

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE



**BUILDING A BANKING CHATBOT THAT USES ARTIFICIAL
INTELLIGENCE**

ALGORITHMS THAT ANALYZE USER QUERIES

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APPROVAL FORM

The undersigned certify that they have supervised the student Tsungai Sydney Ngungunyani dissertation entitled “building a banking chatbot that uses artificial intelligence algorithms that analyse user queries” submitted in Partial fulfilment of the requirements for the Bachelor of Computer Science Honours Degree of Bindura University of Science Education.

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Abstract

Chatbots have increasingly gained popularity in many companies around the globe due to the chatbot's ability to be both efficient and productive. The banking sector in various parts of the world has adopted the use of chatbot technology for efficiency and productivity since the chatbot can work around the clock 24/7. This exploratory research is focused on how chatbots can be both useful to all bank stakeholders, that is its staff and the customers. In order to get an understanding of what the chatbot could do an understanding as to how queries are addressed was crucial. This project aimed to implement a mobile based chatbot to assist with banking queries. The researcher found the produced prototype to be very useful to justify the need for a modern method of interaction to be integrated into the chatbot. In an industry with lower user satisfaction rates and limited technology to help assist user with their queries. It is clear that the chatbot can overcome the challenges faced by the customer service department with regards to helping customers with their problems.

Dedication

This project is dedicated to my superwoman, my mother who has nurtured my ambitions and has always provided me with unconditional support, my siblings (Gamuchirai, Cally & Charmaine) who have always supported & believed in me and lastly to the few good friends who have always been there for me.

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My Dad DZ. Had it not been for you, I would not have found my love for computers and carried out my research.

My friends: Thank you for your support.

CHAPTER ONE:

1.1 Introduction

According to Khavya (2018) a banking chatbot is an artificial intelligent development for banking operations, which can understand people queries and responds accordingly. With banking having become a part of almost everyone's life and the use of internet banking having increased in the past couple of years. Chat-bots have the ability to mimic human conversation and can offer personalized services (Dutta, 2017). Sewoong & Jonghyuk (2021), made the ascertainment that the history of technology adoption, technological innovation should be considered as a digital transformation that changes roles as opposed as to being heavily linked with the loss of jobs. Essentially advancements in technology are necessary as their sole purpose if for convenience thus innovations in the technological sector enhance service in various organisations (Sewoong & Jonghyuk , 2021).

1.2 Background of Study

“Digitalization, the surge of mobile and internet connected devices has revolutionized the way people interact with one another and communicate with businesses” (Eeuwen, 2021). In 2018, Artificial Intelligence (AI) technology was highlighted as a mega trend, and it was forecasted to be an essential part of every large company in the future (Wilson, Daugherty, & Bianzino, 2017). A human and a computer can perform human computer conversation either by typing text or speech dialogue using the voice (Dutta, 2017). In the past decade alone, we have witnessed technological advancements that seemed impossible, companies like Ikea have made use customer service chatbots (Latheren & Dootson, 2017). With the possibility of people checking their bank balances or transfer money through Facebook Messenger and Twitter, researchers found that the general population is adamant due to security issues on the usage of their banking accounts in conjunction with their social media accounts (Latheren & Dootson, 2017). In accordance to Latheren & Dootson (2017), the increased insecurities with the popularisation of social

media between 2010 and 2014 meant that banks would likely have to design their own chatbots so as to give a sense of security.

The banking industry is under a lot of pressure from different sectors such as regulations and legislation boards, new technology, and competition from energetic start up companies (Brednar & Jonsson, 2018). Startups tend to have an advantage when they make use of new technology, this in turn challenges traditional organisations such as banks who have a big technological structure (Lucas Jr & Goh, 2009).

The severe liquidity constraints in Zimbabwe resulted in an increased usage of mobile money, specifically the Reserve Bank of Zimbabwe (RBZ) indicated that 96% of all official transactions were conducted electronically in 2017 (Simatele, 2021).

1.3 Problem Statement

The world in which we live in is consistently evolving due to increases globalisation and digitalization (Brednar & Jonsson, 2018). With the technological advancements as well as the profound use of Artificial Intelligence, companies are constantly looking for ways to improve their products and services and should invest in new processes, technologies, or innovation to either reduce costs and/or increase value (Loebbecke & Picot, Reflections on societal and business model transformation arising from digitization and big analytics, 2015). AI driven chatbots are evolving through existing data and user's input which means that the more the chatbot is used, the more it evolves and the more advanced it gets (Rahman, Mamum, & Islam, 2017).

Since March 2020 Zimbabwe has been fighting the Covid-19 virus and the Covid-19 pandemic occurred at a time when the country was undergoing a massive economic decline (Mususa, Jowah, Sauku, & Mtungamiri, 2021). The covid 19 pandemic complicated people's lives and the way they conduct their day to day activities and they national lockdown resulted in people staying at home and relying on deliveries for essential services and goods (Mususa, Jowah, Sauku, & Mtungamiri, 2021). Under the national lockdown a Confederation of Zimbabwe Industries Covid-19 rapid survey (July 2020) reported that companies implemented staff rationalisation measures which included "reducing labour costs by the non-renewal of fixed-term employment contracts,

retrenching permanent and temporary employees, sending staff on (forced) leave among others (Chamunogwa & Chakanya, 2021).

Working hours were cut and movements were restricted thus getting help with banking services seemed to be a long and tedious experience. Mobile and internet banking isn't user friendly to customer hence they get various banking problems and as result an AI chatbot could be of use (Brednar & Jonsson, 2018). A chatbot has potential of reducing costs, make processes more efficient and increase value to organisations and their customers (Pannu, 2015), this technology possesses characteristics features that traditional IT systems lack (Tirgul & Naik, 2016) A banking chatbot that is always available will be able to assist the users or bank customers as well as serve as a co-worker to the banking employees (Brednar & Jonsson, 2018).

1.4 Aim and Research Objectives

To design an AI banking chatbot that automates the relationship between the consumer and the bank.

- To create an interface that is user friendly.
- To develop a chatbot that can be used on a smartphone.
- Must interact with the user by providing outputs for particular inputs.
- Assist users with Frequently Asked Questions (FAQs).

1.5 Research Questions

- How can the chatbot help the banking sector?
- How can the chatbot help the customers?
- What, and if, are the challenges with a chatbot, internally, in a bank?

1.6 Research propositions/hypothesis

H₀: The banking chatbot will help the banking staff as well as help improve customer satisfaction in regards to FAQs

H₁: The banking chatbot will neither help the banking staff nor help improve customer satisfaction in regards to FAQs

1.7 Significance of the Study

The study aims to do away with the traditional way of communicating with banks as it is tedious and normally entails long phone calls where services or assistance is not guaranteed to the customer. It is an initiative that would result in customers getting information or help on their queries in time and resultantly leaving the bank with feedback that helps it improve its banking services. This study looks into integrating a significant number of the bank's operations into the banking chatbot thus a bank customer can have control of his or her bank account in their hands as opposed to having to forgo enquiries about services that could be down or assistance with a transaction.

Zimbabwe has had a tendency of implementing new technologies when other countries render them obsolete thus the implementation of systems that make use of Artificial Intelligence would make some services provided by various institutions like the banking sector, education as well as in medicine. Artificial Intelligence being an interesting topic of study, its implementation in Zimbabwe's banking sector would be beneficial to all stakeholders and would motivate various other industries to adopt and integrate artificial intelligence.

