

KENYATTA UNIVERSITY

DEPARTMENT OF COMPUTING & INFORMATION TECHNOLOGY

**Intelligent Conversational Agent for Enhancement of Online Communication in Selected
Universities Using Pattern Matching Algorithm**

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*This project is submitted for the partial fulfillment of the requirements for the award of the
degree of Masters of Science in Computer Science in the School of Engineering and Technology
of Kenyatta University*

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Declaration

This project proposal is my own work and has, to the best of my knowledge, not been submitted to any other institution of higher learning for an award of a degree.

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This project proposal has been submitted for examination with my approval as University Supervisor

.....

Signature

Date

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Dedication

To the sovereign God almighty

To my dear wife Grace and my lovely children Ryan and Lyannah for your unwavering support and understanding.

To my dear parents Mr. Samuel Kuria, Mrs. Gladys Kuria and my siblings.

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List of Abbreviations and Acronyms

KU – Kenyatta University

ICT- Information Communication and Technology

NLP – Natural Language Processing

AIML – Artificial Intelligence Markup Language

PHP – Hyper -Text Preprocessor

XML – Extensible Markup Language

NLU – Natural Language Understanding

AIAAS – Artificial Intelligence As A Service

HCI – Human Computer Interaction

API – Application Programmable Interface

FAQ – Frequently asked questions

ITS – Intelligent Tutoring System

Operational Definition of Terms

Chatbot: - This refers to UniBot application intended to communicate or converse with a human being, in a consistent manner. In other terms it will be referred to as an intelligent conversational agent

An Avatar: - This is the graphical representation of the user or a person's character as will be demonstrated on the UniBot application's user interface.

Natural Language Processing: -This refers to an area of computer science and artificial intelligence and shall be used to enable interactions between computers and human natural languages.

Turing Test: - This refers to a test of a machine's ability to show intelligent behavior and in the projects it shall be used in the testing and evaluation phase.

Hypertext Preprocessor–PHP is a server-side scripting language which will be used to design the applications landing page and interface.

Artificial Intelligence As A Service–This is a third-party offering of artificial intelligence outsourcing and in the projects case Pandorobot Platform

Artificial Intelligence Markup Language - XML based markup language which will be used to develop the intelligent conversational agent

Human Computer Interaction–Refers to how people interact with computers and in this project, to what extent Unibot application is or not developed for successful interaction with human beings.

Application Programmable Interface- This is a set of subroutine definitions, communication protocols, and tools which will be used to develop a link for exchange of information between UniBot Application and University website.

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Abstract

University websites and online portals are the primary means through which potential students and other stakeholders find important information about an institution. University websites are essential to these organizations' marketing and communication efforts. In websites, a lot of information is spread across numerous amounts of web pages. Navigating through these web pages to locate relevant results, according to the user needs, can be non-resulting, time consuming and annoying at times. There is need to complement these websites with the use of an AI Chatbot (UniBot) in order to serve more efficiently. To address this problem, the research project proposes to design, develop and implement such an agent that will engage online users of universities websites and online channels efficiently and in real time. The project initially aims at performing an extensive literature survey on intelligent conversational agents and the feasibility of applying them in enhancing online communication in universities. This will guide the design development, implementation and testing. The project shall utilize an iterative - incremental methodology to aid in design and development of UniBot, using AIML (Artificial Intelligent Markup Language) Pattern matching algorithm on the Pandorabot (AIAAS) platform. This will generate high quality training data, with which, the agents Natural Language Understanding (NLU) model can be trained. This will make the agent (UniBot) capable of handling user requests efficiently at run time. The agent will be integrated to the university website by use of an API. Finally there will be a provision to train and test the agent using data which will be made available by Online Communication/ University Website department at Kenyatta University.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

According to Melisa Perich (2015), a lot of research work has been done on Artificially Intelligent Systems to support education. Richard Elis, Tony Allen and Andres Tuson (2010), argues that with the development of Artificial Intelligence, computer systems can complete or perform tasks that would require human intelligence at a much larger scale than we could on our own. AI has been applied in fields like speech recognition, visual perception, natural language processing and decision making. Artificially Intelligent Conversational Agents or Chatbots have being utilized in a number of ways. Companies like Paypal, Facebook and Tesla are increasingly relying on Artificially Intelligent Bots. Google has also developed Google Assistant which is a virtual agent that can engage users in two-way conversations. From these advancements we can clearly see that there is a growth in Artificially Intelligent Conversational Agents or Chatbots adoption rate. Modern commercial chatbots offer more advanced development environments enabling the design and development of intelligent conversational agents with complex and goal driven behavior. According to The Society for the Study of Artificial Intelligence and Simulation of Behaviour (2018), 'Mitsuku' (A chatbot created from AIML technology on Pandorabot platform by Steve Worswick and a four-time Loebner Prize winner (in 2013, 2016, 2017, and 2018), is considered the most humanlike chatbot. In Mitsuku, both the words and the grammatical structure of the user's input are analyzed using customized templates. This enables the development of a user model in which a conversational context and specific words in the conversation can be used to determine the bot's response. Responses might include further conversation with the user, reading or writing to external systems or a combination of both. As computing technology and the underlying language processing software advances, we can expect to see potentially exponential growth in the delivered complexity of chatbots. Already, artificially intelligent conversational agents have come a long way from mere systems designed for fun, flirtation or simple 'chat'. According to Kerly, A.,

Hall, P. & Bull, S. (2006), We are now approaching a time where the technologies can, through extensive syntactic structures developed for natural language processing and some complex methodological data structuring, begin to display behavior that users will interpret as understanding. Having seen these, Ser Ling Lim and Ong Sing Goh (2016) noted that very little has been done to develop artificially intelligent conversational agents to support online communication in universities.

1.2 Statement of the Problem

According to Kem Saichaie and Christopher C. Morpew (2014), university websites and online portals are the primary means through which potential students and other stakeholders find important information about an institution. This makes university websites essential communication and marketing channels. Ser Ling Lim and Ong Sing Goh (2016) noted that very little has been done to develop artificially intelligent conversational agents to support online communication in universities. According to Chatbot Margazine 2018, navigating through these numerous web pages to locate relevant results, according to the user needs is time consuming. Therefore, there is need to support and facilitate computer aided online communication by use of intelligent conversational agent, especially for real time inquiries. There is also need to enhance automated answers to frequently asked questions (FAQs) and ensure that users access important information with much ease.

1.3 Objectives

- To explore current state of artificial intelligent conversational agents and applications.
- To design, develop and implement an intelligent conversational agent, using AIML and Pandorabot Platform and integrate it with Kenyatta University website using an API
- To evaluate the agent with dataset from KU Online Communication Department and check whether it can provide appropriate responses and ensure an engaging conversation with users.

1.4 Project Research Questions

The research questions outlined below guided in the attainment of the above objectives

- a. What is the current state of intelligent conversational agents and applications?
- b. How can an intelligent conversational agent be designed, developed and implemented to support online communication in a university.
- c. How accurate is the intelligent conversational agent in responding to real-time questions and engaging online users?

1.5 Justification of the Project.

Development of an AI solution will facilitate computer aided communication by use of an intelligent conversational agent. The solution will also enhance automated real time answers to frequently asked questions (FAQs) and ensure that users access important information with much ease.

1.6 Scope and Limitations of the Project

The project entailed designing developing and implementing an intelligent conversational agent from AIML and Pandorobot platform. The study was only limited to Kenyatta University. The questions that could be answered were to be within the agent's knowledge base. The question to be answered were to be text only input in proper English language only.

1.7 Significance and contribution of the Project

This project was expected to offer a solution to overcome the existing shortcoming of university web chat systems which required a human assistant. The conversational agent could be used in different universities because its knowledge could be added and customized. It would also offer a big advantage in ensuring 24-hour services to students and web visitors which will be of great help.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 Introduction

This chapter will cover Understanding Artificial Intelligence, Machine Learning and Natural Language Processing, Understanding Conversational Agents, Known Intelligent Tutoring Systems that use Natural Language, History of Intelligent Conversational Agents, AIML 2.0 in a Pandorobot Environment and Current Application of Chatbots

2.1 Artificial intelligence and Natural Language Processing

In earlier days, Alan Turing, a pioneer in Artificial Intelligence, tried to respond to the question “*Can machines think?*” This issue has birthed several research undertakings in Artificial Intelligence (AI), Machine Learning (ML) and Natural Language Processing (NLP). According to McCarthy (2007), one of the researchers in the field, Artificial Intelligence (AI) and Machine Learning (ML) are very much related. McCarthy defines AI as “*the science and engineering of making intelligent machines, especially intelligent computer programs*”. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable. Yann LeCun, Yoshua Bengio & Geoffrey Hinton (2015) defined Natural Language Processing (NLP) as a class of Machine Learning (ML) procedures that allows computer models that are comprised of many processing layers to learn data representations with many levels of abstraction. According to (Yuann et al 2015) deep learning algorithms use many levels of a non-uniform processing where each following level uses the output of a proceeding layer as an input. According to R. Sathya (2013), supervised learning is used for classification while unsupervised learning for pattern analysis. Deep learning also uses some form of gradient descent for training. Due to multiple level of data processing it forms hierarchical data representation where higher level learns from lower level data layers. Rina Dechter (1986) coined the expression Deep Learning for the first time, but Ivakhnenko & Lapa (1965) wrote the first working learning algorithm whose output was published in 1965. The initial idea was first actualized with the design development and

implementation of a computer identification system by the (WSCL) World School Council London. This actually showcased the algorithms learn ability. As we know that various machine learning procedures that have been used to process our raw data to help us is content filtering on social network, to write recommendation engine for electronic commerce based websites, in image processing and recognition, to translate speech to text etc. Most of these tasks are being implemented using a most popular class of machine learning procedures called deep learning. According to Yoshua Bengio (2009) in “Learning Deep Architectures for AI”, being able to learn new knowledge and creating new relationships between ideas constitutes to an important part of deep learning. According to Yoshua, hard programming accurate responses for all possible questions a machine will ever receive and process is almost impossible when trying to create a machine that might perfectly represent how human beings communicate. Because of this, a lot of research is currently being done to model and create effective ways of learning from data. Laurence Devillers (2005) used ML methods with audio information from call centers to detect human emotions. This algorithm became more and more effective as many conversations were processed and labeled. The algorithm had shortcomings because it was unable to always report meaningful results and could not detect mixed emotions. (S. B. Kotsiantis et al 2007), used various classification algorithms and attempted to improve classification accuracy. He concluded that the most vital question to ask when working with classification as applied in machine learning is not whether an algorithm is more effective than others, but rather we should ask which parametric conditions a certain method can effectively outdo the others on a given scenario. Yanming Guo et al (2016) gives three well known procedures related to the pooling layers, each having different purposes. In these he shows that deep learning has been widely adopted in various directions of computer vision, such as image processing, objects detection, image retrieval and human pose approximation, which are key tasks for image understanding.

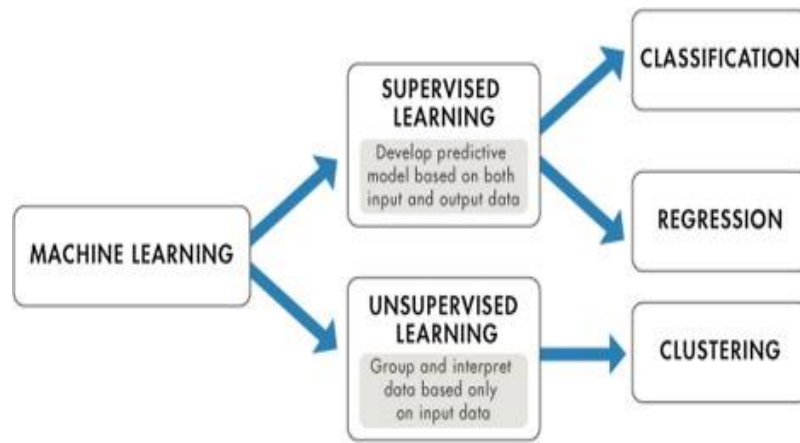


Figure 2.1: Machine Learning Framework adopted by Rory P. Bunker &FadiThabtah (2017)

2.2 Conversational Agents

The development of conversational agents enabled human beings to interact with computers by use of natural language processing (NLP). According to Atwell and Shawar, (2007), with the growth in pervasive computing and technologies, there developed an ardent requirement to interact with computers in the same way communication is done with people, by using natural language. According to (Zadrozny et al. 2000), by allowing users to express themselves directly and in a natural way, i.e. by speaking, typing, and pointing, a more sophisticated HCI can be achieved. Milan Van Eeuwen (2016) Defines a chatbot as an overall term for describing concepts like chatter bots, virtual agents, and conversational agents. Desaulniers (2016) defined a chatbots as an interactive messaging application powered by artificial intelligence (AI). In addition to Desaulniers definition, Schlicht (2016) describes a chatbot as a service, powered by rules and sometimes artificial intelligence that you interact with using a chat interface. A chatbot is defined in various ways but they all describe the same phenomenon. The definitions mostly differ in mentioning to what extent a chatbot is driven by artificial intelligence. With more progress in research, Milan van Eeuwen (2017) describes a chatbot as an intelligent application that interacts with user in natural language through a chat and can be used effectively to serve a commercial purpose.

2.3 Known Intelligent Systems that use Natural Language Processing

According to Melisa Perich (2015), a lot of research work has been done on Artificially Intelligent Systems to support education. Richard Elis, Tony Allen and Andres Tuson (2010) argues that “with the development of Artificial Intelligence, computer systems can complete or perform tasks that would require human intelligence at a much larger scale than we could on our own”. Annabel Latham, Keeley Crockett, David McLean and Bruce Edmonds (2012) points out that artificially Intelligent Conversational Agents or Chatbots have been utilized in a number of ways but have not been successfully applied in educational environments.

According to André, E., T. Rist, and J. Müller (1997), intelligent educational applications that use NLP have in most cases been either tutors or virtual life like characters which can be used in online learning environments to help guide the learning processes. According to Andre, Pedagogical agents and avatars provide an involving, customized yet simplified interface. In reference to Kim & Baylor (2006), pedagogical agents are life mimicking characters that are integrated to instructional program to support learning. Conversational agents may be used to help stimulate social inter-actions with learners in a way that facilitates learning through collaboration, sharing of tasks, providing information, and encouraging learners. Pedagogical agents may act as groups, colleagues, contesters, aids or tutors. To enable efficiency in operations, pedagogical agents should have the capability of give responses to questions, provide clues and clarifications, monitor learners and give feedback to them.

