became indicated in [10] that more vulnerable segments of the society (e.g., the aged, the much less educated and humans with disabilities) tend to have an excessive level of dissatisfaction with the functionalities that cutting-edge ATMs present. The authors simulated a virtual fact environment for ATMs so one can help people with some kinds of incapacity in improving the convenience of use of ATMs. In [11], an amendment to the capabilities of the ATM turned into proposal to be able to

assist older adults, and less knowledgeable inside the use of ATMs.

Many authors have proposed multi-lingual systems as a way of increasing the convenience of use, performance and effort expectancies of the ATM for users. In [12], an Athosmail turned into offered, that is a multi-lingual adaptive spoken talk device for the email domain. It is used for studying e mail messages. Model and the combination of different tactics for verbal interaction are the key capabilities of the software. The software is made up of a flexible device shape that helps multiple components which have one-of-a-kind functions. The Athosmail system is made up of different components. Some of those components are for input interpretation, dialogue management, output generation, user modeling and text processing. The principle goal of the application is the gaining access to of mail boxes the usage of a preferred cellular or laptop phone by means of users. This software is primarily based on the existing mailman software [13]. The Athosmail includes two components and it is the real dialogue system that the users have interaction with. It has the functionality of each speech input (speech recognition) and dual tone multi-frequency or touchstone interfaces. The Athosmail system is constructed with the aid of adopting jaspis architecture [14][15], which helps disbursed and coordinated components, shared device know-how and device-level version.

The multilingual Question and Answering system is a system developed to allowed users to have interaction with machines of their local languages, contributing to less difficult, faster and more equal information access [16].

Healthcare service delivery quality can be enhanced with the support of information technology even in low resource settings like Uganda. In 2009, MSF started experimental study on two telemedicine systems; one was in English and the second in French. Later in 2012, the third one was introduced that make use of Spanish language. Finally, in 2013, the three telemedicine system was converted into a single multilingual system because of the constraints of the operations of the telemedicine system by the field workers. The multilingual system was developed on a secure server [17].

In [18], the authors presented a framework of multi-lingual voting machine for developing nations and Nigeria was cited as a case study. The device in keeping with the authors is to offer a reputable voting system in Yoruba, Hausa, Igbo and the English language; consequently presenting one of a kind platforms for citizens to explicit their evaluations within the election system, and to provide a reliable degree to track the results of elections right from the point of balloting.

There are numerous technologies utilized by the ATM to make certain authentication, secrecy and protection which include encryption (the manner of encoding messages or statistics in this sort of manner that handiest legal parties can read it) and digital signatures (any electronic means that shows either that a person adopts the contents of an email correspondence, or extra extensively that the person that claims to have written a message is the only who wrote it) to confirm the identity of the customer and provide data integrity. Different computer security technologies, which include firewall, antivirus applications and intrusion detection systems, are also used. Present day ATM physical protection

concentrates on denying using the cash in the system by unauthorized customers, by using the usage of exceptional kinds of shrewd banknote neutralization systems. ATMs are linked to interbank networks, allowing customers to withdraw and deposit cash from machines that do not belong to the financial institution in which they have their account or within the country wherein their debts are domiciled (enabling cash withdrawals in local foreign money). A few examples of interbank networks are Pulse, Plus, Cirrus, inter-switch, star, link and so on. Many banks charge a small charge for ATM utilization, this fee is meant for users who are not customers of the bank where the ATM is placed.

Presently Uganda consists of 56 ethnic tribes with language and cultural variety; with the principal ones being Baganda (16.2%), Iteso (8.1%), Banyankole (8.0%), Basoga (7.7%), Bakiga (7.1%) and such a lot of different minor tribes that include the Banyarunda (5.8%), Lango (5.6%), Bagisu (5.1%), Acholi (4.4%), Lugbara (3.6%), Batoro (3.2%), Banyoro (2.9%), Karamojong (2.0%) and others (20.3%). The official language is English language. But, majority of the country's populace do not comprehend English. Furthermore, Ugandans opt to speak the use of their local languages or in one of the 3 dominant languages. Uganda is not the only country with many tribes and languages globally. There is range of languages and cultures in many countries in the world. This is pertinent contextual issues that need to be taken into consideration at some stage in technology generation development with a purpose to facilitate the adoption and appropriate utilization of any technology.