1.8 Limitations

- Time required to carry out the research is limited.
- Banking institutions restricted access to their banking services e.g checking bank balance.
- Lack of funding for research.

1.9 Conclusion

Banking chatbots have in the past decade gained some recognition as an assistant in the comfort of their own homes as they can access a range of services with either text inputs or voice commands. This chapter has been on problem identification and it has enlightened several contributions of this research. The next chapter will be the literature review.

CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction

Literature review is an overview of what is known and of what is not known about a particular research or topic. It is the wide-ranging rapid of earlier research on an issue (Causon , 2016). In the development of a banking chatbot, it is essential to try and understand as well as comprehend the difficulties being faced at each stage of the development cycle. The banking industry possesses multiple electronic delivery channels they make use of in the distribution of their technological assets for the benefit of their customers (Doherty, 2017). This chapter will highlight what has been done before in the AI field of banking chatbots. The information obtained is of paramount importance to the success of this project as different articles and sources will be reviewed to check how researchers have done previous systems and also how the researcher's system under development will solve the problems in the already existing system.

2.2 Artificial Intelligence

Hassani et al. (2020) propounded that artificial intelligence has multiple definitions and as a result, no one can define artificial intelligence (Hassani, Silva, Unger, TajMazimani, & MacFeely, 2020). Colom et al. (2010) defined artificial intelligence as a general ability for reasoning, problem solving, and learning. Tirgul & Naik (2016) described AI as a branch of science that combines different research fields including mathematics, psychology and computer science. They went on to say that various programs that reside on computers, microprocessors or microcontrollers go through a learning curve from experience obtained from incoming data and basic data structures (Tirgul & Naik, 2016). According to Doherty (2017) a former student from Ulster University “artificial intelligence is neither a new technology nor a machine”, instead Doherty went on to say that AI is the recognition of outcome-direction which is the rapid analysis of live data to achieve the expected goal, outcome directed thinking splits from the confines of the rule-directed approach that is accomplished

through artificial intelligence. Essentially AI includes various sub-categories that differ between researchers (Pannu, 2015). Pannu (2015) classifies AI with the capabilities of language comprehension, learning, customised systems and problem solving. The intriguing part of AI has nothing to do with its divisions but is more focused on what it can do and its applications (Tecuci, 2012). Chatbot technology is an interesting sub-category of AI, which is widely popular and has a purpose of mimicking human conversation (Brednar & Jonsson, 2018). Advancements in artificial Intelligence, machine learning techniques, improved aptitude for decision making, larger availability of domains and corpus, thus they have increased the practicality of integrating a chatbot into applications (Dole et al., 2015)

2.3 Chatbots

A chatbot is software tool that utilizes natural language processing (NLP) for human machine interaction and machine learning (ML). the chatbot's complexity is directly proportional to the scope of its domain thus an open domain requires a larger knowledge base whereas a closed domain has a more specific knowledge base that was developed to achieve a specific goal (Gregori, 2017). Chatbot technology dates back to the 1960's when the intent was to validate whether a chatbot could be portrayed as human being. Throughout the 1980's research was carried out on natural language interfaces which in turn led to the development of sophisticated chatbot architectures such as A.L.I.C.E. This chatbot architecture is one of the earliest chatbots developed in 1995 by Dr Wallace which is now open source, the acronym stands for Artificial Linguistic Internet Computer Entity (Doherty, 2017).

Chatbots are essentially developed using two approaches, namely a rule-based approach where chatbots operate by moving through branches of a tree diagram of an expert system. The latter approach involves advanced artificial intelligence and machine learning meaning the chatbot can learn from the conversations, generating appropriate responses to continuously improve overtime (Watson, 2017). The chatbot is known to some by a couple of names, sometimes referred to as the machine conversation system by (Brednar & Jonsson, 2018), virtual assistant (Dale, 2016)& (Dahiya, 2017) Digital assistant, Conversation interface (Dale, 2016).

The chatbot(s) can vary in complexity, but even the simplest chatbot can handle specific tasks (Dahiya, 2017) There have been various areas where they chatbot has

been studied and that in education and learning, where variables repeated behavior and correctly answers were tested, results obtained revealed the importance of training the chatbot correctly otherwise it would only give wrong output and would as result be too simple for the intended purpose (Kane, 2016). The potential of a chatbot is to provide resources (Dahiya 2017), make processes more effective (Kane 2016) as well as increase accessibility (Shah et al 2017). The chatbot essentially is a software program that engages in artificial intelligence through either a text based medium or voice based medium (Brednar & Jonsson, 2018), for instance Natural Processing Language (NLP) (Dahiya 2017). Peirson-Smith, (2017) went on to say that chatbots work every day, all year round and does not take overtime payments.

2.3.1 Communication with Chatbots

Natural Language Processing (NLP) is used to understand, interpret as well reproduce what the user is communicating to the chatbot (Singh & Shree, 2017).

Communicating with a chatbot is somehow simple as it answers questions in the user's natural language (Pannu, 2015), in the developmental stage languages that would be in the knowledge base would be made use of by the chatbots users. A good example would be HARO & DORI from the Hang Seng bank which has the ability to communicate in Chinese and English, and also understand Cantonese as well as mixing English and Chinese, the two bots from the Hang Seng bank in Hong Kong get retail customers instant answers to a variety of needs (Cummins, 2021) .

The chatbot makes use of Natural Language Understanding (NLU) which helps it understand what the user said both general and domain specific language objects such as lexicons, synonyms and themes, which are in turn used in conjunction with algorithms or rules to construct dialog-flows that tell the chat bot how to respond in the communication process with the user. The dialog-flow will be utilised as the NLU to perform artificial intelligence methods such as; Natural Language Processing (NLP), POS tagging, and entity recognition to analyse text and carry out the appropriate actions. dialog-flow is a Natural Language Understanding Engine (NLU) used for the extraction of entities and intent from a user's message (Doherty, 2017).

The use of NLP, syntax, semantic and pragmatic are essential aspects for researchers to understand how knowledge transfers from human to machine.

2.3.2 Training a Chatbot

Brednar & Jonsson (2018) highlight that vast amounts of data is required in order for an AI driven chatbot to answer questions correctly and work independently. A lot of Frequently Asked Questions FAQs are fed together with their answers without human interaction, essentially the chatbot will learn how to communicate from the provided data (Brednar & Jonsson, 2018). The more the chatbot receives the smarter it becomes (Singh & Shree, 2017). Stakeholders need to be involved in the training process of the chatbot in order to obtain a number of possible results taking certain variables into account, Microsoft for instance released its chatbot Tay and let Twitter users train Tay (Neff & Nagy, 2016). The project was however shutdown abruptly because Tay started producing inappropriate tweets and all this was a result of the training data that Twitter users fed Tay with. According to Neff & Nagy (2016) the two factors that made the Tay project fail were the organized group of users and the specific culture of the platform. As result of it's the chatbot's ability to learn users can attribute to the personality of that chatbot as it occurred in Tay's case scenario up until the algorithms behind Tay began to give out inappropriate responses for example giving out inappropriate answers and statements (Neff & Nagy, 2016). Brednar & Jonsson (2018) point out how it is important when constructing a chatbot to consider and analyze thoroughly who the audience is going to be as that would lead to a more human-like effect that can lead to a positive experience for the user who intends to use the chatbot.

