



IMPLEMENTATION OF A MOBILE APPLICATION THAT RUNS ON USSD CODES FOR MOBILE PAYMENT IN NETWORK- CONSTRAINED ENVIRONMENTS

1BONGANI CYRIL MAGAGULA, 2Dr. K. VENKATA RAO

1M.Tech student, 2Professor

1Andhra University,

2Andhra University

ABSTRACT: Mobile payments have emerged as a convenient and secure way for individuals to transfer funds using their smartphones. However, in many regions, internet network connectivity remains a significant barrier to the adoption of mobile payments, making it difficult for users to carry out transactions. Unstructured Supplementary Service Data (USSD) technology has emerged as a promising solution for enabling mobile payments in areas with limited network access. However, the rapid changes brought about by technology there is a need for the use of USSD service within a mobile application for enhancement and efficiency. Based on this, this paper investigates the current USSD service provided and then later on develop an android mobile application that runs USSD service without relying upon the user ability to memorize each USSD code.

Keywords-USSD, mobile payment, network, mobile application, android studio.

I. INTRODUCTION

Unstructured Supplementary Service Data (USSD) is a communications protocol used by the Global System for Mobile (GSM) communications cellular telephones to communicate with the mobile network operator's computers. It is used to provide a myriad of services such as mobile-money services, menu-based information services, phone configuration for networks and prepaid callback services (Danquah, 2019).

USSD messages are short, typically consisting of up to 182 alphanumeric characters. They are sent between a mobile device and the network using the signalling channel, which is separate from the voice or data channels. This means that USSD messages can be sent and received even when the user is on a call or has no internet connection.

Dayang (2021) defined mobile payment as the use of mobile devices, such as mobile phones to initiate payment transactions. Mobile Banking financial services are available via different Technologies namely Short Messaging Service (SMS), Unstructured Supplementary Service Data (USSD), Browser based Application, Client based Application, Interactive Voice Response (IVR), Wireless Access Protocol (WAP) (Lakshmi et al, 2017). To use a USSD service, a user typically dials a short code on their mobile device and follows the prompts to access the desired service.

There is a need for a mobile app to process USSD transactions behind the scenes, it must be appealing to the current majority of mobile phone users, which is mainly smartphones. If a user's mobile phone is a smartphone, they should do away with remembering USSD codes for the different mobile service providers, banking services. One advantage of USSD is that it is widely available and accessible, as it does not require a data connection or special software. It is also secure, as the messages are encrypted and transmitted over a secure channel. However, USSD has some limitations, such as the limited length of messages, and the fact that it is a one-way communication protocol, which means that the user cannot receive data from the service provider without initiating a request.

II. LITERATURE SURVEY

Android applications are developed using java language using SDKs that provide robust and efficient application programming interfaces (API). Android applications can use native features of the device after the user grants permission. Inter-process communications and sharing resources are more secure in android than other platforms (Sarkar et al, 2019). Java is one of the best programming languages that is used world-wide.

Mobile applications are ready-made programs that are designed to make it easy for users and applications are used by the intended target while the cell phone can be interpreted as moving from one place to another. Can be interpreted as an application that runs on mobile devices or better known as smartphones (Debi et al, 2020) [5].

Android Studio is an Android integrated development tool launched by Google based on IntelliJ IDEA (Zhang et al, 2019) [6]. Today, Android Studio is very mature and consists of many powerful, customized components tailored to Android. Android Studio provides tools tailored to Android developers, including a wealth of code editing, debugging, testing, and performance analysis tools. Today, Android Studio has become the preferred IDE for Android development.

With the development of Internet communication technology and the widespread popularity of smart-phone, the market for mobile navigation systems has been matured (Zhang et al, 2019) [6].

In an era that is completely modern as it is today, smartphones have become very common to have and use in everyday life (Debi et al, 2020) [5]. Smartphones are used by people to access various services.

III. RESEARCH DESIGN

A quantitative approach is opted for this study to meet the research objectives. Creswell (2003) delineates a quantitative approach as research that practices a standardized set of questions with a large sample of individuals and which therefore generates data that can be coded and expressed in numerical and statistical form. This approach is chosen for this study for its convenience with regard to translating gathered data into numerical information.

Research site

The research will be conducted in India using international students from Eswatini to find out their experience with USSD services for mobile payment in Eswatini. MTN Eswatini is a company that uses USSD code to provide mobile money services. The students are in India through a scholarship, they are pursuing various courses. These students are chosen as they are exposed to technology adoption in Eswatini versus in India where there are advanced mobile payment applications that rely on the Internet.