The following are the deductions established from the literature reviewed and they form the basis of the system proposed in this paper.

III. METHODOLOGY

In this study, the Automated Teller Machines (ATMs) of banks in Kampala and Ateso Region of Uganda served as knowledge sources for this study. There are multi-lingual technologies that exist and are being used in banking systems in developed and developing countries. ATMs in Uganda currently operate in three languages (English, Swahili and Luganda). But no study from our findings is yet to introduce the fourth language (Ateso) in order to enhance the adoption of the ATM multi-lingual technologies in the banking industry in Uganda.

3.1 Multi-lingual ATM software system

A multi-lingual system for ATM being proposed in this study is mainly for end-users or customers on transaction models of the system.

3.1.1 ATM system architecture

The ATM machine is modeled using unified modeling language (UML). Figure 3 provides the ATM architecture. The software architecture followed is Client-Server architecture which allows huge variety of customers to operate the machine from different remote stations. The architecture is divided into three sub-systems: the Graphical User interface, the ATM kernel and the output unit.

The Graphical User interface subsystem: The customers or clients' screen is an interactive interface via which customers are capable of view their account details, input their pin codes, select amount, choose the sort of account they need (cheque, financial savings, etc.) and choose out their preferred desired language

The ATM kernel sub-system: It is through this sub-system that the banking transactions are completed or done. The banking transactions performed are as follows: bills fee processing, debit/credit transaction and purchase of cellphone voucher, and many others.

The output unit sub-system: It is through this output unit that all reports on customers' transactions are generated and printed for management decisions or for further processing by the management of the bank.

3.1.2 Architecture of the multi-lingual system for ATM transactions

The logical diagram of the interrelationship between the relations in the database model is presented in Figure 3.

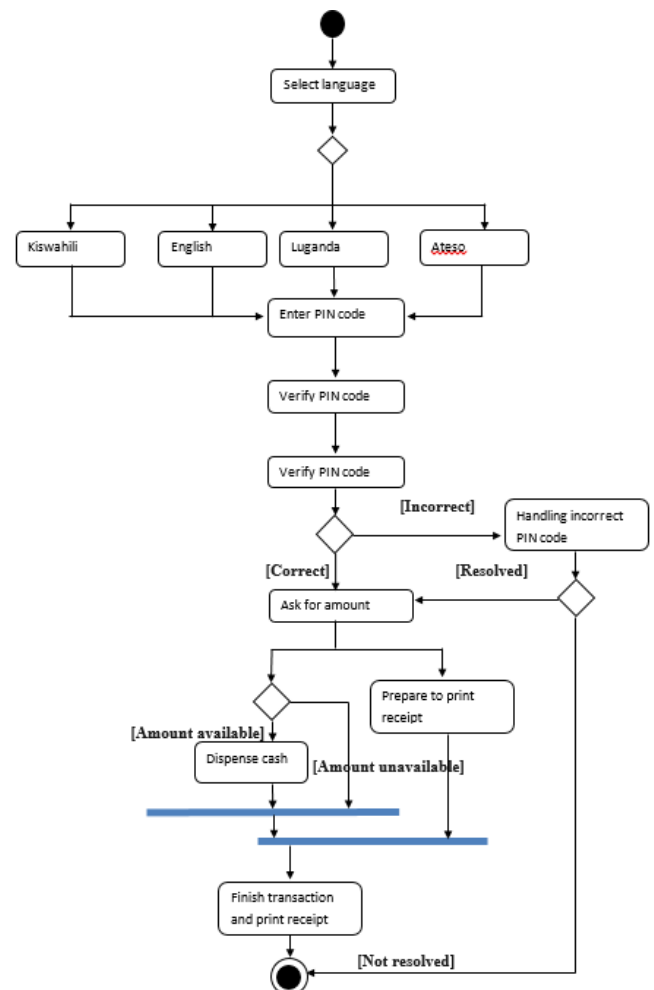


Fig.3 Architecture of the Multi-lingual system for ATM transactions

IV. IMPLEMENTATION

The system implemented is composed of the following interfaces: welcome interface, authentication interface, language selection interface, operation selection interface,

account selection interface and amount selection interface. This system prototype was developed using Dev C++ and mySQL.