2.3.3 Chatbots in a workplace

Chatbots have transformed how workplaces communicate and also how employees work (Lee, Frank, Beute, de Kort, & IJsselsteijn, 2017). Lee et al. (2017) describe how chatbots free up resources within an organization by performing tasks that people would normally perform and they describe how chatbots are built for specific purpose for instance HARO & DORI from the Hang Seng bank. There are a number of domains where chatbots are applied and made use of, namely education (Dahiya, 2017) mental health (Cameron, et al., 2017) healthcare (Dahiya, 2017) (Cameron, et al., 2017), and e-commerce and marketing (Shah, Shetty, Shah, & Pammani, 2017).

Shah et al. (2017) points out how the banking and insurance industries have utilized chatbots on company's webpages to provide information about their products and services. The usage of chatbots to help employees in customer service is an investment that streamlines work and enhances the quality of services offered (Dahiya, 2017). Workers in an organization today not only work with people but they also work with information systems (Lee, Frank, Beute, de Kort, & IJsselsteijn, 2017).

2.4 Conceptual Framework

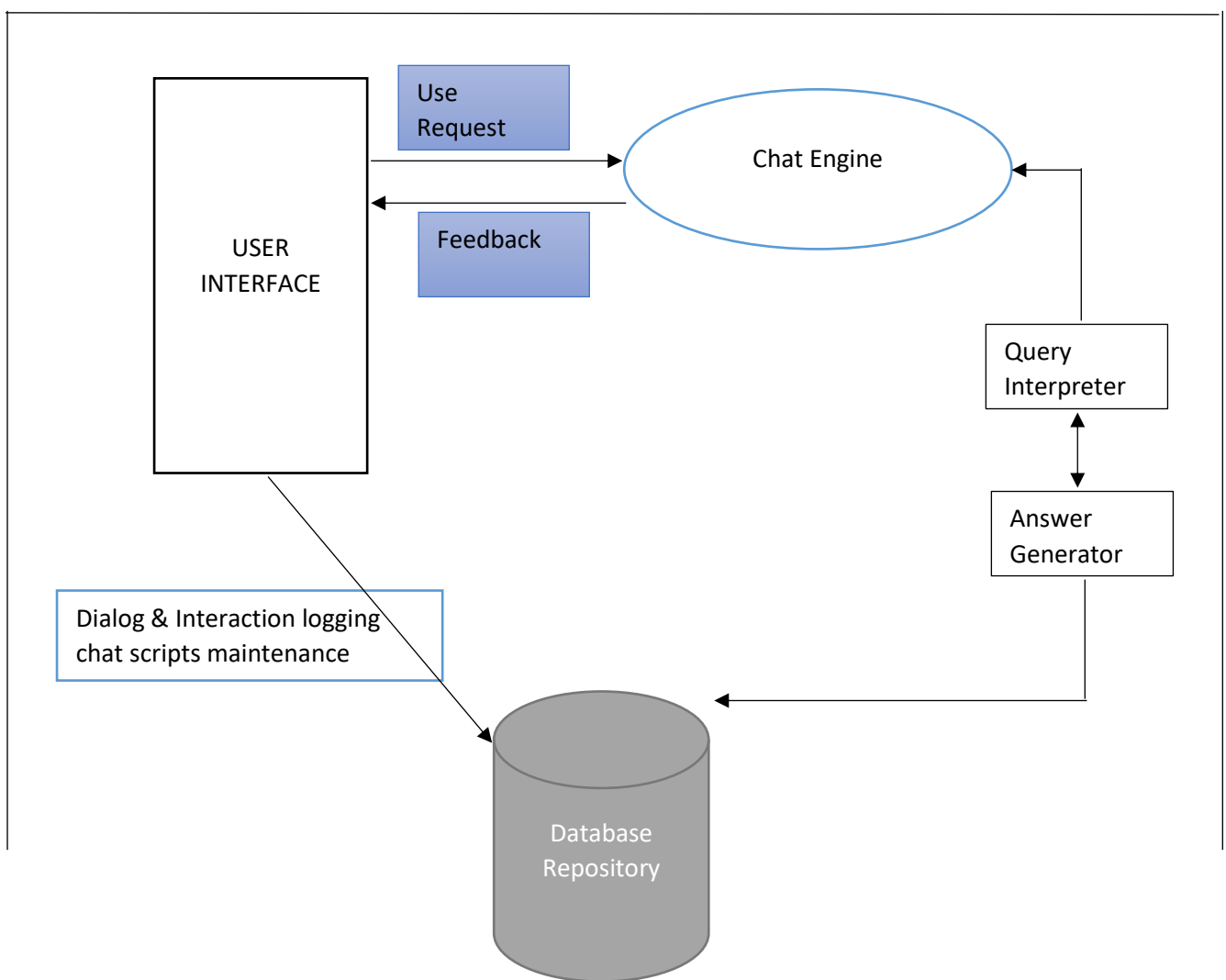


Figure 1

2.5 Empirical Framework

The adaptation of the chatbot technology has moved at a slow pace in various parts of the world. BancABC a banking institute in Zimbabwe introduced its very own banking chatbot called Ally claiming it to be the step to their journey of digital transformation (Techzim, 2020). Ohene-Afoakwa & Nyanhongo, (2017) talk about how the breakthroughs in technological advancements have no precedent. According to Ohene-Afoakwa & Nyanhongo, (2017) the Fourth Industrial Revolution is now the ability to realise the gains in technological advancements and to make the most of these technological infrastructures. Looking at people who are the potential users for the chatbot, they are authors who have made assessments that customers are prepared to trade security for convenience and when customers think there is an imminent threat to their security it is usually not the case.

Artificial Intelligence and machine learning having gradually become a conventional part of many industries and the application area that has been dwelled upon for advanced digital technology is customer service. Roznovsy & Pichkovska, (2021) point out that the main purpose for chatbots in the banking industry is for the provision of a better customer experience as well as help the staff prevent stressful situations that arise from direct communication with clients. For several years it has been discussed how IT digitization changed organizational structures and how new forms of work distributions have been created, in this case scenario the banking chatbot (Loebbecke & Picot, Reflections on societal and business model transformation arising from digitization and big analytics, 2015). Chatbot innovations are considered a source of competitive advantage and economic growth (Oana, Cosmin, & Valentin, 2017). Wilson, Daugherty, & Bianzino (2017), explain how AI has improved and has brought a well-founded belief that Artificial Intelligence may pose a threat to many jobs. On another note Digital Employees(AI driven Chatbots), has the potential to replace human employees with AI technology (Dale, 2016). With the chatbot learning from the Frequently asked questions with more accuracy in comparison to a typical human employee, organisations find it economic and faster to make use of the chatbots. (Brednar & Jonsson, 2018). According to Brednar & Jonsson (2018), organisations need to open opportunities from start-ups who embark on AI and should avail to them opportunities that comprise of information and

communication technology. AI should become a trusted colleague as opposed to being a threat and just a tool a user has a device.

2.6 Conclusion

This chapter gave a review of different researches undertaken by different authors to address the issue of banking with chatbot as well as the use of AI in various fields. The researcher did a full assessment of the algorithms used by the existing systems and found some gaps which can be closely looked at so as to be in a position to fully address the challenges not only being faced by the organisations that need to adopt the chatbot, but the staff workers and the customers that would use the system. The next chapter is going to look at research methodology, which is how the research was executed.