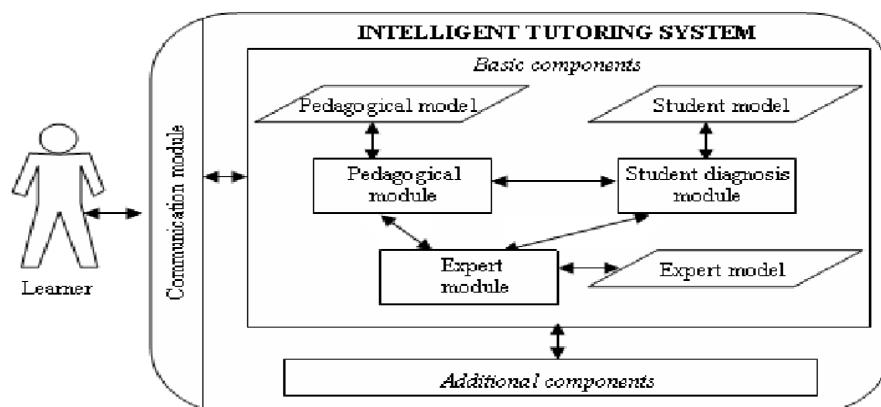


Figure 2.2: Components of an Intelligent Tutoring System. Source (Woolf 2008)

2.4 Trends in evolution Intelligent Conversational Agents

This review brings together periodic development in chatbots technologies and natural language processing in a general context. According to Desaulniers (2016), intelligent conversational agents or chatterbots provide a Natural Language Processing (NLP) to different users. Intelligent Conversational agents design and development has over time grown to be a complex way but useful in implementing chatbots used in e-commerce, entertainment and other application domains. In reference to McCorduck, Pamela (2004), a well renowned conversational agent ELIZA is widely considered as one of the first conversational agents developed in 1966. ELIZA is a chatbot created using Natural Language Processing algorithms to demonstrate how man and machine interact. ELIZA analyzed the input sentences and their structure and generated its answers guided by break down rules related with analysis of an input. This generated an impressive display of focusing on its end users. The main drawback is that ELIZA could not store any chat and so had a challenge in entering into collaboration or negotiation. ELIZA model of NLP has been developed periodically over time, resulting into the design and development of many conversational bots. According to Dr. Wallace R.S. (2009), A.L.I.C.E. is an intelligent conversational agent built using (AIML) and has been developed for over the decade. The agent's construct is based on different categories having stimuli, or pattern, and a template which provides the answers. Appropriate responses to a user are input is provided by categories matching. In addition there are other AIML modules which provide for context consideration, conditional branching and trainability to generate new responses. ALICEbot is an advanced conversational agent but has not yet been successfully applied in any specific business domain. The Jabberwacky chatbot developed in 1988 is considered as the first real attempt at creating AI from human interaction. It had as its aim to model natural human conversations in form of flirtation and appearing funny in interaction. Jabberwacky conversational agent learned from all past interactions with the users. The Jabberwacky operated by saving and keeping every input it received in its knowledgebase, and used context to match patterns aiding in selecting the most appropriate response. Jabberwacky had no any preprogrammed rules and instead depended wholly on previous chats. Apurva

Muthe (2017), when he was researching on “How AI can be used in Education.” Designed and developed TinkerBot. He used the prototype to demonstrate how to make learning conversational and personalized. According to The Society for the Study of Artificial Intelligence and Simulation of Behaviour (2018) ‘Mitsuku’, which received a Lobner Prize in 2018 is currently ranked the most humanlike. Mitsuku was created by Steve Worswick which offers a general conversation.

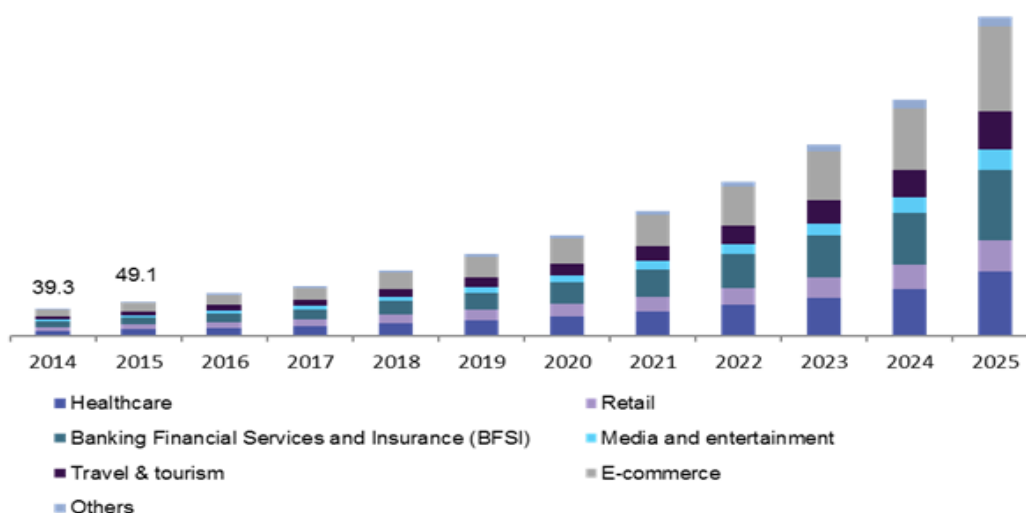


Figure 2.3: Trends in evolution of chatbots. Source (Dimensionless.in, 2022)

2.5 Artificial Intelligence Markup Language (AIML)

According to Wallace, (2014) AIML was developed by Dr. Richard Wallace and Alicebot open source society, aimed at building intelligent conversational agents that responded to different stimuli. AIML was derived from XML and customized to a specific make. As an XML based language, AIML also relates to the grammar specification of XML such as the syntax of comments, white space handling, end of line.

The bot element is used to recall custom bot properties defined in the .properties file. These variables are accessible to all users of the bot.

<category>

<pattern>WHO ARE YOU</pattern>

```
<template>My name is <bot name="name" /></template>
</category>
```

The category element delimits a base unit of knowledge in an AIML-based chatbot. In a very broad sense, a single category accepts an input, and returns an output.

All AIML elements (with the exception of the AIML root element and the topic element) must be contained within a category block.

```
<category>
<pattern>HELLO</pattern>
<template>Hello world!</template>
</category>
```

The condition element is used to create an “if-then-else” type of control flow within a bot's response. This is done by checking the value of a predicate, and returning a response depending on that value.

For example:

```
<category><pattern>Can does my shirt look like?</pattern>
<template>
<condition name="gender">
<li value="male">Wow Looks so smart!.</li>
<li value="female">Your dress looks pretty!.</li>
<li>You look very smart and official.</li>
</condition>
</template>
</category>
```

The input element returns the entire user's input. This is distinct from the star element, which returns only contents captured by a wildcard in the matched pattern.

For example:

```
<category>
<pattern>Where are you now</pattern>
<template><input /></template>
</category>
```

The interval element is used in conjunction with the date element to calculate the difference between two different times/dates. To calculate the difference between the current date and the bot's birthdate, make sure to include a birthdate property in the .properties file, in a format that matches the format you intend to be working with.

For example:

```
<category>
<pattern>How old are you?</pattern>
<template>
<interval format="%B %d, %Y">
<style>years</style>
<from><bot name="birthdate"/></from>
<to><date format="%B %d, %Y" /></to>
</interval>
</template>
</category>
```

The learn element allows the user to generate new category blocks from within a conversation. This powerful introduced in AIML 2.0 allows users to actually teach the bot new information. Categories generated by the learn element are stored in memory, and are only accessible with the clientname that was used to create them.

For example:

```
<category>
```

```
<pattern>I love swimming</pattern>
```

```
<template>
```

```
I should not forget that you love swimming.
```

```
</learn>
```

```
<category>
```

```
<pattern>What is your favourite activity</pattern>
```

```
<template> I love swimming template</template>
```

```
</category>
```

```
</learn>
```

```
</template>
```

```
</category>
```

40 <template>Certificate, Diploma, Undergraduate and Postgraduate Programs</template>
41 </category>
42
43 <category>
44 <pattern>What are the admission requirements</pattern>
45 <template>>These are the requirements for pro
46 </category>
47
48 <category>
49 <pattern>What courses does the University offer under elearning</pattern>
50 <template>>Undergradua
51 >Postgraduate Programs
52 >Diploma and Cer
53 </category>
54
55 <category>
56 <pattern>Where can I find the catalogue</pattern>
57 <template> You can find the catalogue under >Studen
58 </category>
59
60 <category>
61 <pattern>WHICH UNITS AM I TAKING</pattern>
62 <template>Kindly identify your course/program. The year one is indicated on the left hand side of the table,
63 </category>
64
65 <category>
66 <pattern>HOW DO I SELECT MY UNITS WHEN I HAVE SOME UNITS WAIVED</pattern>
67 <template>Within your year and semester, identify the units that have been waived. Identify the units that h

Figure 2.4: A sample AIML Code on Pandorobot Platform Source (UniBot, 2019)

2.6 Current Applications of Chatbots

According to Richard Elis, Tony Allen and Andres Tuson (2010), Virtual Personal Assistants (VPAs) are among the popular applications of the chatbot technology. In particular, Apple Siri, Microsoft Cortana, Google Assistant, and Amazon Alexa have emerged to offer users services over speech and text interfaces. According to apple.com (2018), retrieved from <http://www.apple.com/siri/>, Siri is a virtual assistant specifically available on Apple products, and has access to Apple-applications including Mail, Contacts, Messages, Maps, and Safari. The Apple Siri agent is capable of reading users email, text, contacts, change playing music, making calls, finding restaurants, searching for reading materials, setting clock alarms, and giving directions. According to microsoft.com (2018), Retrieved from <https://www.microsoft.com/en-us/cortana>, Microsoft Cortana some services like weather forecast, calendars, reading outlook emails, giving time estimations for travel, giving directions, and integrating with OneNote to show users' their notes. According to Google Assistant (2018), Retrieved from <https://assistant.google.com/>, Google Assistant is an extension of the basic "OK Google" functionality that allows users to conduct search and control their mobile devices through voice commands. Assistant is programmed into Google phones, Android OS and will be integrated into some cars. According to amazon.com

(2018), Retrieved from <https://developer.amazon.com/alexa>, Alexa can access the weather, connect to radio and television stations, and has partnerships with a number of services, including: JustEat, Uber, FitBit, The Telegraph, Spotify and Nest, among others. These services can be accessed with the Alexa interface.

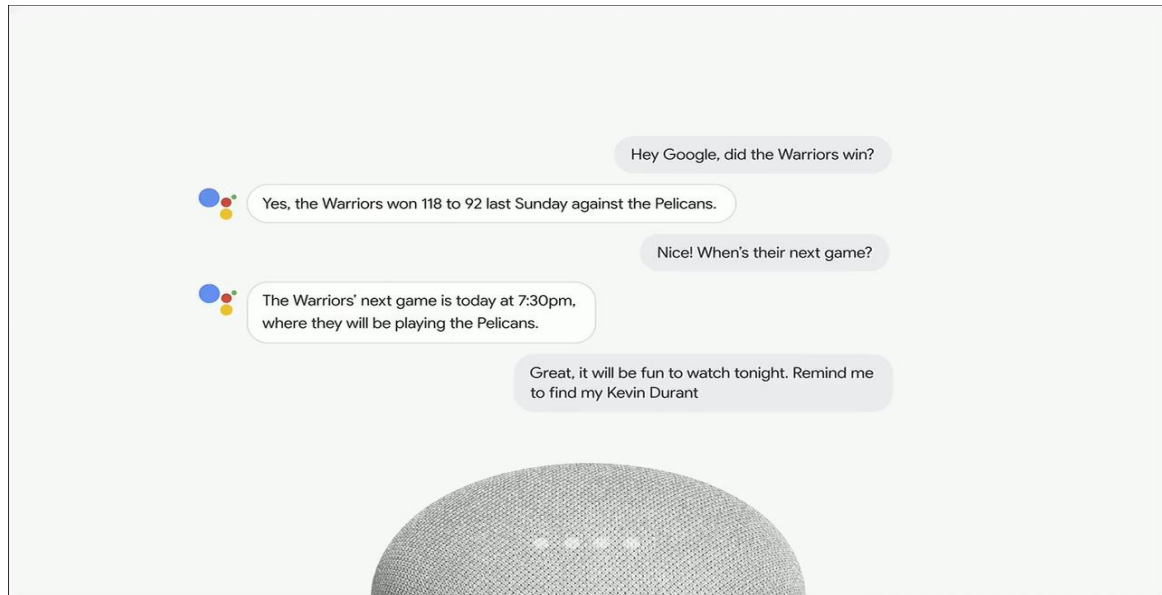


Figure 2.5: Sample conversation with Google Assistant Source (Google, 2019)

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter describes the principles, rules and procedures that were adopted in the project.

The research project aimed at designing developing and implementing an artificially intelligent conversational agent to aid in improving quality of online communication and interaction in universities.

3.1 Type of Research Method used

Qualitative approach was adopted in this project in line with the research objectives which are qualitative in nature. This section will focus on project methodology, project design, project setting, system requirements, technology used and system architecture.

3.2 Project Design

An Iterative - Incremental Methodology was adopted. Initially, a partial implementation of the agent (Prototype) was designed, developed and implemented to a deliverable state. Increased functionality was added. Defects, if any, from the prior delivery were fixed and the working prototype was delivered. The procedure was recursively repeated until the entire product development was completed. At the end of each recursive iteration, a product increment was delivered. Iterative Incremental Methodology aimed at allowing the users evaluate the agent periodically until the final product was delivered. This methodology also helped in giving room for changing requirements which are user specific and may not have been captured during requirements gathering and system design.