4.1 Customers Interactive Interfaces

The ATMs interfaces allow the customers to successfully interact with the system in: language selection; PIN authentication; selection of required bank service like: cash withdrawal, Cash deposit and account balance enquiry.

A sample cash withdrawal transaction carried out with the system using Ateso language is illustrated in Figure 4 to Figure 19.

The screenshot of the language selection interface is presented in Figures 4 and 5. This is where the customer selects the language he/she wants to use

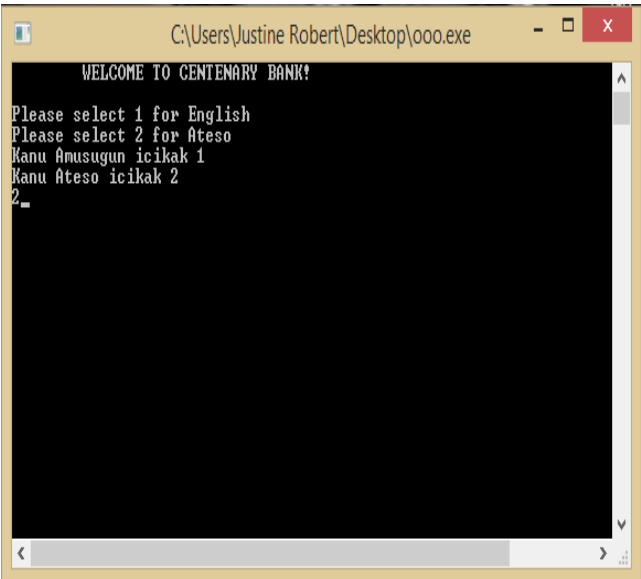


Fig. 4 Language Selector In Ateso

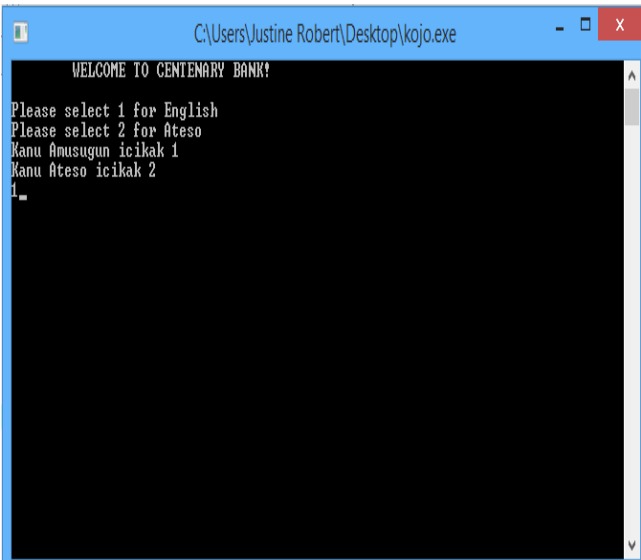


Fig. 5 Language Selector In English

The screenshot on Figure 6 and 7 prompts the user of the ATM to enter his/her 4-digit PIN after the user has selected the language Ateso.