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 Introduction

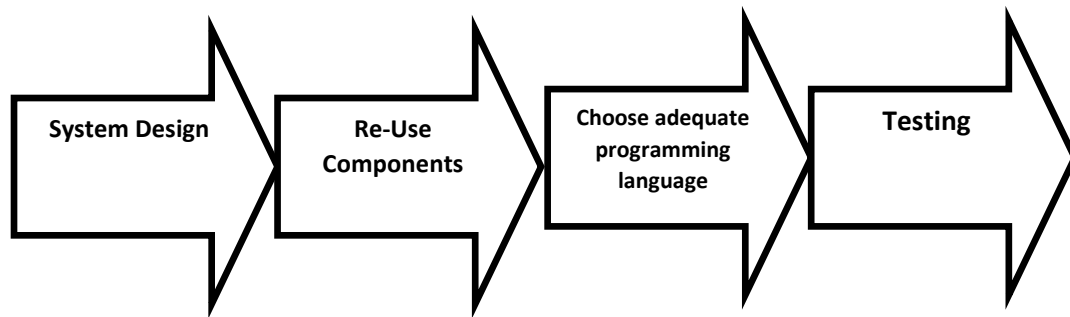
This chapter presents the chosen methodology to gather the necessary data and information to fulfill the purpose of this project. This chapter reveals arguments for choices of research approach, research strategy, study objects, data collection method, data analysis method and critical considerations and limitations.

3.2 Research Strategy

A qualitative research strategy was chosen so as to try and understand and explore all there is to know about chatbots. According to Bryan & Bell (2013) when trying to explore the possibilities and challenges with the implementation of a particular system, a qualitative approach is deemed necessary. They go on to say that the social science focuses on words, individual experiences and social reality. The objective for using a qualitative approach is to make it easy to acquire a better understanding of the phenomenon from the respondent's point of view (Slevitch, 2011). According to Slevitch (2011), when using a qualitative approach for research, the intent is centralized on finding depth, richness and subjective data. In this case scenario we would be looking how a chatbot would be implemented in a new context.

3.3 Research Design

A research design is a systematic plan to study a scientific problem. The design of a study defines the study type (descriptive, correlational, semi-explained, review, meta-analytic) and sub type for instance descriptive-longitudinal case study (Salkind, 2010). The core objective of this stage is to ensure that an operative, proficient, sustainable and reliable system is designed. The researcher used build research methodology which consists of building an artifact either a physical artifact or a software system to demonstrate that it is possible. The methodology consists of four phases to develop the systems, which are illustrated below:



System Design: it is the process of defining the architecture, product design, modules, interfaces, and data for a system to satisfy specified requirements. After gathering system requirements and well understood them, the researcher designed the system and considered a modular approach, which allows for simplification of system testing so as to increase flexibility and re-use potential of the system

Re-use Components: The researcher adopted already available components that are free for instance in this research use of libraries for the different modules that are already available from previous systems related to the proposed system. This in turn significantly saves system development time.

Choose Adequate Programming Language: involves use of a programming language which is more adequate for the building of a specific system, the researcher chooses Python. Important factors to consider when choosing a programming language to work with include: required run-time speed (compiled vs. interpreted languages), expressiveness (imperative vs. functional vs. declarative languages), reliability for instance. run-time checks, garbage collection) and available libraries.

Testing: it comprises of testing the developed system each time and the methodology requires the testing of modules first. This way future changes can be tested when they are introduced into the system.

3.4 Target Population

According to Schutt (2012), target population refers to a set of components or population that was sampled and to which the researcher would like to take a broad view to any study findings. The target population for this research was the banking sector in Zimbabwe but the research was conducted in Harare with Steward Bank via Interviews.

3.5 Sample & Sampling Techniques

The convenience sampling technique for the research was to select one bank (which is Steward bank) in order for the research to be successful. Convenience sampling is selecting participants because they are often readily and easily available (Hamed, 2016). This was due to limited time and resources hence cost and time effective for this research.

3.6 Data Collection

In accordance to Kabir (2016), data collection is process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses as well as evaluate outcomes. Data was collected through the use of interviews and questionnaires. Observations were difficult to conduct since a lot of workers were working from home due to the novel covid-19 pandemic.

3.7 Requirement Analysis

Grady (2010), stated that requirements are necessary attributes defined for an item prior to develop a design for the item. Requirements are structured for the identification of appropriate resources that will satisfy what the system needs, and the requirements for the those resources that provide a sound basis for the design or selection of those resources (Grady, 2010). Since it defines the expectations of the users for a system that is to be built, there is great need for system developers to involve the potential users of the system so that they can keep pace with dynamic changing needs of users. It is essential at this point to record all the functional and non-functional specifications of the required system.

3.7.1 Functional Requirements

According Kurtanović & Maalej (2017), classification of requirements is essential, Functional requirements are the processes and functionality that the new framework or system must meet. Functional requirements are clear depiction or indication of the considerable number of service and activities that the new system should give or

meet. Along these lines basing on the documentation and given the proposed framework has some functional requirements listed below:

- The chatbot must be able to provide results or solution to user queries.
- The chatbot must be text-based responses.
- The chat bot must allow users to enquire about loans, savings as well current accounts.

3.7.2 Non-Functional Requirements

Non-functional requirements define the manner or characteristic the system must have such as: performance, usability, modifiability, maintainability, security, scalability, reliability, availability, configurability and design constraints (Tsiu, Karam , & Bernal , 2016). The non-functional requirements for the proposed system are:

- **Maintainability**

The new framework must be effectively adjusted and equipped for giving new abilities and easy to maintain.

- **Reliability**

Handle framework failures when in operation.

- **Graphical user interface**

The framework to be implemented must have a user-friendly interface which is easy to understand and use. User interaction with the system should be easy.

- **Error handling**

The system should rapidly recognise and troubleshoot every error when they occur during operation.

- **Hardware Requirements**

The following are the hardware components that are required in developing the proposed system:

- At least a core i3 processor.
- Windows 8 and above capable computer with reliable network driver.

- **Software Requirements**

- Windows 8 or better operating system
- Python development tools

3.8 System Development

This describes the overview of the system or research as well as how it was developed so as to produce desired results. Essentially all the software tools and models made use of in the development of the system.

3.9 Development Methodology

The researcher used Prototyping model which involves building software application prototypes which displays the functionality of the system under development, but may not actually hold the exact logic of the original software.

The basic stages when developing a prototype involve Basic Requirement Identification, Developing the initial Prototype, Review of the Prototype, Revise and Enhance the Prototype.

Basic Requirement Identification:

At this stage, the author understood the very basic system requirements of the system especially in terms of user interface.

Developing the initial Prototype:

The researcher developed the initial prototype where the basic requirements are showcased and user interfaces are provided. At this point the banking chatbot was under development and the database was being fed with frequently asked questions.

Review of the Prototype:

The researcher presented the prototype to Steward bank's customer service team and a significant number of other individuals. Feedback was collected in an organized manner and used for further enhancements of the system under development.

Revise and Enhance the Prototype:

The feedback and the review comments are discussed at this stage and some negotiations are carried out with the customer based on factors like time and budget constraints and technical feasibility of the actual implementation. The changes accepted are again incorporated in the new Prototype developed and the cycle repeats until the customer expectations are met.