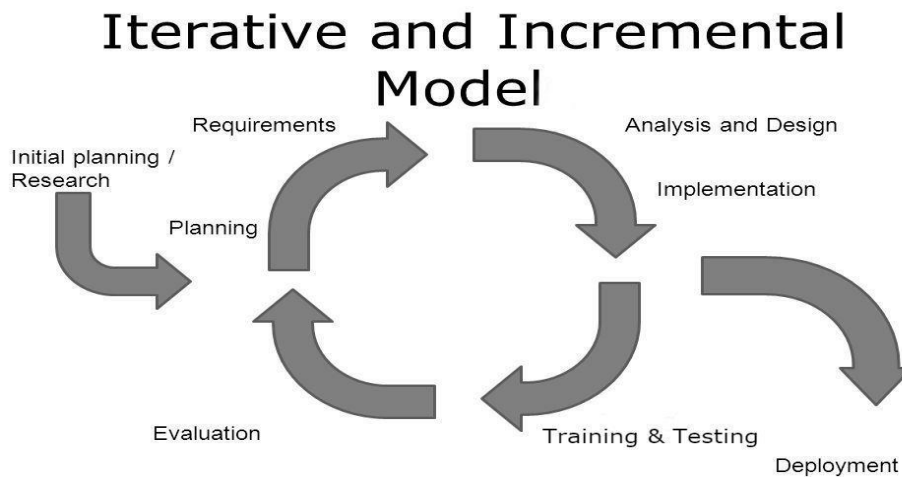


Figure 3.1: Iterative Incremental Model

3.2.1 Planning Phase

In this phase, the selection of which methodology to be used was done. Iterative Incremental methodology had been chosen because of its advantage to provide a working model to the end users to better understand how the agent would work before the complete system.

3.2.2 Analysis Phase

This phase was aimed to study the specification of the intelligent conversational agent to be developed based on the problems that have been identified in planning phase such as the need to automate chat communication and to provide 24-hour service for the convenience of students and website users. The knowledge needed for this prototype such as FAQs and basic general knowledge can be obtained from KU website and Online Communication Unit.

3.2.3: Design and Development

After identifying the user specifications in analysis phase, the design of the prototype was produced. The design was UniBot's system architecture which consisted of chat interface, knowledge base, AIML interpreter and the university website. The detailed description of the conversational agent's system architecture is explained in figure 8.

3.2.3.1 System Architecture of the Agent

The intelligent conversational agent prototype was integrated to the University Website to offer the function of an online chat. Kenyatta University Website is hosted by Kenyatta University ICT Department. Pandorobot AIML interpreter is hosted by Pandorobot Platform. The database

and knowledge base run on Pandorabot hosting platform. The web server offer translation of PHP programming script into HTML while the web browsers / clients such as Google Chrome, Mozilla Firefox and internet explorer translates the client script such as JavaScript before being displayed via the user interface. When a user poses questions to the chat interface, the question is processed by Pandorabot AIML interpreter by referring to the knowledge base which contains the bots knowledge base, frequent asked questions (FAQ) and the general knowledge that comes from AIMLfiles. The botmaster can constantly maintain the knowledge base by adding the knowledge in AIML file format.

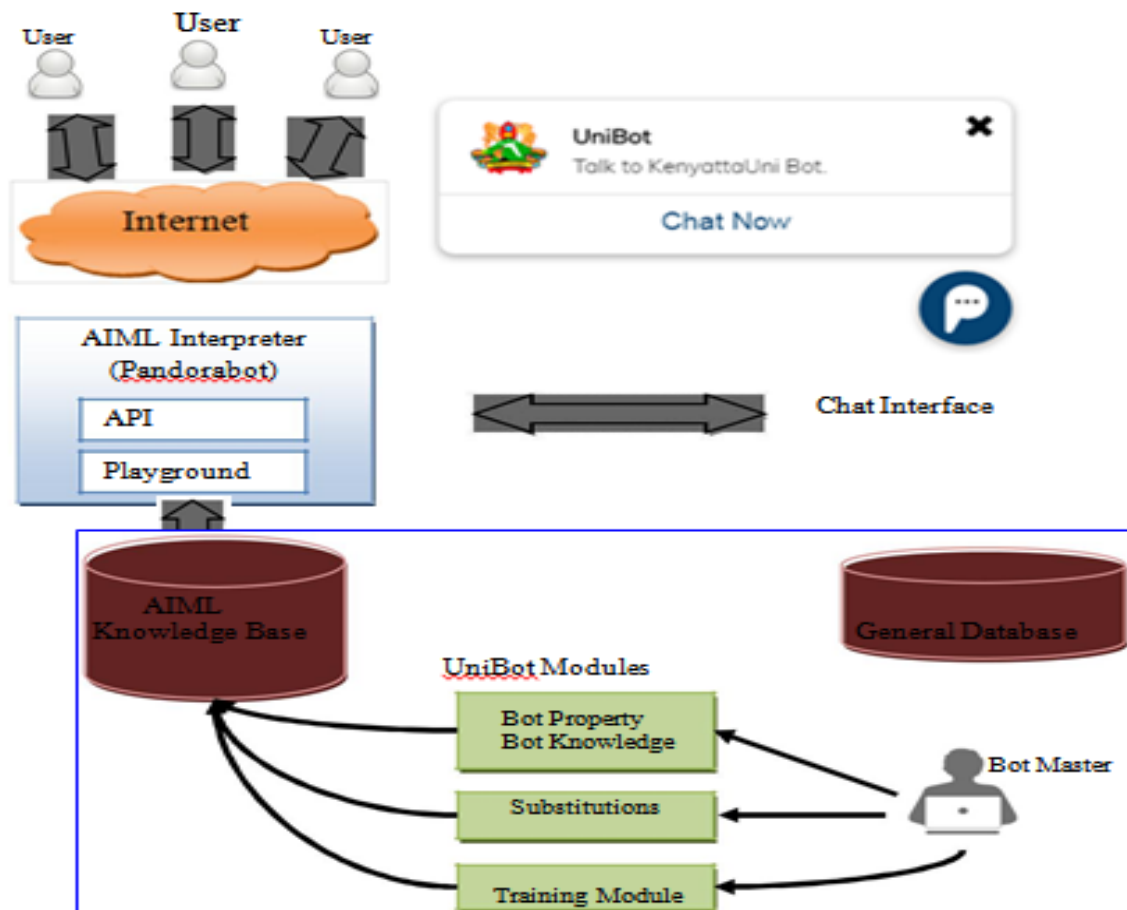


Figure 3.2: UniBot Conversational Agent Architecture

3.2.3.2 Chat Interface

The chat interface was integrated to Kenyatta University website. The chat interface was linked with the bottom widget of the website. It is the work of the chat interface to receive text input from the agent's end user and forward it to Pandorabot AIML interpreter.

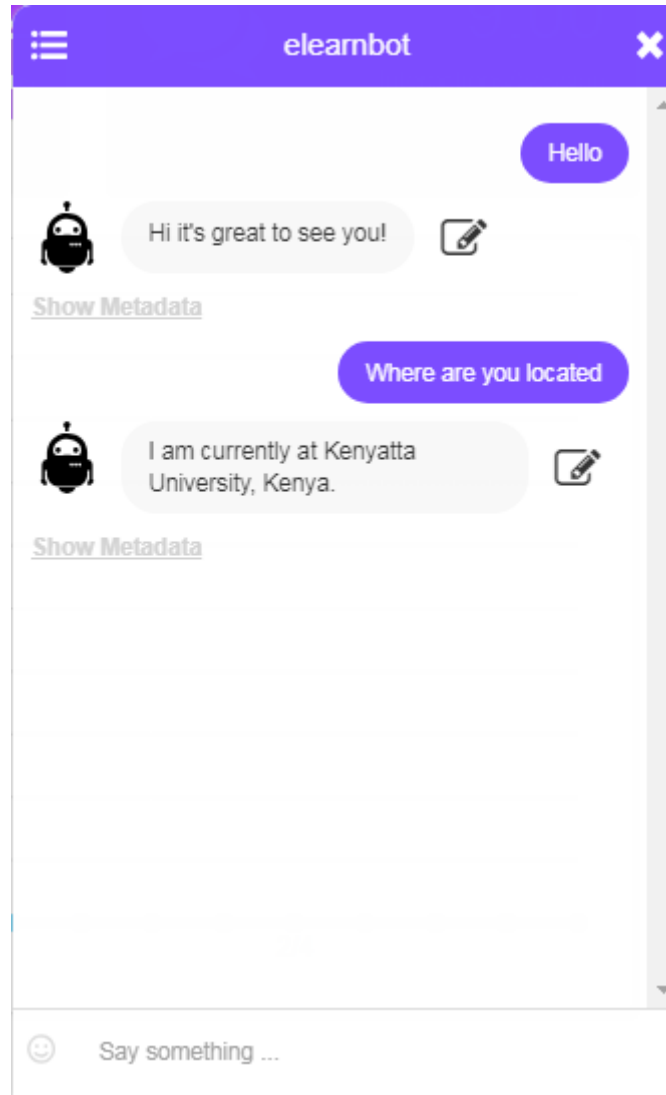


Figure 3.3: Chat Interface

3.2.3.3 Conversational Agent Knowledge Base

Knowledge of UniBot consists of Kenyatta University information, FAQ and a free open source library from ALICE. University Information Knowledge was provided by Kenyatta University - Online Communication Department. The FAQs were added into the knowledge base using pandorabot "Training Module" by the botmaster. This was added periodically by reading the logged conversations and looking for frequently asked questions in the dialogue and adding the responses to the knowledge base using PAND_LEARN.aiml file. This

ensured that the most common enquiries were taken care of. The files comprised of the brain of the award winning conversation bot ALICE. The availability of these files for free download at Google Code made the job of cloning easier. Notepad++ was the text editor for creating AIML files which was saved saved into the knowledgebase with “.aiml” extension. Kenyatta University information and FAQ will be written in AIML.