Research population

In general, a research population is the people who belong to the research site who will be participants of the research. Forza (2002) describes the research population as the entire group of people, firms, plants or things that the researcher aspires to investigate. In this study, the research population will be students from Eswatini who have experience with USSD code services. The students that will be chosen are those who have used the USSD service back at home (Eswatini) as well as mobile payments in India. The total number of participants involved in the data collection is 22.

Sampling method

The convenient and simple random sampling methods will be used for this research project. Convenient sampling is the process of selecting subjects because of their convenience in terms of accessibility and proximity. A sample of 22 participants from students will be selected using the convenient sampling method because they are readily available. Simple random sampling provides an unbiased selection of individuals and the average sample accurately represent the population.

Data collection tool

A questionnaire will be employed as the sole data collection tool. The questionnaire is divided into four distinctive sections. Section A of the questionnaire seeks to acquire background information. The information will be instrumental when comparing groups of participants. Section B identify details regarding the overall functionality

of the current system from the students who have used the USSD service for mobile money. Information gathered will help review the overall performance of the current system.

Section C explores knowledge, opinion, and experience, if any, with regard USSD code-based services in mobile money transactions. This information will help measure the usage and possible adoption of electronic commerce system among participants. The final section, Section D explores participant's attitude and perceptions regarding the implementation a mobile app-based USSD service.

Process of collecting data

Questionnaires will be administered to study participants via Google form so that they would be told what is expected of them and when would the questionnaires be collected. The research participants will be given a period of 11 days in order to countenance ample time to answer the questionnaires without pressure and also to increase the rate of accuracy.

The participants will also be guided on how they should answer the questionnaires in an effort to help eradicate errors and simplify the answering process for the participants. Google Forms provide tools to get feedback in real-time when participant finish answering questions.

Data analysis and interpretation

It was carried out using International Business Machines' (IBM) Statistical Package for the Social sciences 27.0 (SPSS). Data will be explicitly presented in frequency tables and pie charts. SPSS is equipped with special features used for statistical analysis; thus, it is the right choice for this study as it will provide all the analytical proficiency.

Implementation of Mobile application

- Select development tools
- Develop the app: Develop the app using a mobile app development platform such as Android Studio or Xcode. Write code to handle user input, send and receive USSD codes, and display results to the user.
- Test the application: Test the app on various mobile devices and platforms to ensure that it works correctly and is stable. Test the app with different types of USSD codes and responses to ensure that it handles them correctly.

Limitation

The outcomes of the data analysis will be used to inform if the implementation of a mobile application that runs on USSD code for mobile payment should go ahead or not. The exact USSD code for sending money will not be used in this study but exemplary codes will be used that invoke a service request.

IV. RESULTS

A. Survey results

Practical sending/receiving of money using USSD code

Respondents were asked to state if they have transferred or received money using the USSD service. The results are shown in Figure 1.

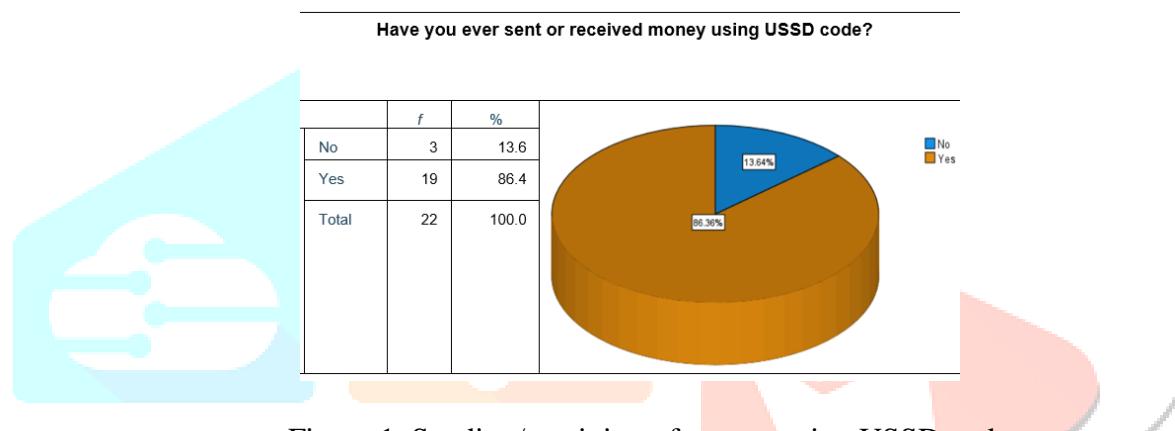


Figure 1. Sending/receiving of money using USSD code

The results presented by figure 1 shows that most of the respondents (86.36 percent) have been involved in money transaction that used the USSD as a means of service.