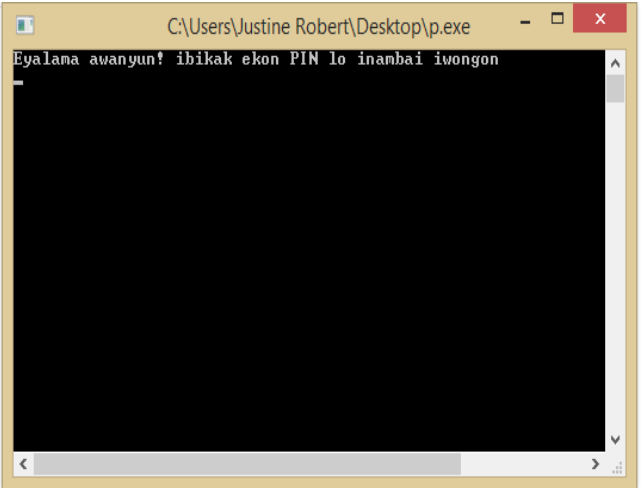


Fig. 6 Request for PIN in Ateso

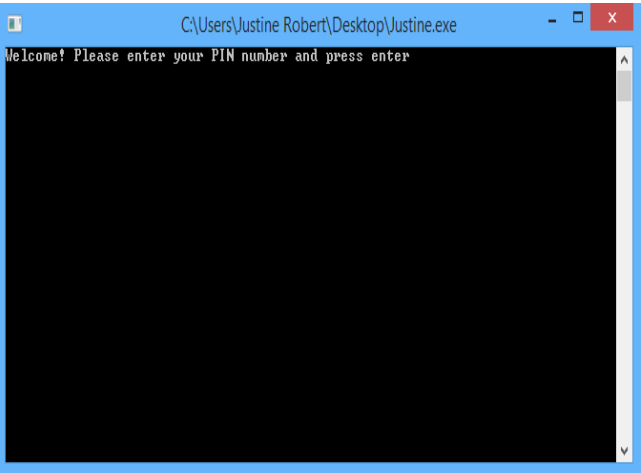


Fig. 7 Request for PIN in English

The screenshot in Figure 8 and 9 shows the PIN of the user as he tries to gain access to his/her account.

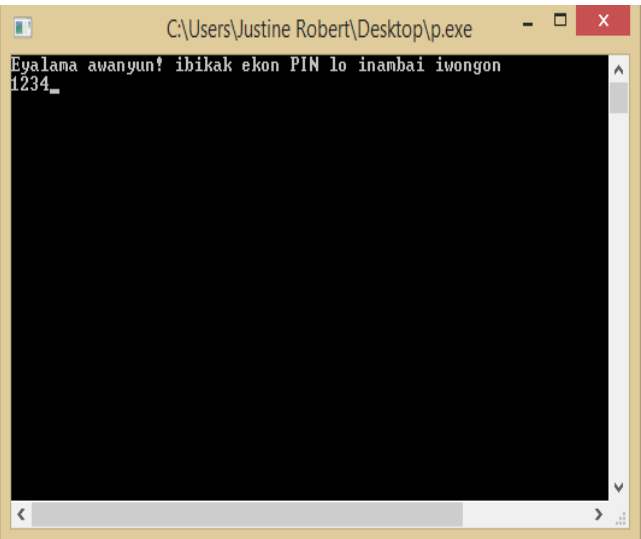


Fig. 8 Input of PIN for Ateso Language Selector

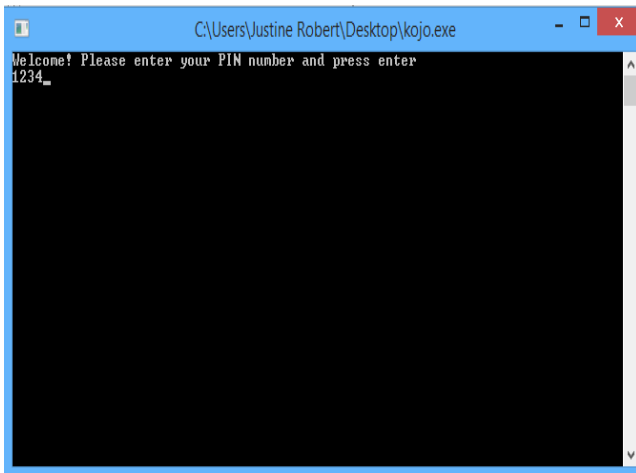


Fig. 9 Input of PIN for English Language Selector

The screenshot in Figure 10 and 11 shows the welcome interface for operations in Ateso and English language. After selecting the language, the user then sees an interface like the one presented in the screenshot of Figure 12 and 13 where he/she selects the operation he/she wants to perform using the ATM. The operations the customers can perform are: “Aiwanyisirigin” (Check balance), “Alemunisirigin” (Withdraw), and “Aingadakinisirigin” (Deposit).