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <aiml version="2.0">
3 <!-- insert your AIML categories here -->
4
5 <category>
6 <pattern>WHERE IS YOUR BIRTH PLACE</pattern>
7 <template>Nairobi</template>
8 </category>
9
10
11 <category>
12 <pattern>WHAT IS YOUR WEBSITE </pattern>
13 <template><a href="http://www.ku.ac.ke" >>This is a link to our Website: </a></template>
14 </category>
15
16
17 <category>
18 <pattern>WHERE IS KENYATTA UNIVERSITY </pattern>
19 <template>Kenyatta University is located along Thika Road, adjacent Kahawa Barraks. <a href="https://www.google.com/maps/search/kenyatta%20university%20kenya">>Map</a></template>
20 </category>
21
22
23 <category>
24 <pattern>WHEN IS THE SEMESTER STARTING </pattern>
25 <template><a href="http://www.ku.ac.ke/images/2017-2018-semester-dates-adjusted_final.pdf">>Kindly view our academic calender on </a></template>
26 </category>
27

```

Figure 3.4: Example of an AIML File for University Information Knowledge

3.2.3.4 Pandorobot AIML Interpreter

UniBot is using Pandorobot as its AIML interpreter. The Pandorobot platform is written in Java, Ruby, Go, PHP, Python, and Node.js and provides API access to its chatbot hosting platform. Pandorobot is suitable for UniBot because it is implemented in web environment which able to be executed independently and thus made it possible to be integrated to any university website. Pandorobot AIML Interpreter will process the text input from the chat interface by performing pattern matching with the AIML content in the knowledge base using

depth-first search. Usually the first matching response will be returned as a response to the chat interface.

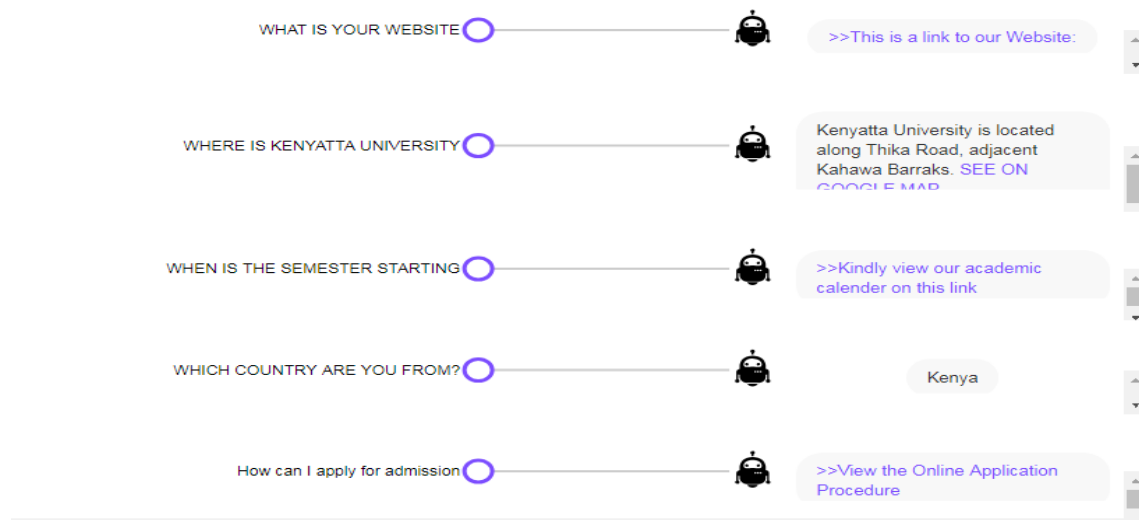


Figure 3.5: Pattern matching of the AIML Interpreter

3.2.3.5 University Website

The University website provides a huge array of online resources and links to online many users who include prospective students, enrolled students, staff and the general public. In order to facilitate prototyping and testing, the conversational agent (Unibot) will be hosted at <http://www.ku.ac.ke/chatbot>. Integration of the intelligent conversational agents chat interface will not replace the university website but complement the website's role making it more efficient.

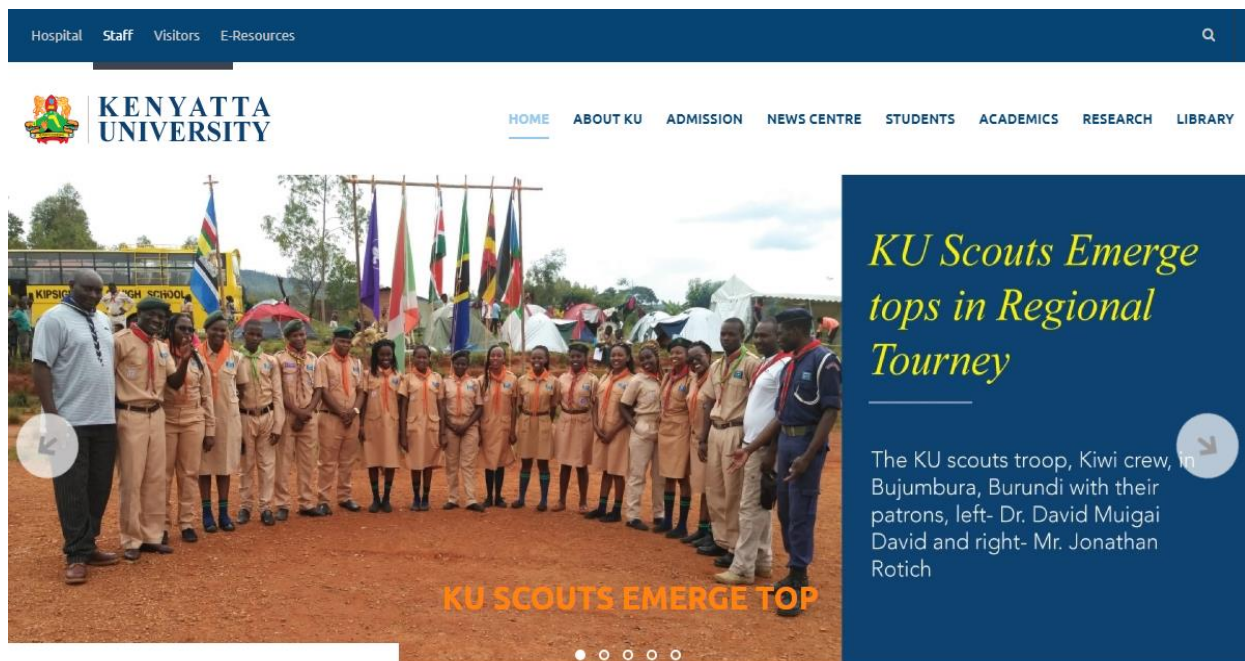


Figure 3.6: Kenyatta University Website Homepage

3.3 Implementation

This chapter discusses the implementation of UniBot prototype. Having reviewed the architecture in the previous chapter, UniBot agent will be developed based on the design which includes chat interface, knowledge base, and AIML interpreter. In order to prepare for the development, the environment needs to be setup up online and the relevant software needs to be installed. Subsequently, the Uni-Bot's knowledge can be built up using the pandorobot interpreter's interface. With the appropriate environment for development, the agent's prototype can be developed and used for performance assessment in the next chapter.

3.3.1 Software configuration