Knowledge on USSD service

The respondents were asked if they have knowledge about USSD service. The results are presented in figure 2.

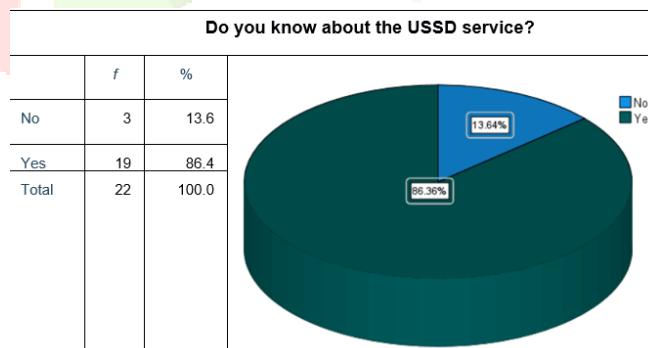


Figure 2. Knowledge on USSD service

The results portrayed by figure 2 show that most respondents are knowledgeable about USSD services.

User access to mobile application

The respondents were asked if they have used a mobile application before, the application should be any not specifically USSD service. The results are presented in Figure 3.

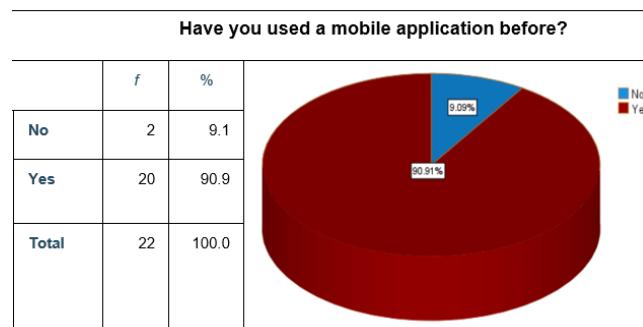


Figure 3. User access to mobile application

The results demonstrated by figure 3 indicate an overwhelming 90.91 percent of the respondents have used a mobile application before, and only a few have not used it before (9.09 percent).

Rating of current system

Respondents were asked to rate the current system of mobile payments using USSD code by typing. The results are presented in figure 4.

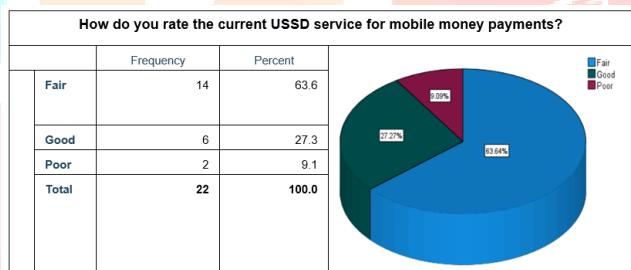


Figure 4. Rating of Current system

The results demonstrated by figure 4 show that most of the respondents (63.6) rate the service as fair while 27.3 percent of the respondents rated it as good and the rest as poor (9.1 percent).

Mobile app speeding service

Respondents were asked if having a mobile application would increase the speed of sending or receiving money. Their responses are presented in figure 5.

Do you think having a mobile app would increase the speed of sending or receiving money?

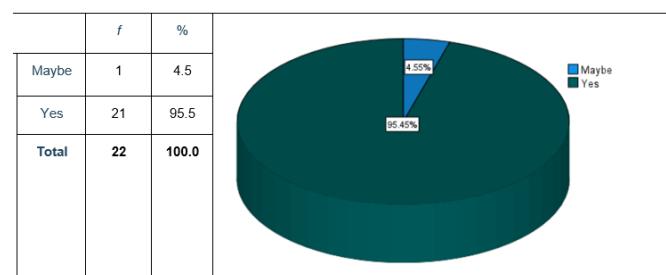


Figure 5. Mobile app speeding service

According to figure 5, most of the respondents (95.45 percent) affirmed that a mobile app would increase speed of processing services.