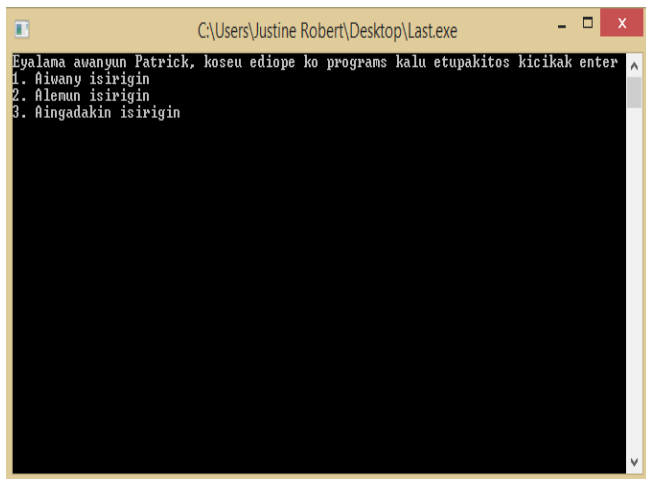


Fig. 10 welcome interface for operations in Ateso

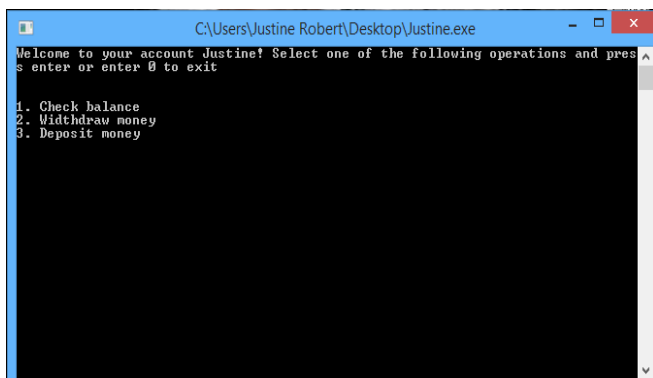


Fig. 11 welcome interface for operations in English

The screenshot in Figure 12 shows that the customer selected option 2 for “Alemunisirigin” (Withdraw).

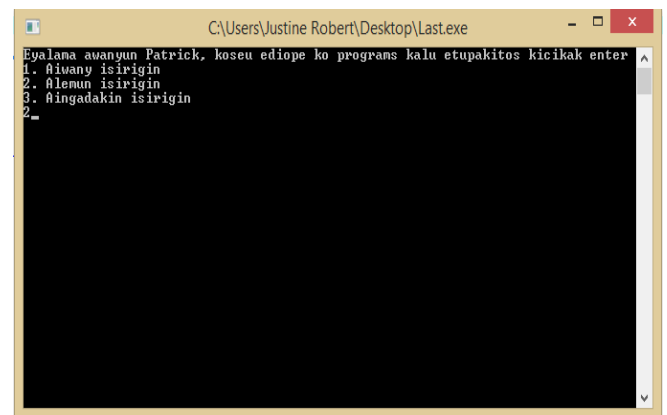


Fig. 12 Customer Selected option

The screenshot in Figure 13 shows the translation of Figure 12 in English.