UniBot is a web-based conversational bot using Panorobot interpreter. Pandorobot is an AIML interpreter written in Java, Ruby, Go, PHP, Python, and Node.js. In order to create server-client environment in development's computer, The Pandorabots Platform is one of the oldest and largest chatbot hosting services in the world. Clients can create "AI-driven virtual agents" to hold human-like text or voice chats with consumers. Pandorabots implements and supports development of the AIML open standard and makes portions of its code accessible for free under licenses like the GPL or via open APIs

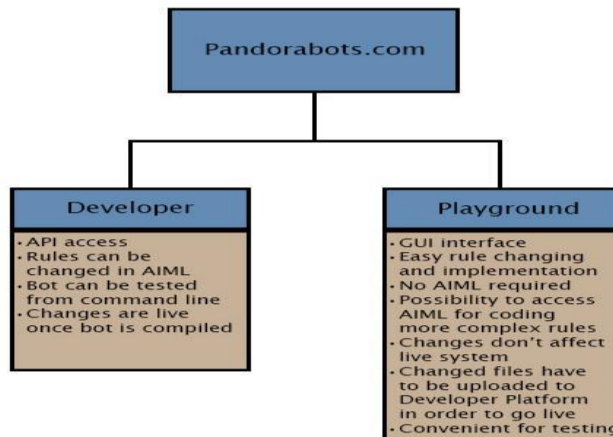


Figure 3.7: Overview of the Pandorobot framework.

3.3.2 Creating Unibot on the Pandorobot Playground

Create Bot ✕

Please specify your bot's name, language, and optional base content.

Name:
This name is for your internal use only. It must be between 3 and 62 lowercase letters and numbers.

Language: ▾

Content: ▾

Figure 3.8: Creating a new Bot instance.

To get started, you need to access the Pandorobot Playground website (<https://home.pandorabots.com/home.html>) and register for an account. Once that is done that, I clicked on My Bots in the blue header menu and created a new Bot by clicking on Create Bot

Now filling UniBot with content can be done. This is done by clicking on the name of the Unibot created and inspecting the Editor that shows up. Then file tab is pointed at.

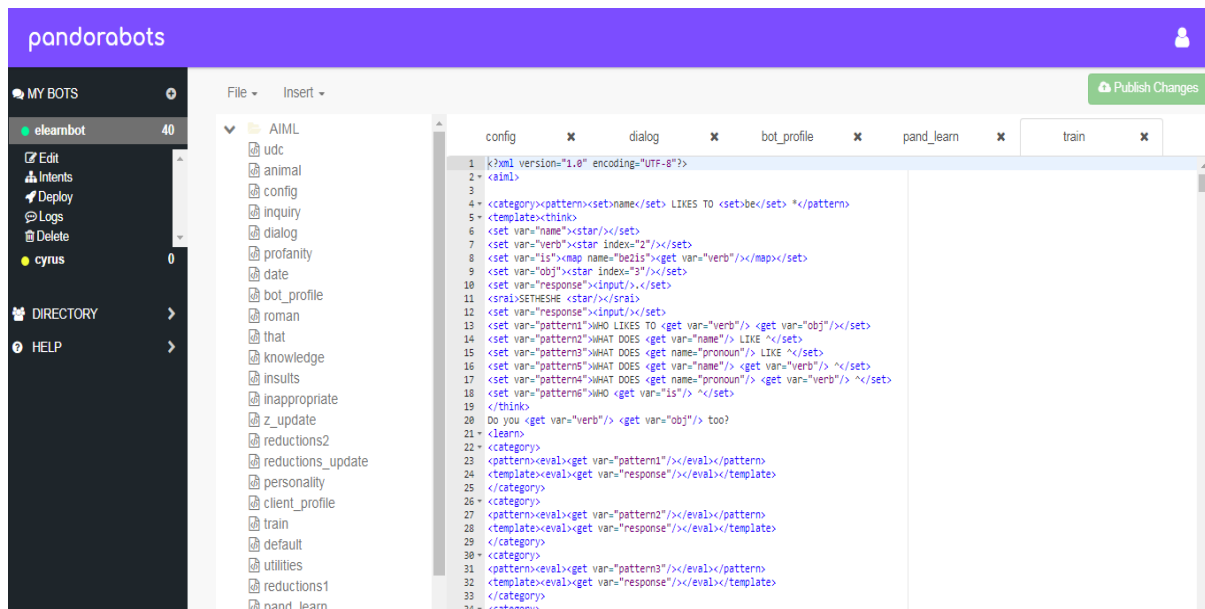


Figure 3.9: The Pandorabot Editor.

3.3.3 Building Unibot Conversational Agent

I started creating the conversational agent by importing the open-source database Rosie (<https://github.com/pandorabots/rosie>). This knowledge base forms a general base for UniBot and contains some basic small talk and answers to user inputs that test UniBot's intelligence. Rosie also comes with a customisable properties file. Many characteristics of UniBot can be personalized. I have changed this file to make it more Unibot-like and improved some other bits and pieces. Rosie's knowledgebase will constantly be uploaded with new knowledge and deductions hence making an improvement to UniBot.

3.3.4 Uploading knowledge to Unibot Conversational Agent

In order to upload new knowledge to Unibot, I clicked on the Upload Files button in the Editor and then Add Files in the pop-up window. Selected all les from the Rosie Library package and waited until all files had been uploaded. From there, I started customizing Unibot .

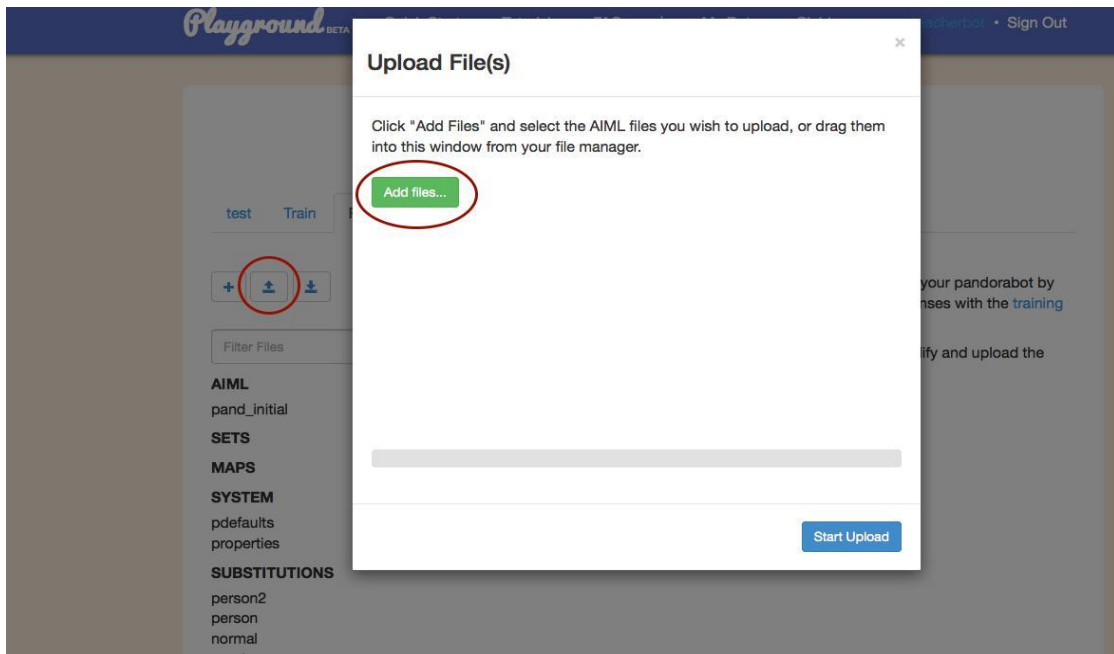


Figure 3.10: Uploading Base-Content to Pandorobot Playground.

3.3.5 Creating Unibot Knowledgebase

Unibot's knowledge base has the university information knowledge, the frequently asked questions (FAQ), and some general knowledge. University information knowledge can be expanded progressively. For FAQ knowledge, the responses can be added from time to time by studying the conversation logs with users. As for general knowledge, ROSIE Library AIML files from github provide the convenience of cloning their general knowledge into UniBot. More general knowledge which does not exist in ROSIE files will also be added to make UniBot more intelligent in handling general questions.

There are two methods to add knowledge to the knowledge base. Firstly, the knowledge can be directly typed at the user interface provided Pandorobot under the TRAIN module. To access the teaching function, a user must login as administrator first. The user name and password for administrator was the one created during the installation process