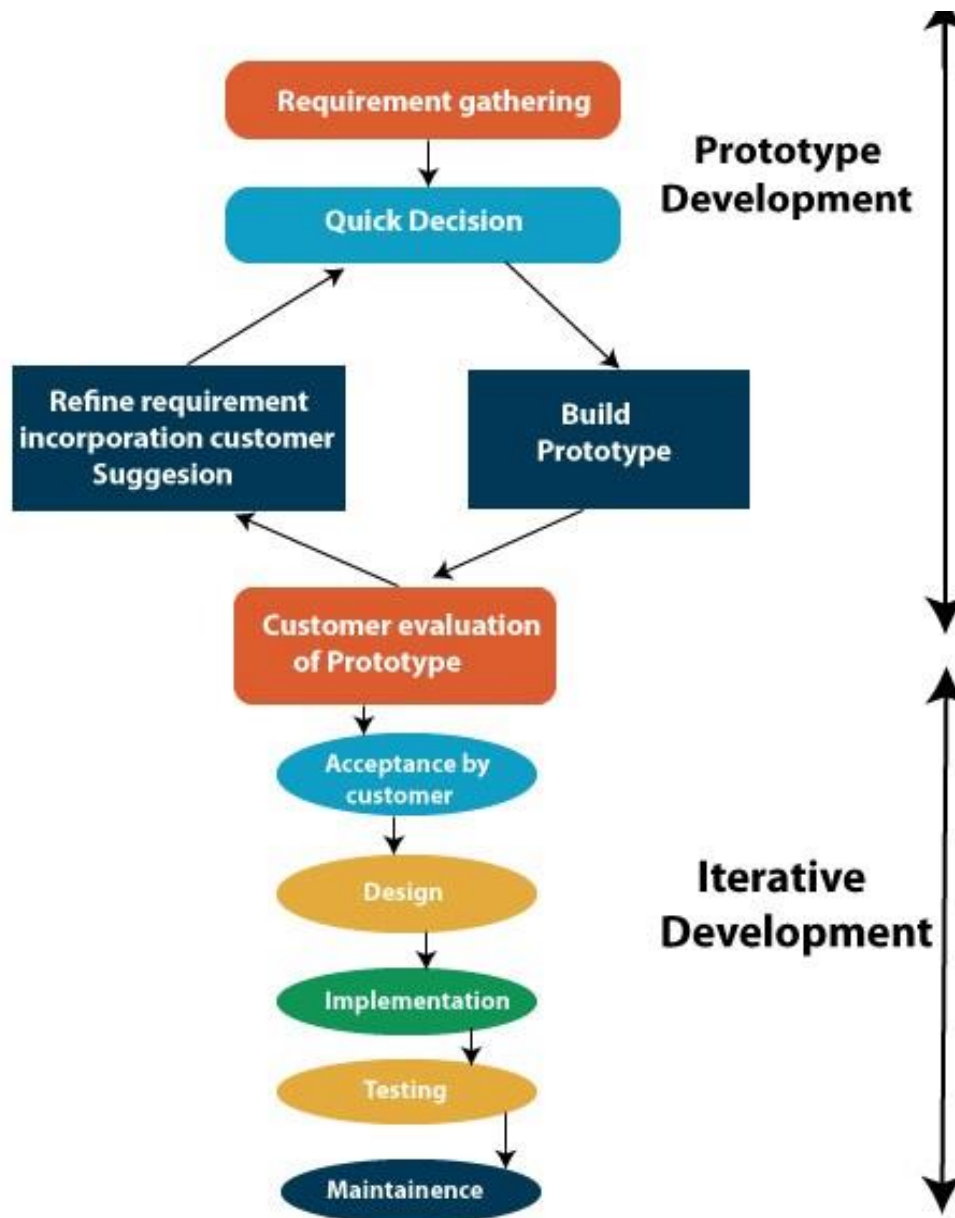
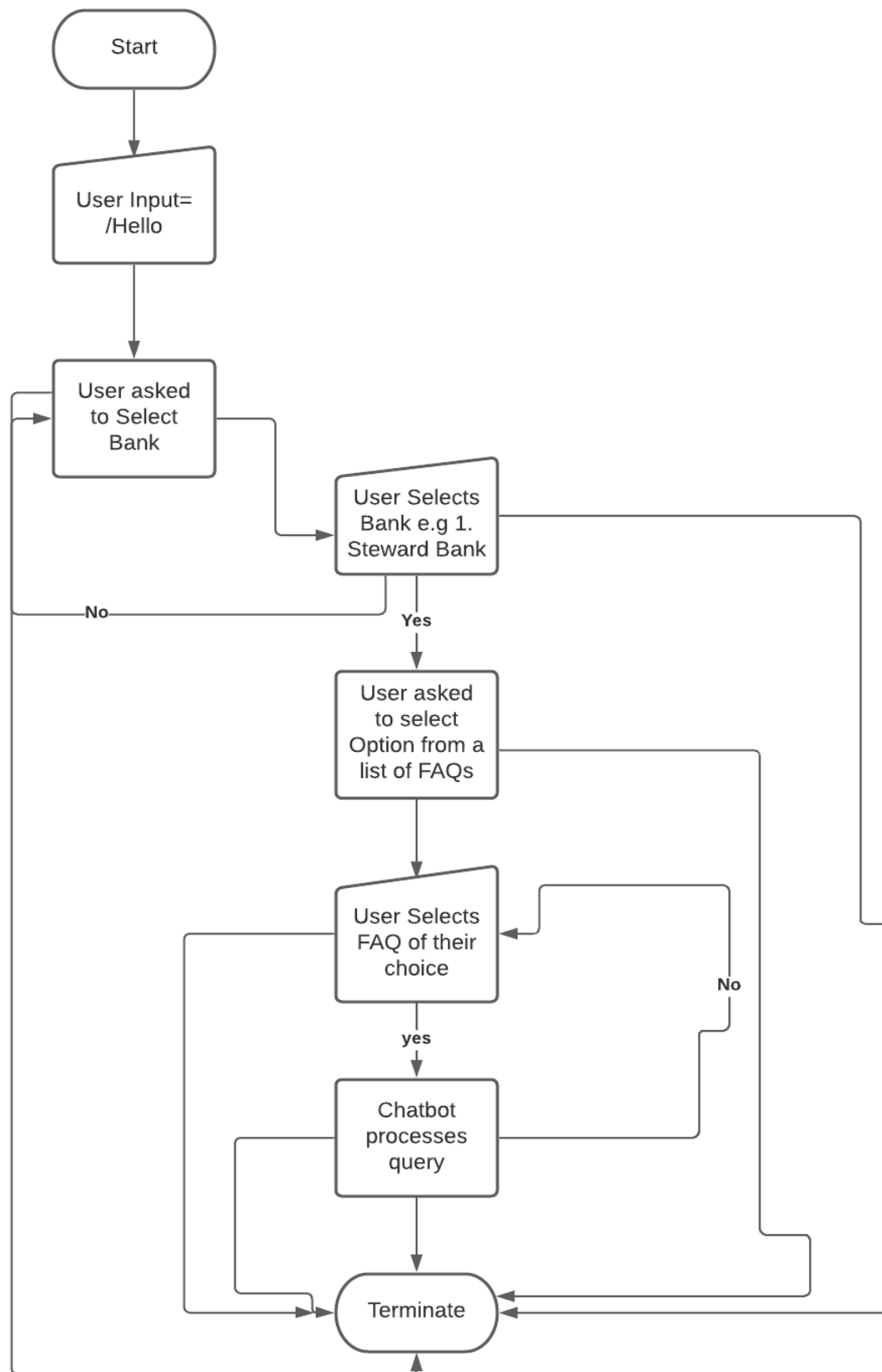
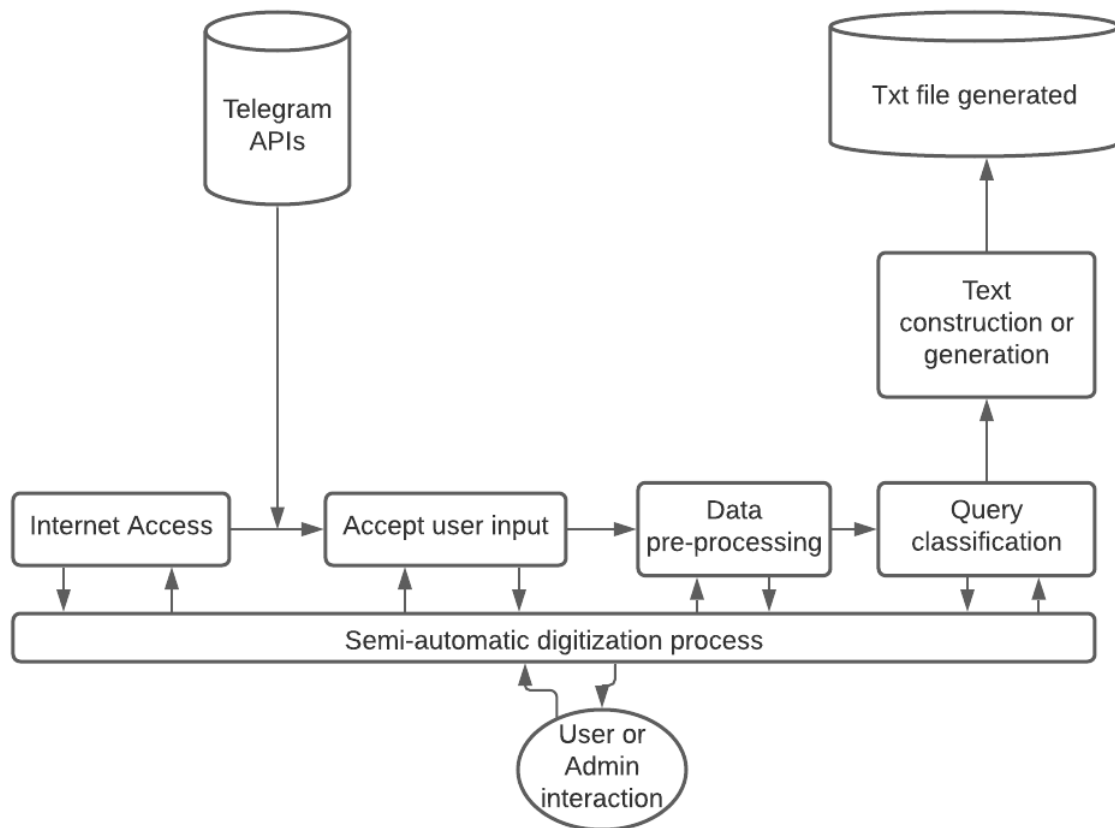