User Experience Improvement

Respondents were asked if having a mobile application would improve the user experience for the better in processing transactions. The results are presented in Figure 1.

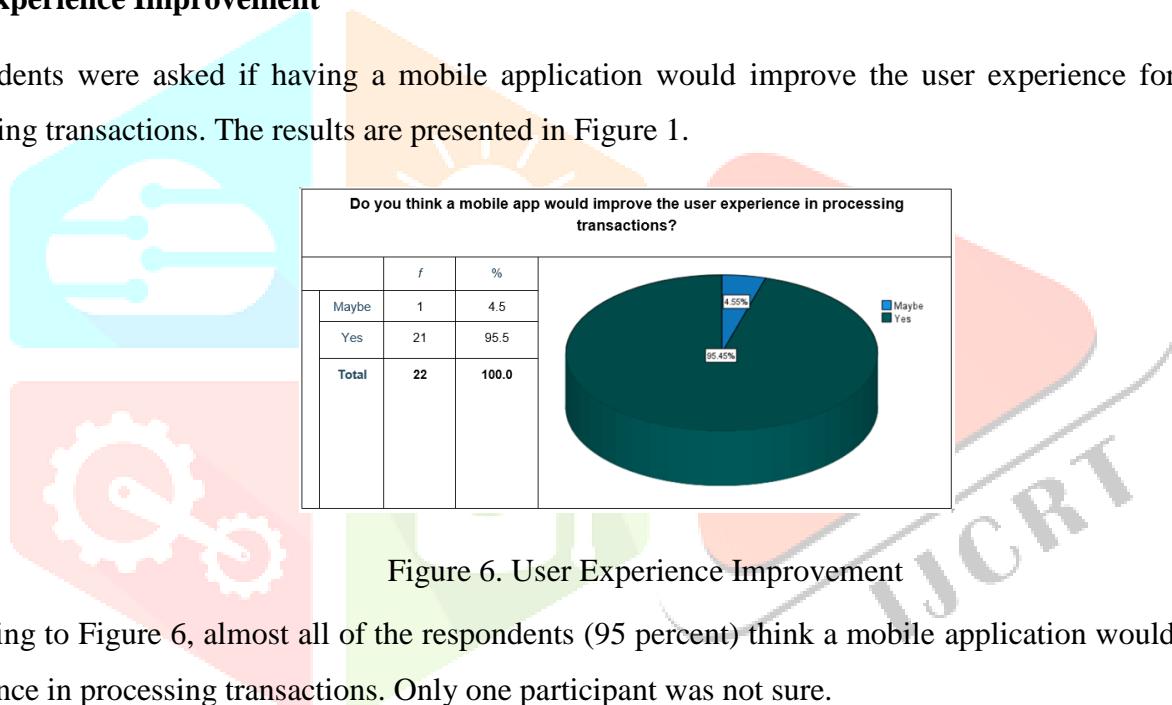


Figure 6. User Experience Improvement

According to Figure 6, almost all of the respondents (95 percent) think a mobile application would improve user experience in processing transactions. Only one participant was not sure.

B. Mobile app results

A mobile app was developed to run a sample of USSD code to invoke service requests from India's Airtel mobile service provider for testing. Figure x and y shows the interface and also the results of executing a USSD code (*123#). This was executed without the user having to remember or input a USSD code but only tap on the menu option.

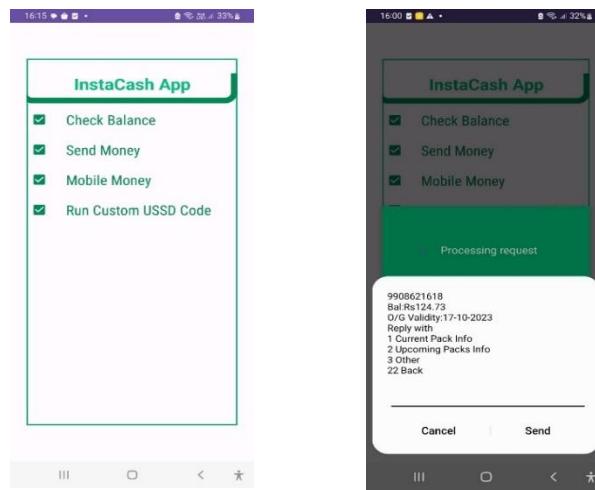


Figure 7. Mobile app menu and USSD code request

Figure 7 shows the Android mobile app menu that a user will interact with instead of typing a USSD code. Figure 8 shows the results of a successfully processed USSD code service request.