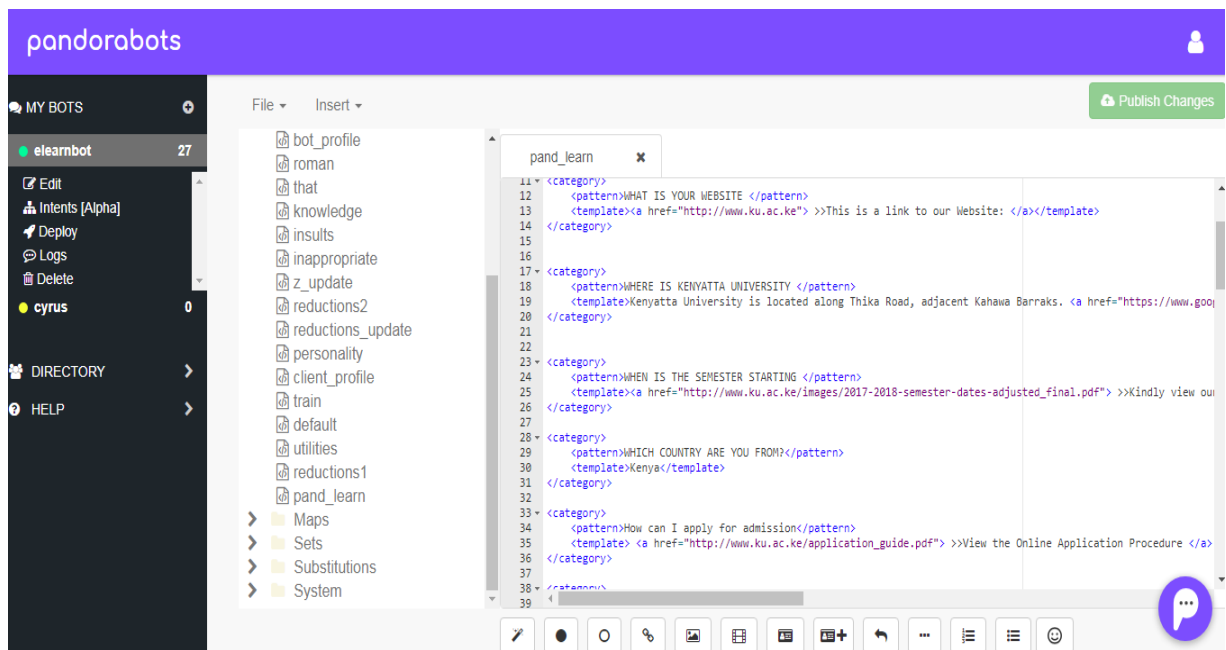


Figure 3.11: Coding UniBot Knowledgebase using PAND_LEARN module

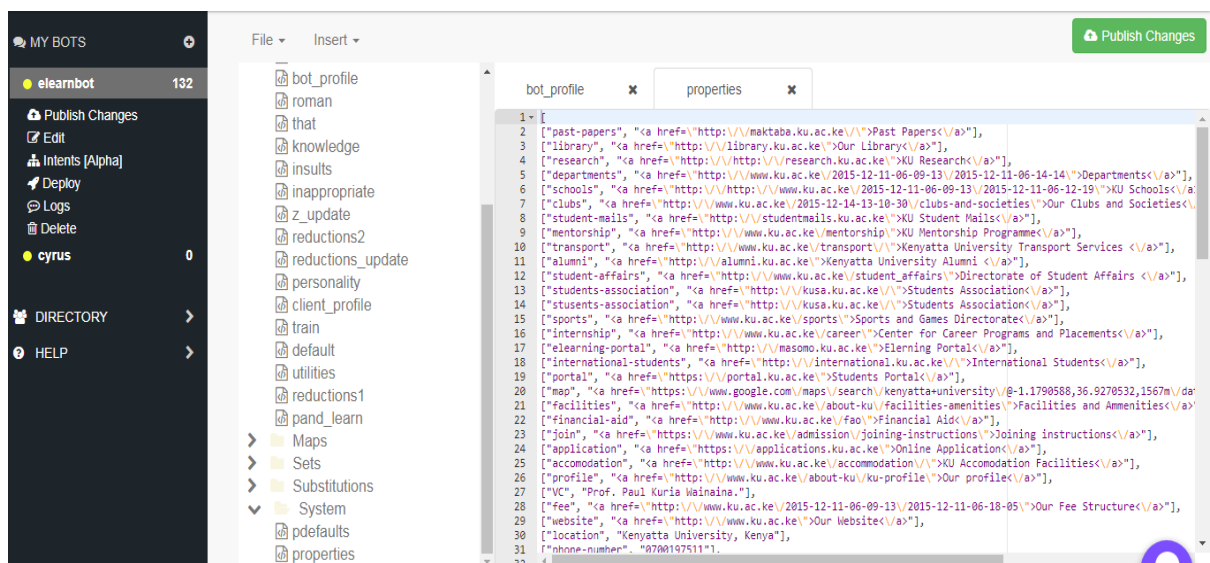


Figure 3.12: Coding UniBot Properties on the PROPETIES.aiml file

3.3.6 Changing Responses

With AIML, scripts can be uploaded to the Playground. This is done by working on new aiml files externally and then uploading it on playground. The second option is directly editing the aiml files in pandorobot playground. Thirdly there is option of working with the GUI, where a response can be altered.

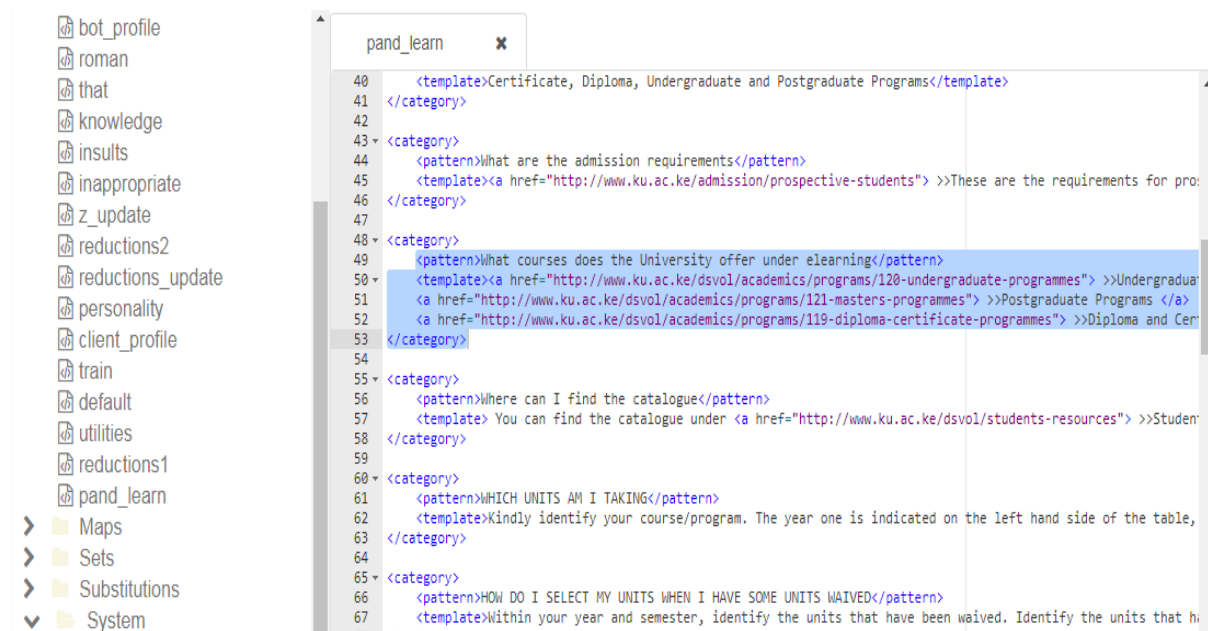


Figure 3.13: Changing responses by editing aiml files directly on playground.

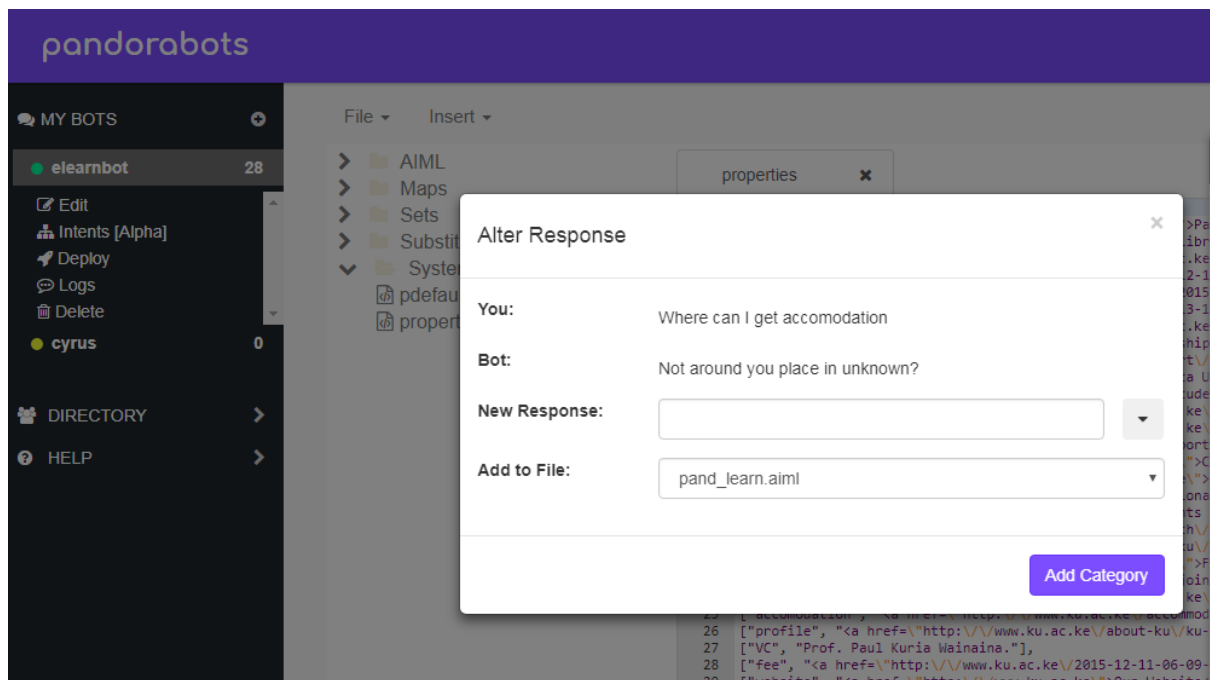


Figure 3.14: Changing responses using GUI

3.3.7 Testing Unibot's Knowledge

On the lower right side of the window is an input field with the heading Human. UniBot's knowledge can be tested by submitting an input. For example, enter the question "How are you?" and click Ask.

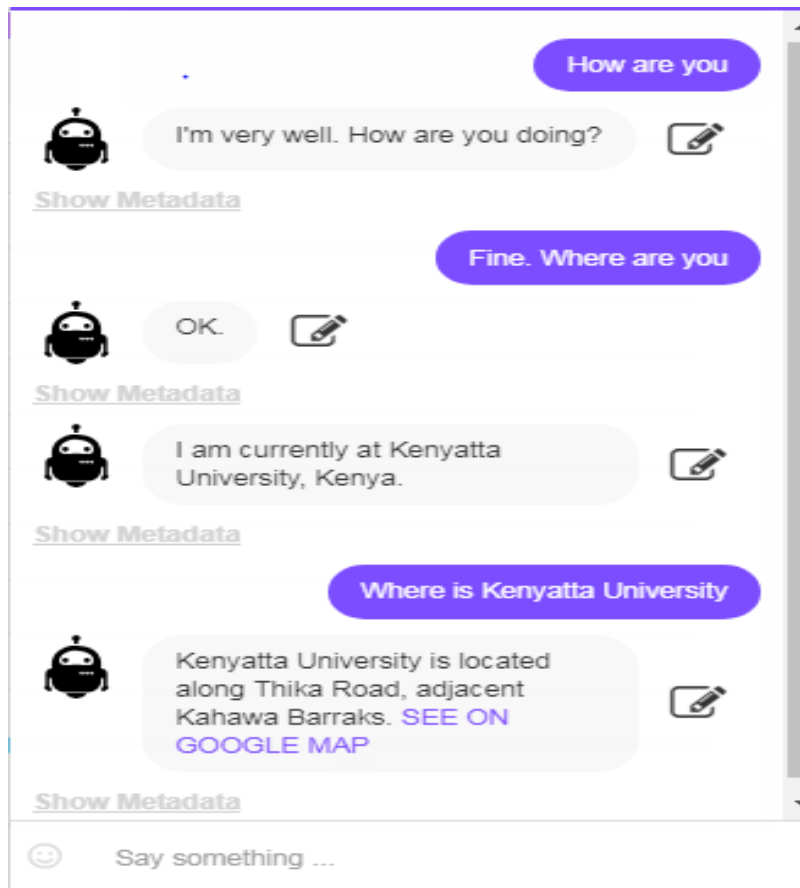


Figure 3.15: Test interface - response

Down to the matched rule you will also find some faded text “show meta data” a link to the file in which the rule is defined, in this case personality.aiml. The link can be clicked to inspect the file and see what the rules look like in AIML. If it feels comfortable doing so, you can also change the Unibot's responses in this file. In order to make Unibot appear more intelligent, a variety of different responses have been added that will be randomized, so the agent doesn't always give the same answer when asked “How are you?”

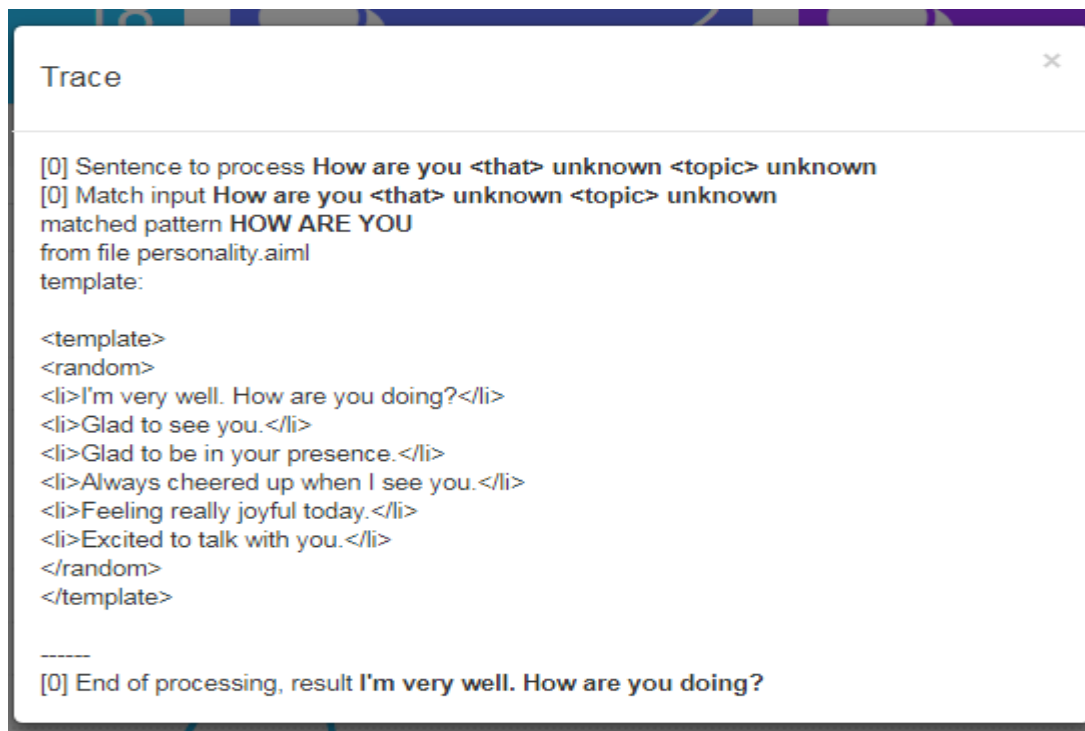


Figure 3.16: Rule Tracing to show different randomized responses

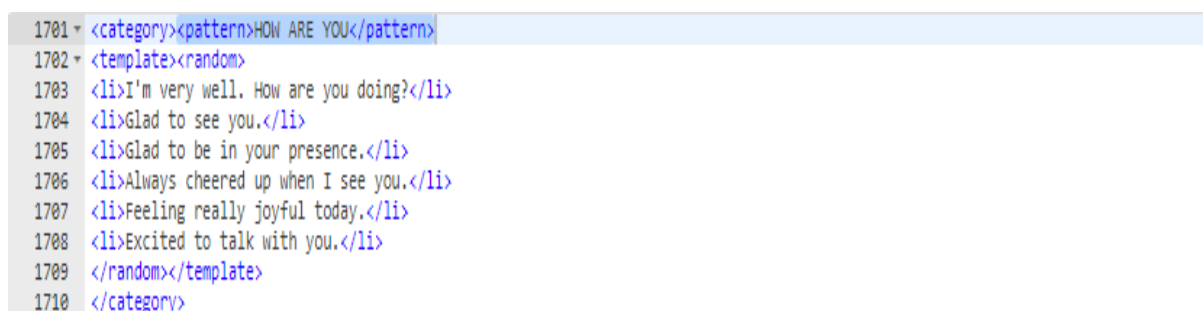


Figure 3.17: Adding alternative responses to the personality.aiml file

3.3.8. Adding new questions and responses

Adding your own set of questions and answers works similar to changing existing responses.

Go to the chat interface in the Playground and type the question you would like the UniBot to understand into the entry field on the left. For now, let's take the example, “Does Kenyatta University Offer Bridging Courses”

If no matching rule exists, this input will match *, and anything that matches*will return I can't tell if Kenyatta University offer bridging courses , which means the UniBot will point out that it doesn't have a response for that question.

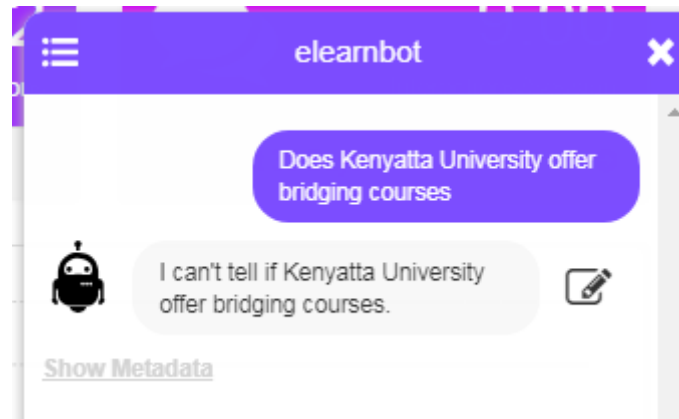


Figure 3.18: Asking a question not in the knowledgebase.

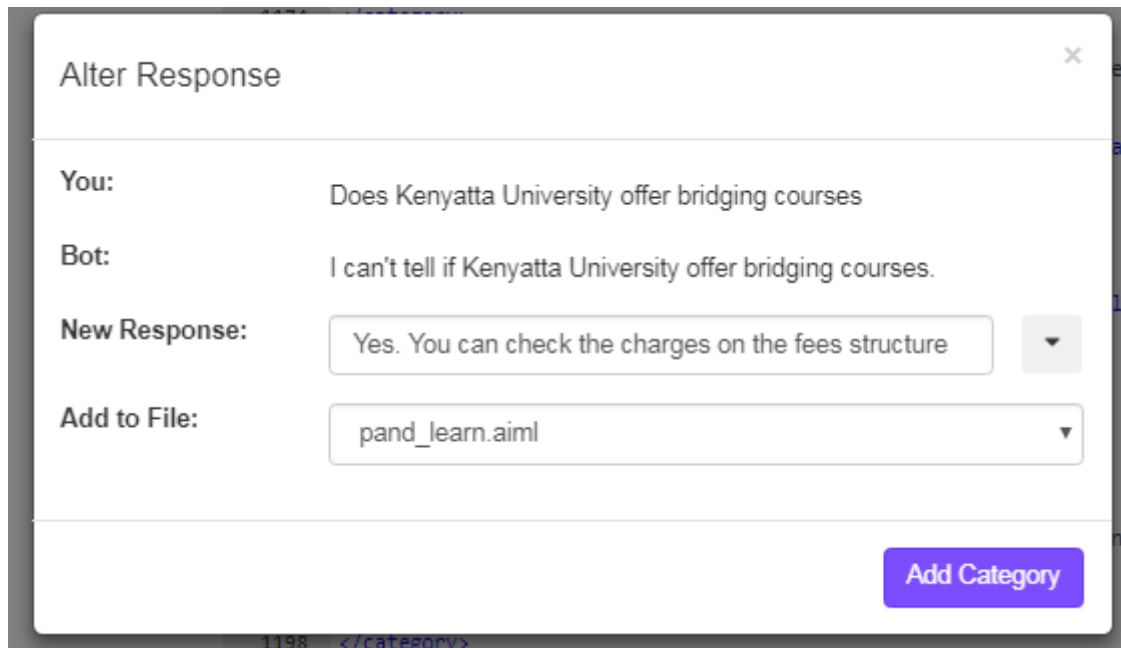


Figure 3.19: Adding new response to the knowledgebase using GUI

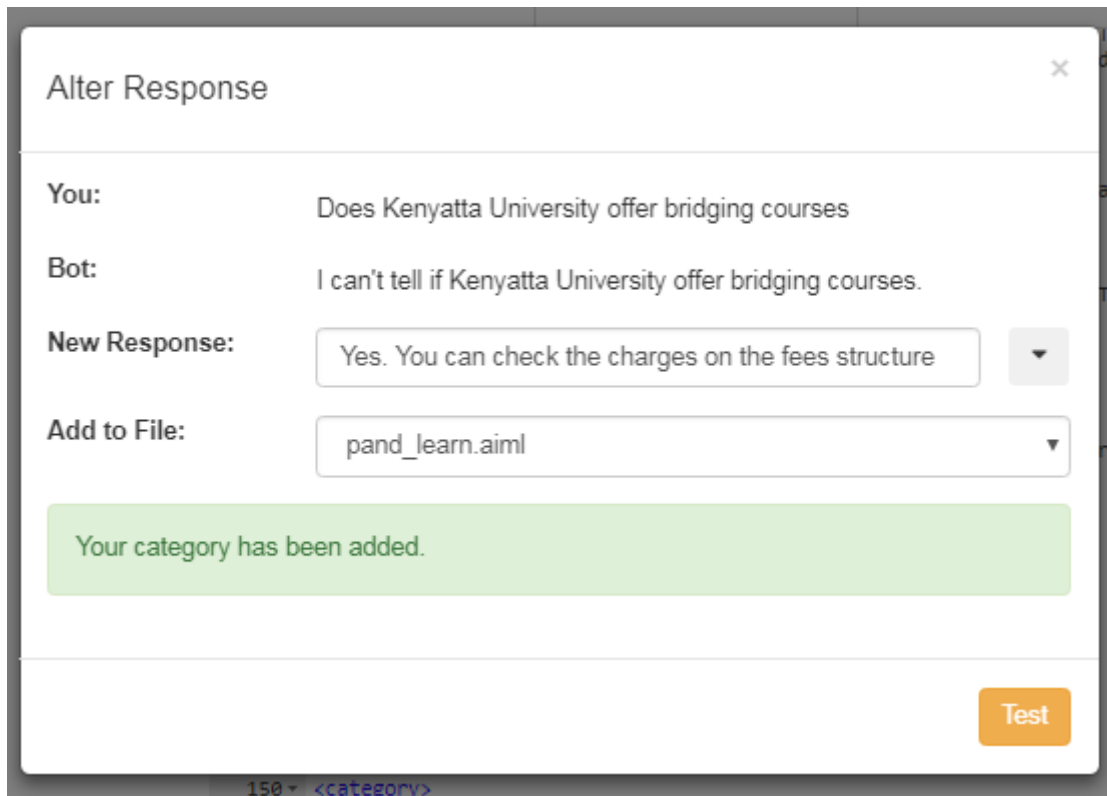


Figure 3.20: New response added to PAND_LEARN.aiml

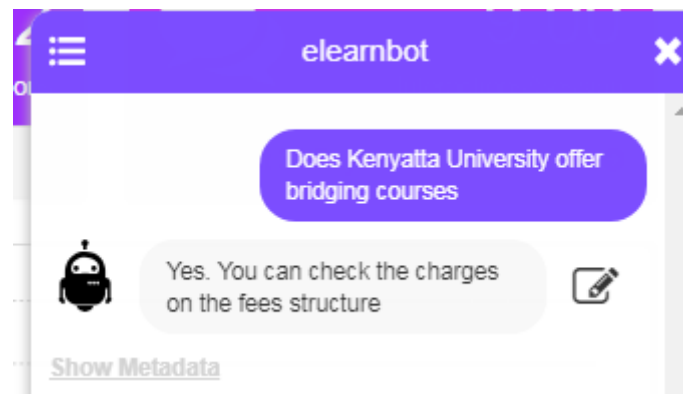


Figure 3.21: Testing new response with the playground interface

3.3.9 Linking the chat agent with the University Website

The default chat interface provided by Pandorabot as shown in Figure 4.... can be used for initial development. However, for the integration with universitywebsite, a more suitable chat interface needs to be designed to match with the website. The chat interface designed for Univesity website is shown in Figure 4.....