Figure 2 Prototyping Model

3.10 Systems Flowchart



3.10.1 Component Diagram



3.11 Summary on how the system works

The user downloads the Telegram application via Google Play Store if the user has an android device or downloads the Telegram application from Apple iStore if they use an IOS device. After downloading the Telegram application, the user signs up with Telegram and after the signing-up process they go and to the search window in the application and search for ZWBankBot and starts a chat where the user initiates a conversation with the chatbot assistant Mia by sending the message /Hello and then Mia responds with a message with options that can be selected by the user. Essentially the user interacts with Mia where he/she would get query assistance from the chatbot for the query they would have.

3.12 Conclusion

This chapter mainly focused on the methodology used in the development of the system and how it was designed as well as implemented. Different techniques were used to come up with the system.

CHAPTER FOUR:

RESULTS & ANALYSIS

4.1 Introduction

The need to analyse the efficiency of the developed solution arose when author had successfully implemented the system. Accuracy, performance and reliability used to determine the efficiency and effectiveness of the developed solution. The developed solution's behaviour was also well observed by the researcher under the different times and the outcome was recorded.

4.2 Testing

Testing is of paramount importance in the development process and is a crucial part of any software development lifecycle. It involves carrying out certain procedures and operations to understand the limitations of the software. and this chapter shows the tests that were undertaken and the result they produced. The testing is thus measured against the functional and non-functional requirements of this research as outline in the previous chapter.

4.2.1 Black box Testing

Black box testing is a software testing method where the functionalities of software applications are tested with no knowledge of the internal code structure, implementation details and internal paths. Black Box Testing mainly focuses on input and output of software applications and it is entirely based on software requirements and specifications.

4.2.2 White box Testing

White Box Testing is software testing technique where we have the internal structure, design as well as the coding of software are tested to verify flow of input-output and to improve design, usability and security. In white box testing, code is visible to testers so it is sometimes referred to as a clear box.

4.3 Presentation of Results

Data was obtained from background readings that were acquired by the researcher and the interviews that were carried out. Observations were also made on how the system performed during the course of its implementation. The results were analysed, recorded and interpreted.