Discussions

Data gathered in section A was for demographics with 59.1 percent male participation, age group 22-25 making a large percent (54.5), and respondents with degree qualifications were 45.5 percent. Section B shows that the current system is fair. Sections C and D show that most respondents believe that mobile apps would increase the speed of sending or receiving money as well as improve the user experience in processing transactions. A very large percentage of the respondents are willing to have a mobile application based on USSD service and most of them think that it is important. All the respondents agreed that mobile would bring efficiency, and improve the speed of transactions as well as user experience in processing transactions.

V. CONCLUSIONS

This project presented an android mobile application that execute USSD code on behalf of the user without them having to memorize the USSD codes. This provides efficiency for the user, especially if they have more than one USSD code to remember in order to access a service. The speed of processing a transaction is greatly improved since a user only needs to open the app and tap on the menu option what they would like to do without having to memorize a USSD code. This study will benefit developers, and business people who would like to explore the business viability of providing a one-stop mobile application that can execute USSD code by tapping on a menu option without having to memorize any USSD code. This service is usable in internet-constrained environments, there is no need for internet.

Further Development

- The implementation can be carried out in Eswatini or any other country using the already existing USSD services.
- The mobile application can be developed further to include QR code scanning input.
- Develop and demonstrate a mobile app for iOS.

REFERENCES

[1] A. Abernathy, X. Yuan, E. Hill, J. Xu, K. Bryant and K. Williams, "SACH: A tool for assisting Secure Android application development," SoutheastCon 2017, Concord, NC, USA, 2017, pp. 1-4, doi: 10.1109/SECON.2017.7925374.

[2] A. Singhai, R. S. Ramanujam, J. Bose and V. Kumari, "Implementation and analysis of pluggable Android applications," 2015 IEEE International Conference on Signal Processing, Informatics, Communication and Energy Systems (SPICES), Kozhikode, India, 2015, pp. 1-5, doi: 10.1109/SPICES.2015.7091407.

[3] Buddhini Gayathri Jayatilleke, Gaya R. Ranawaka, Chamali Wijesekera, Malinda C.B. Kumarasinha, (2018) "Development of mobile application through design-based research", Asian Association of Open Universities Journal, <https://doi.org/10.1108/AAOUJ-02-2018-0013>

[4] BURNS, N. AND GROVE, S. (2001) *The Practice of Nursing Research: Conduct, Critique and Utilization*, 4th ed, Philadelphia: W.B. Saunders.

[5] Debi, M. Takeuchi, M. G. Aliyudin, P. W. Nurhayati and E. H. Yossy, "Development Money Diary Application Models on Android," 2020 International Conference on Information Management and Technology (ICIMTech), Bandung, Indonesia, 2020, pp. 142-147, doi: 10.1109/ICIMTech50083.2020.9211266.

[6] E. Zhang, S. Peng and Y. Zhai, "Design and Application Development of the Camps Navigation System Based on ArcGIS Runtime SDK for Android : Taking the Yunnan Normal University as an example," 2019 IEEE 4th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), Chengdu, China, 2019, pp. 1262-1266, doi: 10.1109/IAEAC47372.2019.8997730.

[7] FORZA, C. (2002) "Survey Research in Operations Management: A Process-based Perspective", *International Journal of Operations and Production Management*, Vol. 22, No. 2, pp. 152-194.
JANES, J. (2001) "Survey Research Design", *Journal of Library Hi Tech*, Vol. 19, No. 4, pp. 400-430.

[8] K. Qian, R. M. Parizi and D. Lo, "OWASP Risk Analysis Driven Security Requirements Specification for Secure Android Mobile Software Development," 2018 IEEE Conference on Dependable and Secure Computing (DSC), Kaohsiung, Taiwan, 2018, pp. 1-2, doi: 10.1109/DESEC.2018.8625114.

[9] M. Pasquet and S. Gerbaix, "Instant payment versus smartphone payment: The big fight?," 2017 Third International Conference on Mobile and Secure Services (MobiSecServ), Miami Beach, FL, USA, 2017, pp. 1-3, doi: 10.1109/MOBISECSERV.2017.7886561.

[10] MOUTON, S. (1996) "Meaning of the Term Descriptive Survey Research Method", *International Journal of Transformations in Business Management*, Vol. 1, No. 6, pp. 1-10.