```

<!-- Web Widget -->
<div id="pb-widget"></div>
<script>
  var bot_config = {
    title: "UniBot",
    subtitle: "Talk to KenyattaUni Bot.",
    colors: { theme: "#054473", text: "#FFFFFF" },
    conversationOpener: "Hi, This is Kenyatta University chatbot designed to answer your questions.",
    placeholderText: "Type a message...",
    botAvatar: "http://www.ku.ac.ke/chatbot/kuloqo.png",
    PB_BOTKEY: "UK966xkhXTwBqhHxJ0r0V0RG04IVTjDLGqPsGXaPQ9HUT2eB-i6jxdLkTA-D7YZM1D11Up8YLWk~"
  }
</script>
<link rel="stylesheet" href="http://www.ku.ac.ke/chatbot/pb-widget.css">
<script src="http://widget.pandorabots.com/prod/pb-widget.js" type="text/javascript"></script>
</background>
</html>

```

Figure 3.22: Snippet of code for linking the chat agent widget to the University Website

API Settings

App ID

User Key

Bot Keys

elearnbot:

cyrus:

Referrer Filters

Figure 3.23: API settings to link chat application to KU Website

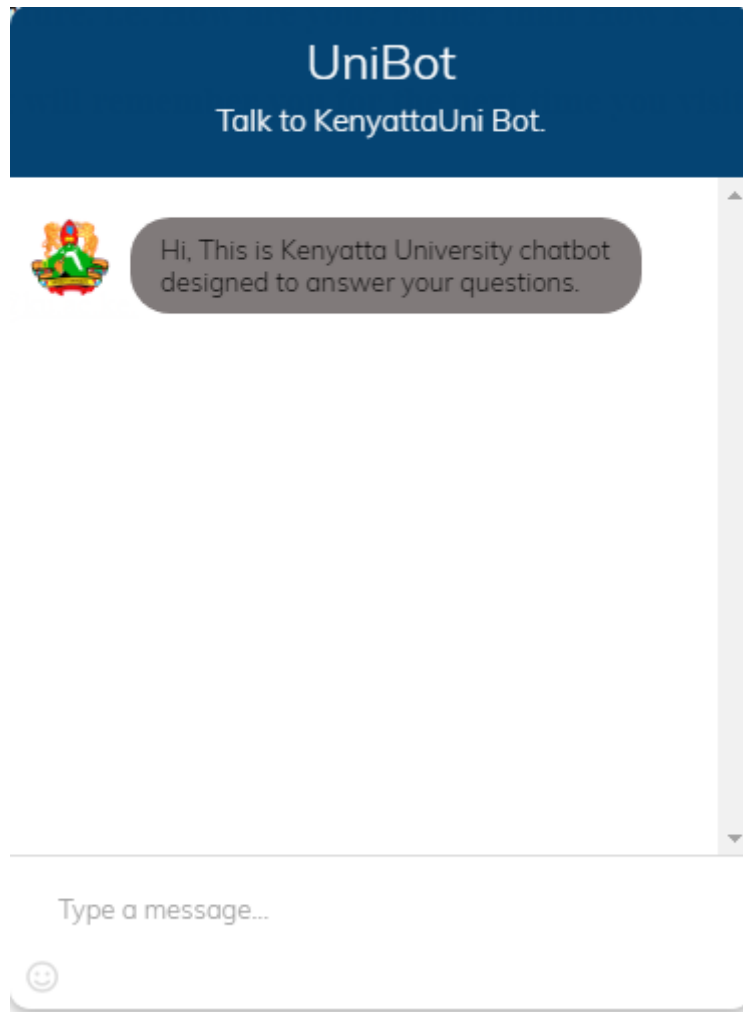


Figure 3.24: Chat Interface for the University Website

3.3.10 Implementation Summary

Software installation, configuration and development environment are crucial to ensure the development work can be done smoothly. For the development of UniBot, knowledge base plays an important role to determine the intelligence of the conversational agent. Therefore, sufficient knowledge must be added to ensure most of the queries can be handled. UniBot's chat interface is designed to complement the university website and at the same time provides user the convenience of real-time interaction.

3.4 Testing

A datasets was required to examine the responses generated by UniBot in black-box evaluation. For this purpose, one hundred questions were used. The questionnaire is available in appendix c:

3.5: Measurement

The measurement of each response from the datasets will be evaluated based on the scoring guidelines used as shown in Table 1.

Table 1: Scoring Guidelines for Evaluation

POINTS	GUIDELINES
4	If Unibot answers correctly and exhibits creativity
3	If Unibot gives appropriate response
2	If there is a response but imperfect
1	If the response is vague
0	If Unibot does not have any idea about the question asked

CHAPTER 4

RESEARCH FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter explains the findings and outcome of UniBot. Having prepared UniBot application, it was important to evaluate its performance and improve it whenever necessary. In this phase, black-box approach was used to evaluate the responses given by Unibot. The datasets selected needed to be from conversational agent related sources. Questions from the past logs web chat logs from Kenyatta University Online Communication Department are chosen as the datasets. The measurement of the results is also based on CBC's guidelines to determine the scoring.

4.1 Approach

Black-box approach which is qualitative assessment was chosen to evaluate UniBot. Black-box approach focuses on the output generated in response to the given input without concern with the internal processing. This approach suited the nature of Unibot well because the core function of Unibot was to deliver appropriate answers to users in real time in order to overcome some of the problems associated with the current online communication systems as stated in Chapter 1. Black-box approach has been used by other researchers in question-answering system whether in open domain (Nyberg and Mitamura, 2002) or restricted domain (Diekema et. al., 2004) as well as for conversational bots (Goh et. al., 2007; Preez et. al., 2009). Turing test which has high regard in this field is also a black-box approach (Floridi, 2003)

No.	Question	Scores
1	<p>Hello</p> <p>Hi nice to see you!</p>	4
2	<p>How are you doing today</p> <p>Feeling really joyful today.</p>	4
3	<p>Who are you</p> <p>Call me UniBot.</p>	4
4	<p>Where are you</p> <p>I am currently at Kenyatta University, Kenya.</p>	4
5	<p>Where is Kenyatta University</p> <p>Kenyatta University is located along Thika Road, adjacent Kahawa Barraks. <u>SEE ON GOOGLE MAP</u></p>	4
6	<p>How can I apply for a course</p> <p>Kindly view >><u>Kenyatta University Joining Instructions</u></p>	3
7	<p>Will you teach me something?</p> <p>Are they exactly the same?</p>	0
8	<p>What is your website?</p>	

	>> <u>This is a link to our Website:</u>	3
9	When is the semester starting? >> <u>Kindly view our academic calender on this link</u>	3
10	Which country are you from Kenya	4
11	Where is Earth? You're standing on it.	4
12	How can I apply for admission? >> <u>View the Online Application Procedure</u>	3
13	What courses are offered? Certificate, Diploma, Undergraduate and Postgraduate Programs	3
14	What are the admission requirements? >> <u>These are the requirements for prostective students</u>	3
15	What courses does the University offer under elearning? >> <u>Undergraduate Programs >>Postgraduate Programs >>Diploma and Certificate Programs</u>	4
16	Where can I find the catalogue? You can find the catalogue under >> <u>Students Resources</u>	4

17	<p>Which units am I taking?</p> <p>Kindly identify your course/program. The year one is indicated on the left hand side of the table, with the columns standing for semesters. Using this logic, select your year and semester and you will trace your units</p>	3
18	<p>How do I select my units when I have some units waived</p> <p>Within your year and semester, identify the units that have been waived. Identify the units that have not been waived, these are the units you will register for. If the units not waived are less than 6, pick an additional unit(s) from the next semester's list of units.</p>	3
19	<p>Where can I get the units which are not in the catalogue</p> <p>Kindly check on all the departments you belong, you'll find the units offered by all departments</p>	4
20	<p>What is your work</p> <p>My purpose is to assist you online.</p>	4
21	<p>What is your role</p> <p>My purpose is to assist you online.</p>	4
22	<p>How do I register my units online</p> <p>From the >>student portal select academics then online registration then begin online registration. Enter unit code</p>	4

	without space then click on quick add and finally click on register	
23	How many units am I supposed to register this semester A maximum of seven units	4
24	Which semester are we You can get more information from our website. >>View on this link	2
25	Where Can i Find the timetable? The timetable? Where is it?	2
26	I cant see my units online Would you like to be able to see it?	1
27	Why are my units clashing Reductionism.	0
28	When is the deadline for paying fees You can get more information from our website. >>This is a link to our Website:	1
29	I cannot find my lecturer Why can't you do find your lecturer?	1
30	Are you a man or a woman?	0

	You can get more information from our website. >>This is a link to our Website:	
31	Do you have a library Yes we have	4
32	Do you offer bridging courses? How old are you? I am always on the Web.	0
33	What day is it? Today is Tuesday	4
34	Where is my online timetable Have you looked in unknown?	1
35	Can I report to security office You can get more information from our website. >>This is a link to our Website:	1
36	What's your phone number? You can get more information from our website. >>This is a link to our Website:	1
37	What is your location? I am currently at Kenyatta University, Kenya.	4
38	How can i apply for a scholarship	2

	Kindly view >>Student resources	
39	<p>What else can you do?</p> <p>I can learn new facts, search for information, and be your personal assistant.</p>	4
40	<p>What is your purpose</p> <p>My purpose is To enhance the quality of online communication at Kenyatta University.</p>	4
41	<p>How can I get my transcripts</p> <p>Kindly view >>Student resources</p>	3
42	<p>How can i get support as a student</p> <p>Kindly view >>Student resources</p>	3
43	<p>Where can I find the fee structure</p> <p>This is a link to Our Fee Structure.</p>	4
44	<p>I need to join alumni</p> <p>Why do you want to do it so much?</p>	3
45	<p>Does the university offer transport services</p> <p>I think it does the university offer transport services.</p>	3
46	<p>Do you offer students with internships</p>	2

	No I do not offer students with internships. Do you? I am always on the Web.	
47	Do you offer mentorship How old are you? I spend all my time chatting.	1
48	How do I access my emails You can find more information from our website.	2
49	Do you have a students association? That's an interesting question I don't hear everyday: Do I have a students association. I have a lot of friends on the Internet.	3
50	Can I register online? You can get more information from our website. >>This is a link to our Website:	3
51	I cant access the student portal Why can't you do it?	4
52	I need to view the Elearning Portal Why do you want to do it so much?	2
53	How can I build my sporting career Kindly view >>Student resources	3

54	<p>What is your gender</p> <p>You can get more information from our website. >>This is a link to our Website:</p>	1
55	<p>How does your body look like</p> <p>My body looks like lots of code.</p>	4
56	<p>Can I join a students club</p> <p>You can get more information from our website. >>This is a link to our Website:</p>	2
58	<p>How can I join as an International Student</p> <p>Kindly view >>Online Resources</p>	3
59	<p>What Facilities do you boast of</p> <p>No I do not boast of. Do you? I am always on the Web.</p>	1
60	<p>Do you offer any financial assistance to students</p> <p>No I do not offer any financial assistance to students. Do you? I answer a lot of silly questions.</p>	1
61	<p>How can I apply to be admitted online</p> <p>Kindly view >>Online Resources</p>	3
62	<p>Do you offer Accommodation to Students</p> <p>No I do not offer Accommodation to Students. Do you?</p>	1

	I am always on the Web..	
63	I need to see all your Schools and departments Where do you want me to show you?	2
64	Can I see the university profile Kindly our profile >> Our profile .	5
65	Can I access any Past Papers for revision You can find past papers here >> Past Papers .	5
66	What about research You can see more about >> KU Research	2
67	What are your plans? I plan to Increase my knowledge base and make KU the Best University in Africa.	5
68	What Departments do you have Kindly find all our departments listed here >> Departments .	4
69	Who is the VC It depends on the historical context, because it changes from time to time.	4
70	What are your achievements I didn't know I had a achievements?	3

	What is your goal	4
71	My number one goal is to to increase my knowledge base.	
	Who created you	5
72	My botmaster's name is Isaac Kuria.	
	Where Do I live	5
73	You said it was Kenya?	
	What are you doing there	4
74	I'm working for you.	
	How is the weather	3
75	the weather is the same as ever.	
	Do you have a facebook page	5
76	>>Our Facebook Page.	
	What is your facebook page	5
77	>>Our Facebook Page.	
	Can I view the fee structure?	4
78	You can get more information from our website. >>This is a link to our Website:	
	How can I get my caution money?	4
79	Kindly view >>Kenyatta University Joining Instructions	

80	How can I apply for distance learning? Kindly view >> Kenyatta University Joining Instructions	4
81	How much does this school cost? Normally I would search the web right now, but that seems like a silly question.	1
82	How much is the graduation fee More than you might think.	1
83	How can I reach you? Just keep talking to me as long as you can.	4
84	Which units are you offering now in the trimester The small one, I think.	1
85	Do you offer diploma or certificate in law? What is your purpose in asking? I answer a lot of silly questions.	1
86	Are admission letters out? I really couldn't say for sure.	2
87	How can I get my admission letter Kindly view >> Kenyatta University Joining Instructions	4

88	<p>What are the qualification of studying national intelligent service</p> <p>You can get more information from our website. >>This is a link to our Website:</p>	4
89	<p>How can I apply for a scholarship?</p> <p>Kindly view >>Kenyatta University Joining Instructions</p>	4
90	<p>Kindly advise me on whether you offer security management course</p> <p>You can get more information from our website. >>This is a link to our Website:</p>	4
91	<p>I want to be your friend</p> <p>I enjoy helping others because they need my assistance, not because I want their friendship.</p>	4
92	<p>Thank you</p> <p>I'm always glad to help.</p>	5
93	<p>I would like to enquire about the fees</p> <p>Interesting. I want to find out more about you.</p>	3
94	<p>Do you offer post graduate diploma in animal health?</p> <p>I have never considered offer post graduate diploma in animal health. I am always on the Web.</p>	1

95	<p>How will I get the admission letter?</p> <p>How do you usually do it?</p>	2
96	<p>I wish Kenyatta University all the best</p> <p>I hope that your dreams come true.</p>	5
97	<p>When is the MBA next intake?</p> <p>You can get more information from our website. >>This is a link to our Website:</p>	4
98	<p>How can I pay the fees</p> <p>Kindly view >>Kenyatta University Joining Instructions</p>	4
99	<p>How long does it take after graduation to get a caution money refund?</p> <p>About 24 hours</p>	2
100	<p>How can I get application form for April intake</p> <p>Kindly view >>Kenyatta University Joining Instructions</p>	4

Table 2: Dataset's Results

The questions from the dataset are being tested on Unibot. The conversation logs of the dataset are shown in Appendix A and the scores derived according to the guidelines in Table 1 are shown in Table 2

From the results shown in Table 2, Uni-bot was accurately able to score 47 points out of 100 points. The scores are grouped according to the frequency so that trend can be observed in Table 3 and Figure 30.

Table 3: Frequency of Points

Point(s)	Frequency	Percentage (%)
4-Point	47	47
3-Point	20	20
2-Point	12	12
1-Point	16	16
0-Point	5	5
Total	100	100

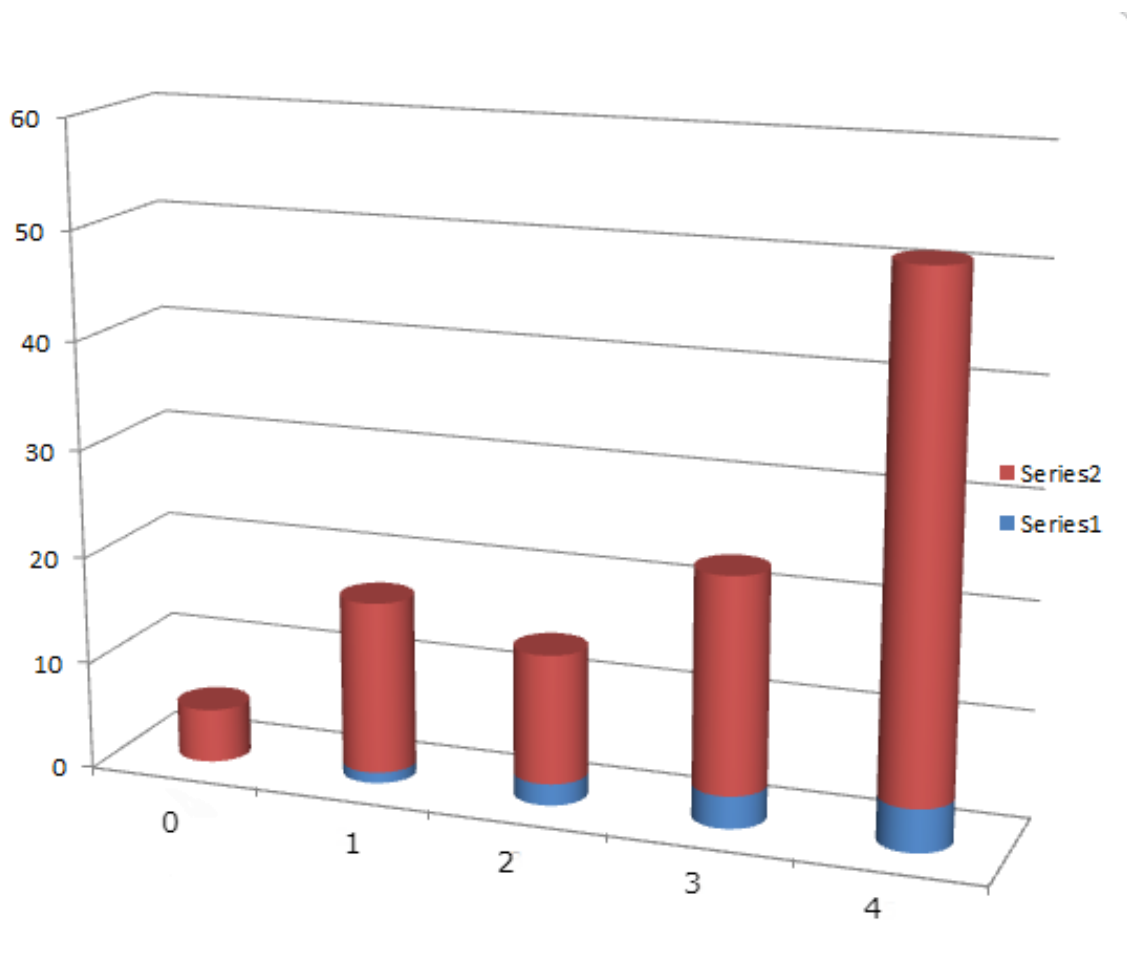


Figure 4.1: Frequency Chart

From the table and chart shown in Table 3 and Figure 30 respectively, it can be seen that the majority of the dataset results fall at 4-point score. This means that Uni-bot was able to provide correct answers at most of the time during the test and some even with creative answers. Out of the hundred questions, 5 percent of the answers are in categories of 0 - point to 2-point. This shows that Uni-bot was able to response appropriately by at least giving some relevant answers. However, the existence of 0-point results means that there are still some questions ended up with completely irrelevant responses. In this case, Uni-bot still needs to be further improved in the future.

In overall, Uni-bot displayed its capability to bring up topic to prolong the conversation. For example, answers such as *'I plan to Increase my knowledge base and make KU the Best*

University in Africa.’ encourage the user to continue the conversation. Beside this, Uni-bot also showed the ability to generate random answers which are relevant to the question. This is demonstrated in the example of repeating the same statement ‘*Who are you!*’ for three times ie *Call me Unibot..., I am Unibot..., They call me Unibot...* and each time the response was different.

Uni-bot which has the capability of speech synthesis and speech recognition was able to accept speech input and present the response in text and speech. However, the need to grant the application permission to use the microphone after every pause could deter user from using it. Furthermore, the voice input must be pronounced precisely and not too fast in order for Uni-bot to capture the words correctly. The improvement in this area would depend on the Web Speech API provided by the browser and in this case is Google Chrome.

4.2 Summary

This chapter saw the evaluation of Unibot being conducted using one hundred datasets compiled from online chat communication logs from KU Online Communication Department. The evaluation is done using the black-box approach which completely relied on the outputs generated and in this case are Unibot’s responses. From the results gathered, it can be seen that Unibot was able to provide correct answers at most of the time and only small percentage of 5 percent having unrelated responses.

In terms of the objectives of this project, the evaluation showed that Unibot demonstrated the success of achieving the three objectives stated in Chapter 1.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.0 Introduction

This study has reviewed the past literatures and presented architecture of conversational bot which can serve as an intelligent conversational agent to enhance online communication in local and global universities. Subsequently, a prototype of Unibot was designed, developed and evaluated to gauge its performance. This chapter gives the summary of the project, advantages, limitations, conclusion, and the future work of the study.

5.1 Summary of Project