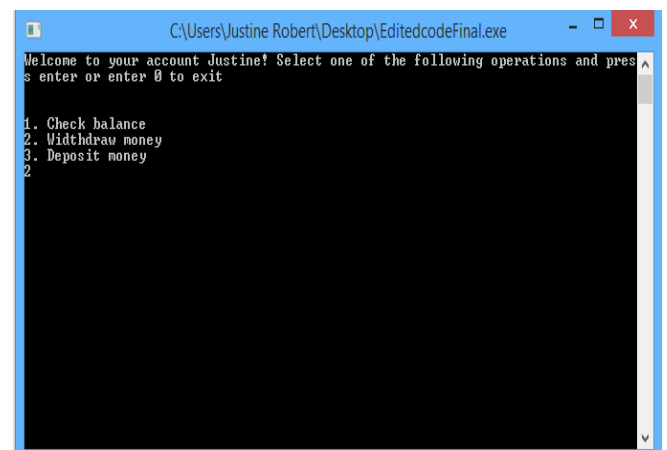


Fig. 13 Translation of Figure 12 in English

The screenshot in Figure 14 prompts the user to enter the amount he/she wants to withdraw.

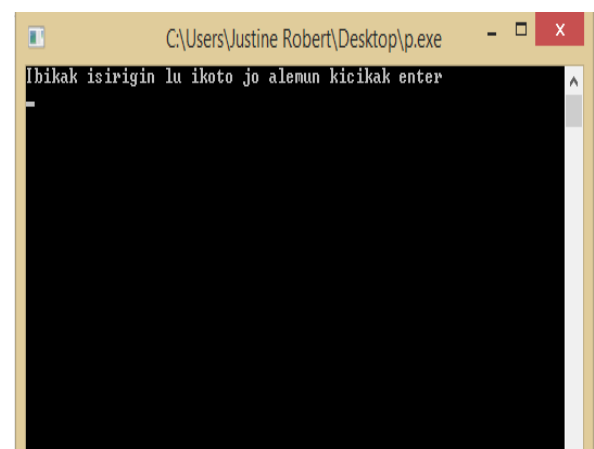


Fig. 14 Enter Amount for withdrawal

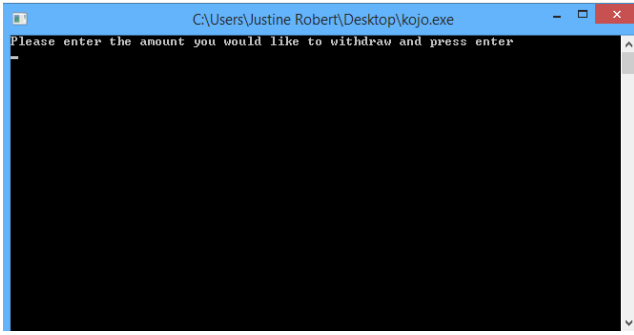


Fig. 15 Translation of Figure 14 in English

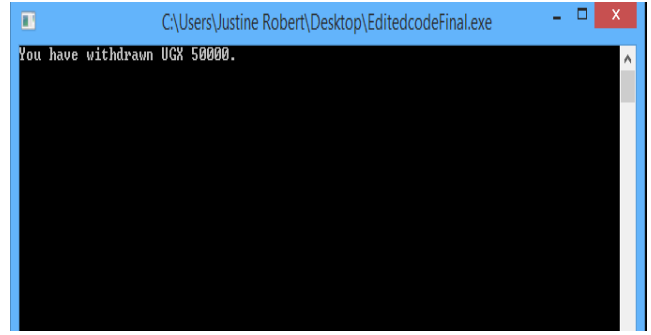


Fig. 19 Withdrawal Confirmation in English

The screenshot in Figure 16 and 17 shows that the user wants to withdraw UGX 50000