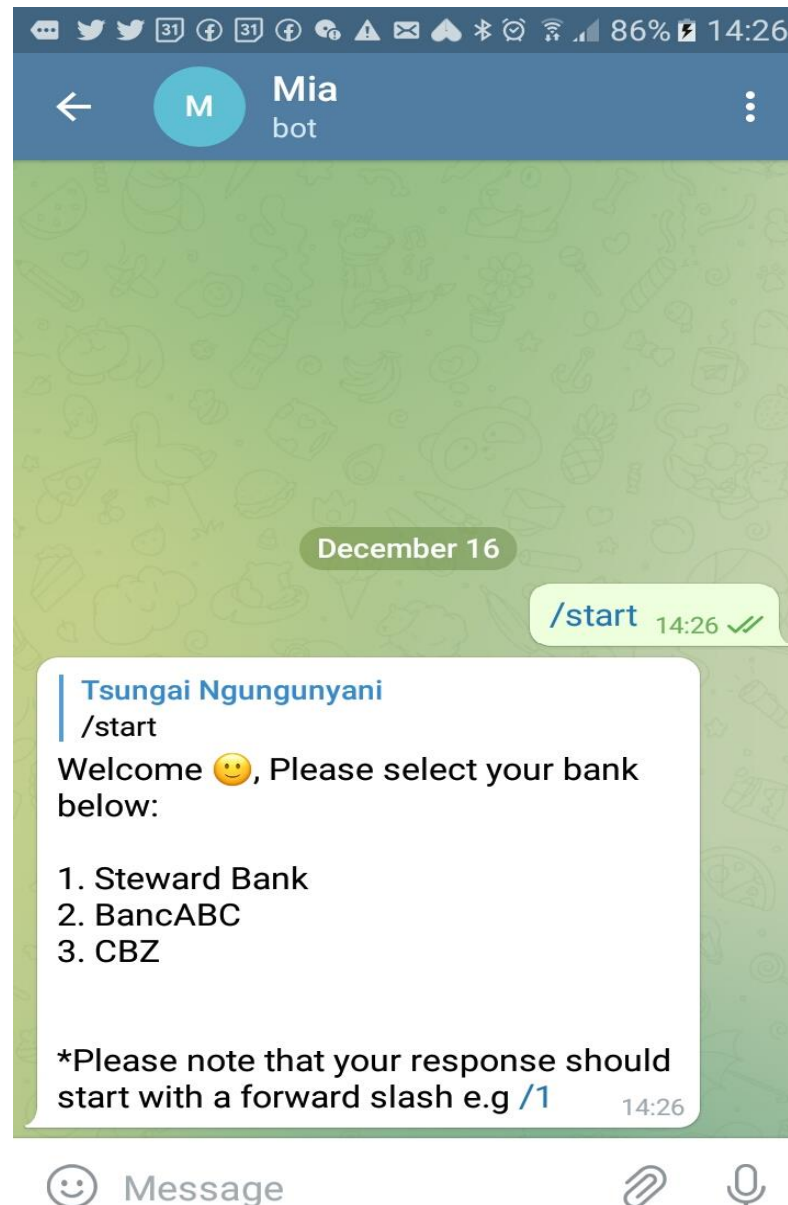


Figure 2 Initilisation of the chatbot

The figure above show that the interface is descriptive and easy for a naïve user to use as it contains detailed instructions as to how one can communicate with Mia the banking chatbot. Taking a look at the options given, one could choose their bank and if it were Steward Bank

then the user would select option 1 by sending /1 as it is illustrated in the example on the welcome message.

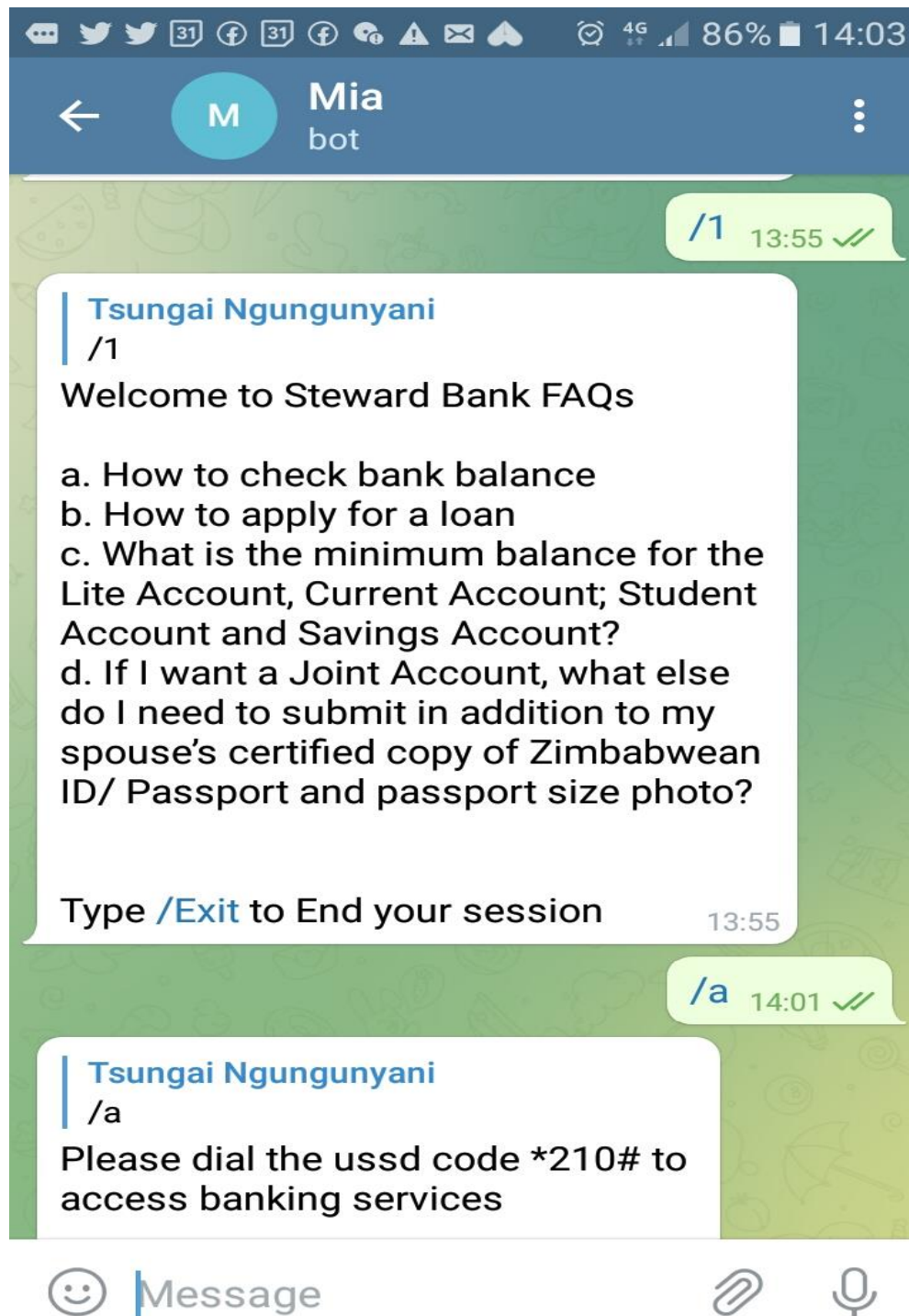


Figure 3 Interaction with the Chatbot

As shown above one could see that if the user is to respond by selecting the bank of their choice, they are then prompted with a message that has a list of Frequently Asked Questions so as to try to make the query process efficient.