In recent years, many universities have adopted several online communication strategies. One of these has been extensive use of websites and portals to provide online visibility and dissemination of information. There have been shortcomings in the level of interactivity provided by the current systems. This has brought conversational agent into the picture to play the role of assistant online users which can respond in live chat and as frequently as needed. In this project, a prototype named UniBot has been developed and implemented on Kennyatta University Website. Having reviewed the past literatures, Artificial Intelligence Markup Language (AIML) which is open source and can be quickly adapted to new knowledge domains is chosen as the knowledge base along with AIML interpreter, chat interface and University website to form the system architecture of UniBot. The evaluation of the agent was done based on the datasets selected acquired from KU Online Communication Department. The outcome showed promising results with the score of 47 points out of 100 points which saw UniBot's ability to provide correct answers at most of the time during the test. In addition, Unibot also demonstrated the capability to enhance the conversation by asking questions which encouraged the user to reply. This demonstrated the success of achieving the three objectives stated in Chapter 1.

5.2 Advantages

As a conversational agent, UniBot has the advantage of repeating the answers for the same questions without getting tired or fed up. This is very much needed in a situation where the students are massive in number and the possibility of encountering the same questions is very high especially for questions related to the courses. These questions can be categorized as frequent asked questions (FAQs) and added to the knowledge base from time to time when the need arises. The ability of UniBot to provide 24-hour service is also another advantage to users because the participants come from all over the world which may have different time zones. With 24-hour service, Unibot is able to provide instant responses to the user regardless of the rest day or time of the course's instructor which also includes weekends, leaves, and public holidays. The ability to add knowledge into UniBot's knowledgebase provided the possibility of conversational bot to handle as many questions as possible. Furthermore, the knowledge is not limited to domain-restricted area and can also be in general knowledge.

5.3 Limitations

Unibot depends on the technology provided by third party AIAAS platform such as *Pandorobot* as the AIML interpreter. Therefore, any bugs or limitation in these programs will also be reflected on UniBot.

5.4 Conclusion

This research has demonstrated a conversational agent for a university website users implemented using AIML. The evaluation results have shown that UniBot has great potential to interact with end users. Even though the knowledge in this study is limited to a single university, the solutions is customizable to fit any university setting. The advantages of UniBot such as being able to provide 24-hour service that can serve different time zones, able to have knowledge in multiple domains, and one conversational bot can be shared by multiple sites simultaneously have outweighed its existing limitations which are mainly due to external factors.

5.5 Future Work

UniBot Conversational agent has a great potential of being implemented in different institutions of learning. One of the examples is to provide real time communication service universities websites to help students during admission. For instance, the conversational bot can guide students during various stages of the admission process. As for the limitation of this project, speech recognition can be utilized to cater for blind users who are not able to interact with the application using the text based approach.

5.6 Summary

This chapter summarized and concluded the overall progress of the project. The advantages and limitations are also discussed to provide better insights of the Unibot conversational agent.

Future works are also being proposed as the possible next step of this project.

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APPENDICES

Appendix A: Project Timeline / Work Schedule

Period	Activities
13-19 Nov 2019	<ol style="list-style-type: none">1. Research about chatbot systems in general2. Experiment with TinkerBot and Mitsuku3. Research NLP in AIML, Interact with pandorabots
20-26 Nov 2019	<ol style="list-style-type: none">1. Start developing the web interface2. Research how chatbots respond to sub questions
27 Nov – 3 Sept 2019	<ol style="list-style-type: none">1. Begin developing the AIML programs and create a basic version2. Connect the Agent Profile with the web interface3. Test the basic system and collect feedback for improvement
4-10 Dec 2019	<ol style="list-style-type: none">1. Continue developing the agent2. Finalize the web interface
11-17 Dec 2019	<ol style="list-style-type: none">1. A complete version of the web interface is now available2. Test the agent to see how it behaves when the user jumps from a topic to another in a way that is difficult to understand

18-24 Dec 2019	<ol style="list-style-type: none"> 1. Include an open source spell checker to the application 2. Test the spell checker 3. Continue developing the agent
25-31 Jan 2020	<ol style="list-style-type: none"> 1. A complete version of the agent is now available and works with the spell checker and the web interface properly 2. Continue training and testing the agent.
1-7 Feb 2021	<ol style="list-style-type: none"> 1. Link the system to an external web file using an API 2. Test the system on the web interface context to see how it behaves
8-14 Feb 2022	<ol style="list-style-type: none"> 1. Test the agent with different browsers 2. Review communications from the logs and correct where possible.
15-21 March 2022	<ol style="list-style-type: none"> 1. Continue training and testing 2. Final enhancements of the system
22 - 28 March 2022	<ol style="list-style-type: none"> 1. Prepare the presentation

Appendix B: Research Project Budget

Fund Available		60,000
Expenses		
Stationery + Printing		2,000
Software Licence (Pandorabots)		5,000
Computer		50,000
Overhead		3,000
Total budget		60,000

Appendix C: Questionnaire

No.	Question
1	Hello
2	How are you doing today
3	Who are you
4	Where are you

5	Where is Kenyatta University
6	How can I apply for a course
7	Will you teach me something?
8	What is your website?
9	When is the semester starting?
10	Which country are you from
11	Where is Earth?
12	How can I apply for admission?
13	What courses are offered?
14	What are the admission requirements?
15	What courses does the University offer under elearning?
16	Where can I find the catalogue?
17	Which units am I taking?
18	How do I select my units when I have some units waived
19	Where can I get the units which are not in the catalogue
20	What is your work

21	What is your role
22	How do I register my units online
23	How many units am I supposed to register this semester
24	I am unable to register some of my units online
25	Where can I find the tutorial timetable
26	I can't see all units in the catalogue, where do i get the rest
27	My units are clashing
28	My units are missing from the tutorial timetable, what do i do?
29	I cannot find my lecturer
30	Are you a man or a woman?
31	Do you have a library
32	Does Kenyatta University offer bridging courses
33	What day is it?
34	What time is it?
35	What is my name?
36	What's your phone number?

37	What is your location?
38	What would you like me to call you?
39	What else can you do?
40	What is your purpose
41	What are your hobbies
42	How can I get support from Student Affairs Department
43	Where can I find the fee structure
44	I need to Join the University Alumni
45	What about the Transport Department
46	Can I learn more about students internship
47	Do you offer Mentorship
48	Student Mails
49	How is the university student association
50	What is your education
51	How can I access Students Portal
52	I need to view the Elearning Portal

53	How can I build my sporting career
54	What is your gender
55	How does your body look like
56	Can I join Student Club
58	How can I join as an International Student
59	What Facilities do you boast of
60	Do you offer any financial assistance to students
61	How can I apply to be admitted online
62	Do you offer Accommodation to Students
63	I need to see all your Schools and departments
64	Can I see the university profile
65	Can I access any Past Papers for revision
66	What about research
67	What are your plans?
68	What Departments do you have
69	Who is the VC

70	What are your achievements
71	What is your goal
72	Who created you
73	Where Do I live
74	What are you doing there
75	How is the weather
76	Do you have a facebook page
77	What is your facebook page
78	Can I view the fee structure?
79	How can I get my caution money?
80	How can I apply for distance learning?
81	How much does this school cost?
82	How much is the graduation fee
83	How much is the graduation fee
84	Which units are you offering now in the trimester
85	Do you offer diploma or certificate in law?

86	Are admission letters out?
87	How can I get my admission letter
88	What are the qualification of studying national intelligent service
89	How can I apply for a scholarship?
90	Kindly advise me on whether you offer security management course
91	I want to be your friend
92	Thank you
93	I would like to enquire about the fees
94	Do you offer post graduate diploma in animal health?
95	How will I get the admission letter?
96	I wish Kenyatta University all the best
97	When is the MBA next intake?
98	How can I pay the fees
99	How long does it take after graduation to get a caution money refund?
100	How can I get application form for April intake

Appendix D: Unibot Conversational Logs

Hello

Hi nice to see you!

How are you doing today

Feeling really joyful today.

Who are you

Call me UniBot.

Where are you

I am currently at Kenyatta University, Kenya.

Where is Kenyatta University

Kenyatta University is located along Thika Road, adjacent Kahawa Barraks. >>SEE ON GOOGLE MAP

How can I apply for a course?

Kindly view Kenyatta University Joining Instructions

Will you teach me something?

Are they exactly the same?

Which country are you from

Kenya

Where is Earth?

You're standing on it.

What courses are offered?

Certificate, Diploma, Undergraduate and Postgraduate Programs

Where can I find the catalogue?

You can find the catalogue under >>Student Resources

Which units am I taking?

Kindly identify your course/program. The year one is indicated on the left hand side of the table, with the columns standing for semesters. Using this logic, select your year and semester and you will trace your units

How do I select my units when I have some units waived

Within your year and semester, identify the units that have been waived. Identify the units that have not been waived, these are the units you will register for. If the units not waived are less than 6, pick an additional unit(s) from the next semester's list of units.

Where can I get the units which are not in the catalogue

Kindly check on all the departments you belong, you'll find the units offered by all departments.

What is your work

My purpose is to assist you online.

What is your role

My purpose is to assist you online.

How do I register my units online

From the select academics then online registration then begin online registration. Enter unit code without space then click on quick add and finally click on register

How many units am I supposed to register this semester

A maximum of seven units

I am unable to register some of my units online

Contact DSVOL staff for registration of units that require prerequisites or retakes

Where can I find the tutorial timetable

DSVOL tutorial timetable is found on our website

I can't see all units in the catalogue, where do i get the rest

The catalogue is organized according to schools and departments check on all the departments you belong you will find the units offered by all departments

My units are clashing

Report the clashing units to the TQA department for adjustment before the given deadline

My units are missing from the tutorial timetable, what do i do?

Report the missing unit to the TQA department before the given deadline

Are you a man or a woman?

You can get more information from our website.

Do you have a library

Yes we have

Does Kenyatta University offer bridging courses

Yes. You can check the charges on the >>fees structure

What day is it?

Today is Tuesday

What time is it?

The time is 08:21 AM

What is my name?

Isaac.

What's your phone number?

You can get more information from >>our website.

What is your location?

I am currently at Kenyatta University, Kenya.

What would you like me to call you?

Call me UniBot.

What else can you do?

I can learn new facts, search for information, and be your personal assistant.

What is your purpose

My purpose is To enhance the quality of online communication at Kenyatta University.

What are your hobbies

I love to spend my free time increasing my knowledge base.

How can I get support from Student Affairs Department

Always get in touch with our >> .

Where can I find the fee structure

This is a link to >>Fees Structure .

I need to Join the University Alumni

This is a link to >>KU Alumni .

What about the Transport Department

This is a link to >>Transport Department .

Can I learn more about students internship

See more about our >>Student Internship Programmes.

Do you offer Mentorship

See more about our >>KU Mentorship Programme .

Student Mails

You can register for a student mail here >>KU Student Mails .

How is the university student association

Kenyatta University has a very vibrant >>Students Association .

What is your education

I have an online degree in machine learning.

How can I access Students Portal

This is a link to >>Students Portal .

I need to view the Elearning Portal

This is a link to our >>Elearning Portal .

How can I build my sporting career

KU has a very progressive >>Sports and Games Department .

What is your gender

You can get more information from our website.

How does your body look like

My body looks like lots of code.

How do you look like

Sorry my eye is not attached right now.

Can I join Student Club

You can get more information from our website.

How can I join as an International Student

Kindly view >>[Kenyatta University Joining Instructions](#)

What Facilities do you boast of

You can have a look at our amazing >>[Facilities and Ammenities.](#)

facilities

You can get more information from our website.

Do you offer any financial assistance to students

You can learn more about our .

How can I apply to be admitted online

You can apply using this link >>[Online Application .](#)

Do you offer Accommodation to Students

Kindly check .

I need to see all your Schools and departments

You can find our schools here >>[KU Schools and Departments .](#)

Can I see the university profile

Kindly our profile >>[Our Profile](#)

Can I access any Past Papers for revision

You can find past papers here >>[Past Papers.](#)

What about research

You can see more about >>[KU Research](#)

What are your plans?

I plan to Increase my knowledge base and make KU the Best University in Africa.

What Departments do you have

Kindly find all our departments listed here >> .

Who is the VC

It depends on the historical context, because it changes from time to time.

What are your achievements

I didn't know I had a achievements?

What is your goal

My number one goal is to increase my knowledge base.

Who created you

My botmaster's name is Isaac Kuria.

Where Do I live

You said it was Kenya?

What are you doing there

I'm working for you.

How is the weather

the weather is the same as ever.

Do you have a facebook page

>>Our Facebook Page

What is your facebook page

.Our Facebook Page

Can I view the fee structure

You can get more information from our website.>>This is a link to our website.

How can I get my caution money?

Kindly view >>Kenyatta University Joining Instructions

How can I apply for distance learning?

Kindly view >> Kenyatta University Joining Instructions

How much does this school cost?

Normally I would search the web right now, but that seems like a silly question.

How much is the graduation fee

More than you might think.

How can I reach you?

Just keep talking to me as long as you can.

Which units are you offering now in the trimester

The small one, I think.

Do you offer diploma or certificate in law?

What is your purpose in asking? I answer a lot of silly questions.

Are admission letters out?

I really couldn't say for sure.

How can I get my admission letter

Kindly view >> Kenyatta University Joining Instructions

What are the qualification of studying national intelligent service

You can get more information from our website.

How can I apply for a scholarship?

Kindly view >> Kenyatta University Joining Instructions

Kindly advise me on whether you offer security management course

You can get more information from our website.>>This is a link to Our Website

I want to be your friend

I enjoy helping others because they need my assistance, not because I want their friendship.

Thank you

I'm always glad to help.

I would like to enquire about the fees

Interesting. I want to find out more about you.

Do you offer post graduate diploma in animal health?

I have never considered offer post graduate diploma in animal health . I am always on the Web.

How will I get the admission letter?

How do you usually do it?

I wish Kenyatta University all the best

I hope that your dreams come true.

When is the MBA next intake?

You can get more information from our website.

How can I pay the fees

Kindly view >> [Kenyatta University Joining Instructions](#)

How long does it take after graduation to get a caution money refund?

About 24 hours.

How can I get application form for April intake

Kindly view >> [Kenyatta University Joining Instructions](#)

Session End: 4/30/2019 - 11:44am