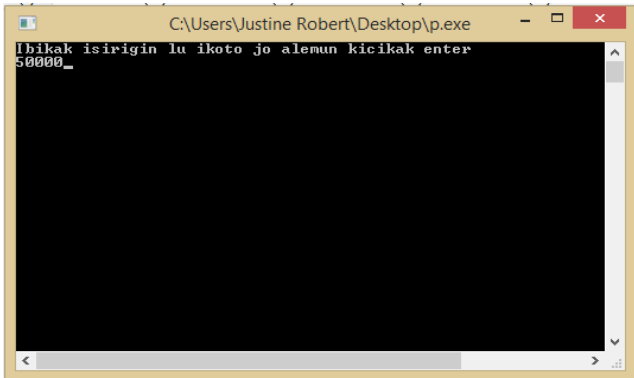


Fig. 16 Amount to be withdrawn Display

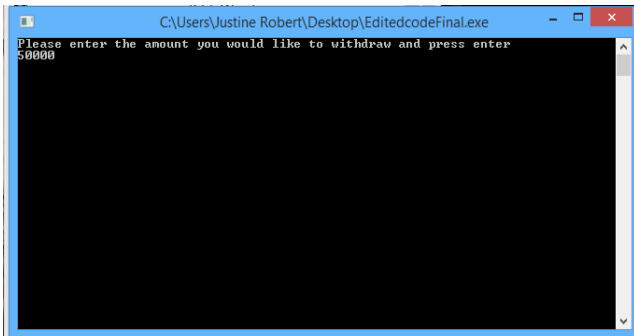


Fig. 17 Translation of Figure 16 in English

The screenshot Figure 18 and 19 shows that the user has withdrawn UGX 50000

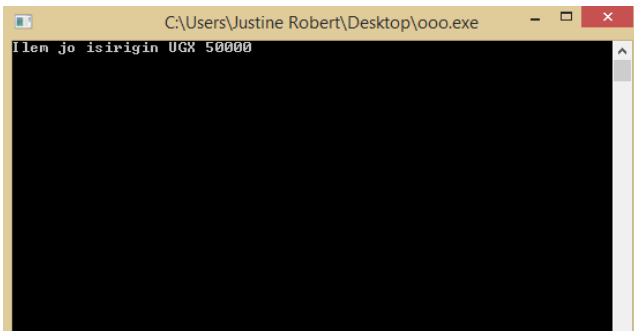


Fig. 18 Withdrawal Confirmation in Ateso

V. DISCUSSION OF RESULTS

The ability of the ATM to present different languages to its users in multi-lingual form would be of immense benefit to Banks and customers. The languages that are common on most ATMs in Uganda are English, Kiswahili and Luganda. A number of authors have discussed numerous multilingual interface languages for ATM system. For instance, some researchers have stressed the need for the alteration of the key features of ATM for the benefits of the rural dwellers [11]. Past studies had also advocated for multi-lingual and multidenominational software for ATM. The authors were able to develop a system whereby users can select different languages of their choice from the ATM. The system has already been pre-configured to dispense cash in any denominations. This framework is similar to our proposed system for Ugandans [5]. Study has revealed that most people would prefer to interact more with the machine in their native languages. Most of the ATMs in Uganda use English as the main language of interaction with few enabled local languages. This has proved over time not to be enough as some of the Ugandans who are illiterate prefer to use their local languages to operate the machine. Consequently, in addition to the existing languages on the ATM, this work suggests more additional local languages to be enabled. This is hereby justified from Figures 3 to 19 which demonstrated how a customer could interact with the ATM both in English and in their local language. For example, figures 4 and 5, allow the user to select the language of their choice either in English or in Ugandan local language. The rest of the figures showed how a user would enter his pin to gain access into his account and do the normal transactions. Customers could withdraw; check balance of their account through the specified language of their choice. The most important of this framework is that it will allow more customers to operate cashless transactions. Another benefit is that it will reduce the long queue that has become a daily routine inside the bank premises.

VI. CONCLUSION

Developing countries in East Africa have their ATM transactions are made in multi-lingual translations with low level of Kiswahili, French and English. Having ATM transaction only in these three languages will increase the

stress of non-speakers or readers of these languages. Taking this into consideration, a system is proposed which gives the customer the flexibility of communicating or transacting in their desired language. This is also an improvement over existing ATM system. Most rural dwellers especially in Africa are traders who make daily income and such money are kept at home due to the complexity of the banking system especially the ATM. These rural dwellers do not put other risks into consideration such as theft, robbery and fire incidence. A simple and easy to use ATM will encourage more users, even the rural dwellers, to deposit their money in the bank and conveniently withdraw their money at the ATMs.

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