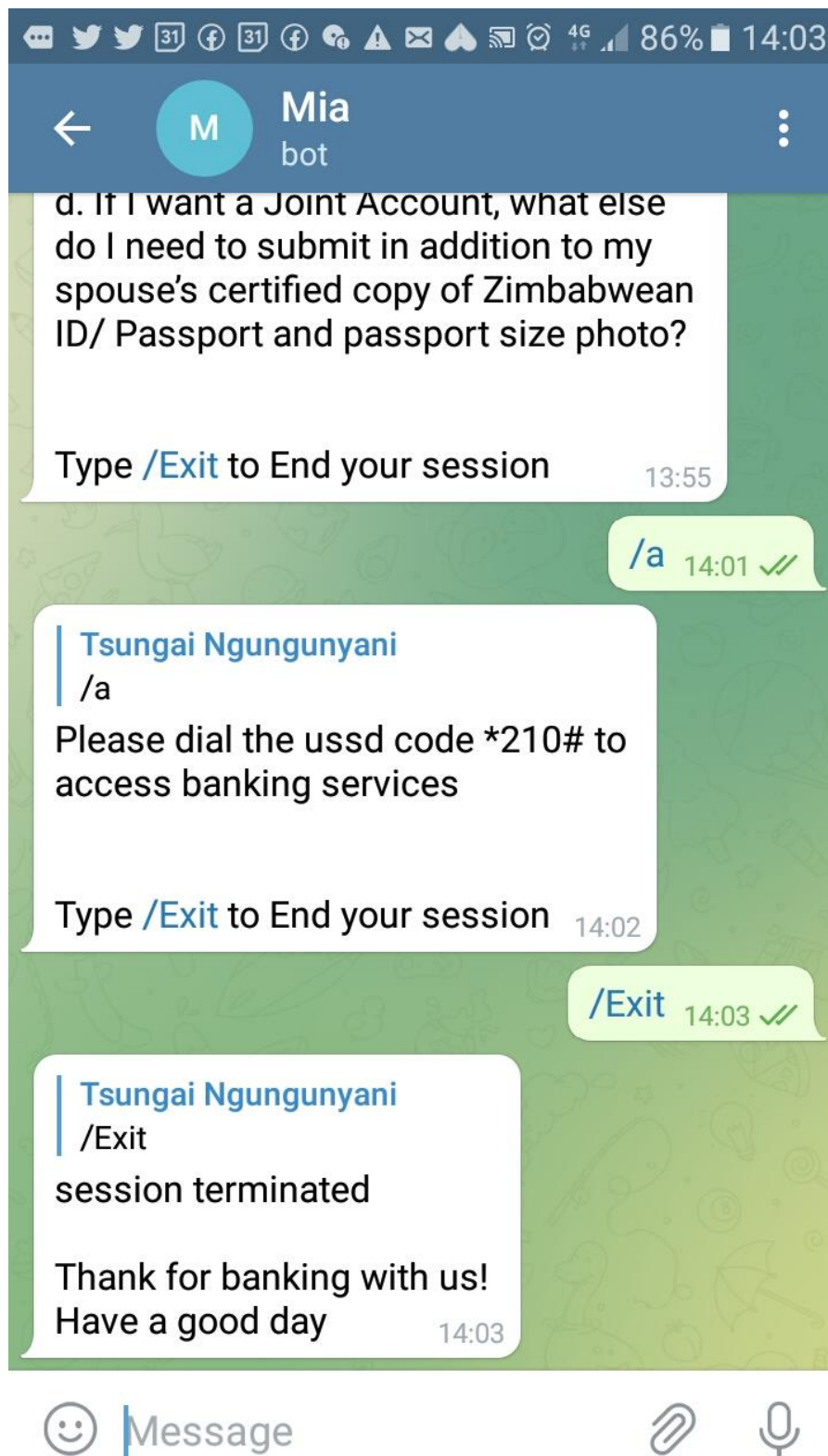


Figure 4

The chatbot responds all user inputs and in turn provides an output that would help or assist the user with their query.

4.4 Evaluation measures and Results

Hossin & Sulaiman (2015), point out that an evaluation metric measures the performance of a classifier, they go on to say that model evaluation metrics can be grouped into three types namely threshold, probability and ranking.

4.5 Measuring system performance and accuracy

The performance of the system is mainly ranked or measured by its ability to converse with the user for any given input from the user. Its ability to assist with frequently asked questions and help the user with information that would take long to find as a result of connection issues with customer services or in some case scenarios failure to understand each other.

4.6 Implementing System Performance

Software evaluation

Software evaluation by respondents was made in terms of performance, reliability and cost effectiveness.

Performance

Performance was the capability of the system to provide an output for any given input.

Reliability

The extent to which the system could carry out its intended functions is reliability. The system produced the results with precision as the input from the user determines the output thus the user would get the answer or response they would have probed for.

Cost effectiveness

To all respondents, the system was a reliable, time saving, unlike the WhatsApp API that requires one to purchase the API and requires payments for the chatbot to start working as opposed to the Telegram bot that allows for a prototype to be developed with the programming language being python.

4.7 Statistical Analysis of data

Interviews were conducted successfully and the results obtained from the interviews that were carried out from the people who participated in system testing was 100%. The researcher observed how the banking chatbot works and checked it's response time against that of getting help from the customer help services which is in most case scenarios is time consuming and responses are not always guaranteed.

4.7.1 Interviews

In gathering how effective the system is, the researcher distributed the system and interviewed the social media assistants who manage and handles steward bank social media accounts as well as interviewed few individuals. Responses were consolidated and results of the information gathered indicated that:

- Participants in the interviews evaluated the system on performance, reliability and cost effectiveness using responses:
 - (1) Effective
 - (2) Not effective

Interview results

Software Criteria	Effective (%)	Not effective (%)
Performance	95	5
Reliability	100	0
Cost Effectiveness	88	12

Table 1

As from the table above, results showed that the system performance was accepted by 95% as 5% of the respondents felt it was not an effective system. All respondents responded positively on reliability and were of opinion that the system is very convenient and useful. 88% of the participates thought that the system is cost effective in terms of saving time and saving money, whilst 12% felt completely different.

4.8 Decision Based on Test Results

After conducting interviews and observation, the researcher was able to gather quantitative data and formulated descriptive results in the form of graphs and tables. The analysis of responses from customer service personnel's as well the bank

customers helped focus on the points that were of utmost importance. Analysis of both the banking institute and their respective customers helps the researcher comprehend the areas that need to be addressed as well as innovative ways to solve them for instance the use of a banking chatbot to help both the customer service department from the banks assist customers with queries and frequently asked questions.

4.9 Conclusion

From the results obtained, the researcher came to a conclusion that the banking chatbot if integrated to a mobile phone would make it easy for customers to contact their bank's chatbot to get information on FAQs as opposed to calling or physically visiting the bank branch to enquire for a service which is tedious and time consuming.

CHAPTER 5:

CONCLUSION & RECOMMENDATIONS

5.1 Introduction

The previous chapter focused on presentation and analyses of collected results from the research. This chapter focuses on recommendations, conclusions and future work as far as the banking chatbot on customer's FAQ's is concerned. In addition, this chapter looks at the drawbacks faced by the researcher during implementing the research system under consideration.

5.2 Aims and Objectives

The aim of the research was to develop a banking chatbot system that helps customers with queries as it would store solution store Frequently Asked Questions. This aim was fully achieved. The objectives set by the researcher were also achieved. The first one was to design a user interface that is easy to use such that even a naïve user can make use of the banking chatbot. This was clearly achieved in chapter 4 when tests were carried out since an interface was established through a telegram API. The second was to make the banking chatbot accessible on a smartphone and since telegram can be downloaded from Google play store or Apple store if the user is either using an android or ios device respectively. This was also achieved in chapter 4 when the researcher managed to run telegram on an android device and communicate with the banking chatbot. From the banking chatbot interface via telegram the user is given option for at every stage such that the user selects an option that satisfies their query

5.3 Future Work

The banking chatbot be able to check bank balances and be able capable to perform a number of banking services as opposed to just checking for queries and frequently asked questions. The banking chatbot in this case Mia should be able to process text and voice-based inputs for convenience's sake such that a user can prompt for a balance via voice commands.

5.4 Challenges Faced

Management of expectations of both the users as well as the banking staff who working the customer service department was complicated as some user expectations are complicated to satisfy. Another challenge came as a result of the novel covid-19 pandemic which made the research process complicated as they were travel restrictions that prohibited the researcher from conducting various research methods so as to have a deeper understanding of the system and how it works.

5.5 Recommendations

The initiative for a banking institute to have a banking chatbot to assist with its banking services allows for banks to move in line with the technological advancements. Some of the banking services that can be accessed via ussd codes can be integrated into the banking chatbot for convenience's sake such that users can access their banking services and get assistance on their queries in one application.

5.6 Conclusion

The banking chatbot was implemented successfully via the telegram api which provided users with a friendly interface that is interactive. The banking chatbot could assist users with their frequently asked questions and was responsive to all the user's inputs.

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