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**THE DEVELOPMENT AND IMPLEMENTATION OF THE FREQUENTLY
ASKED QUESTION ONLINE TEACHING ASSISTANT USING A CHATBOT.**

Abstract

The communication of potential students with a university department is performed manually and it is a very time-consuming procedure. The opportunity to communicate with on a one-to one basis is highly valued. However, with many hundreds of applications each year, one-to one conversations are not feasible in most cases. The communication will require a member of academic staff to expend several hours to find suitable answers and contact each student. It would be useful to reduce his costs and time. The project aims to reduce the burden on the head of information officer or a support manager, and potentially other users, by developing a convincing chatbot. A suitable algorithm must be devised to search through the set of data and find a potential answer. The program then replies to the user and provides a relevant weblink if the user is not satisfied by the answer. Furthermore, a web interface is provided for both users and an administrator. The achievements of the project can be summarized as follows. To prepare the background of the project a literature review was undertaken, together with an investigation of existing tools, and consultation with the head of information officer or customer support manager. The requirements of the system were established and a range of algorithms and tools were investigated, including keyword and template matching. An algorithm that combines keyword matching with string similarity has been developed. A usable system using the proposed algorithm has been implemented. The system was evaluated by keeping logs of questions and answers and by feedback received by potential students that used it. A pre-trained application can deliver high quality information service to the user and the database can be designed on basis of frequently asked questions from the students and visitor. In the current days of technology, A chatbot application can build conversation with the customer or can make customer relationship by chatting. Students can easily get any kind of specific answer of any question by just asking through the chat, and a computer program (known as chatbot) can deliver the answer to a number of students at a time.

DEDICATION

I dedicate this dissertation to my high school teacher Mr Mlambo who did well in his ability to get me in the path I have chosen and supported each one of my dreams in every way that was possible to him. I know he waited for so long time to see this achievement.

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CHAPTER 1: PROPOSAL

1.1 Introduction

One of the cornerstones of the pedagogical model of Bindura university of Science Education is interaction. Improper and untimely interaction with the students can lead to isolation in a distance learning environment. During the initial days of the semester, students will have lot of questions and these questions tend to repeat. As a result, Moodle and Frequently Asked Questions (FAQs) area is formed in the University's Moodle. Moodle is a messaging platform which helps students to post doubts by selecting the area related to their query and then giving a description of their problem. This messaging platform will take a minimal amount of time to respond to all the individual student questions as the course coordinator or the secretary need to reply to the questions personally. Students can even look and find answers for their questions by reading through FAQs. But FAQs contain a lot of information and it is difficult to find a specific data from the provided list of FAQs.

1.3 Problem Statement

Since the start of the 21st century, there has been a rapid increase in more students going to universities and colleges which resulted in a rapid increase in students to lecturer ratios. Currently, the lecturer to student ratio ranges from 1:150 and more which makes it difficult for the lecturer to conduct effective one on one sessions as per need. Mostly lecturers reply repetitive questions each and every day and it becomes monotonous. Due to these increased ratios, a lot of slow learners are ending up finishing the course without fully understanding all the concepts of the course because it is hard for a single lecturer to attend every student each and every time a student need assistance. For an effective education, each student needs at least six hours of one-on-one sessions with the lecturer to fully grasp all the course concepts which is why we came up with an AI assistant that assist students on frequently asked questions to ensure effective education in the academic environment.

1.4 Aim

- To develop an online teaching assistant application that will help and complement the lecturer and students by replying frequently asked questions hence enhancing effective E-learning which is currently adopted in the nation.

1.5 Objectives

- To creating the chatbot that allow the students to send their queries in the form of text?
- To attending the students by giving replies to their repetitive queries.
- To allow the lectures to view questions from the students and update with correct answers.

1.6 Research Questions

- How to improve the learning environment by creating the chatbot that allow the students to send their queries in the form of text?
- What measures can be used to create an online teaching assistant which will help the lecturer in attending the students by giving replies to their repetitive queries.
- How do we create the system that allow the lectures to view questions from the students and update with correct answers.

1.7 Research propositions / hypothesis

The research argues that the use of a chatbot in universities aids in the reduction of workloads to lectures and tutors as it allows them to focus on more demanding issues. Also, the research postulates that the virtual assistant chatbot helps the lectures to track the progress of their students at the comfort of their homes. The virtual assistant chatbot is supposed to in the absents of lecturers. This thereby gives the following hypothesis:

1.8 Significance of the study

With the introduction of the Online Teaching Assistant chatbot, there will be an effective and fast learning environment and delivery of quality education in the academic system. This system

will provide a 24/7 service to the students from anywhere and will serve as many students as possible at a time which will reduce costs and save the time in finding a lecturer for assistance. The online or virtual teaching assistant will reduce the workload to the lecturer from attending frequently asked questions. This online teaching assistant application will be presenting information in an exciting way that will enhance the quality of learning by relieving anxiety or boredom.

1. **H₀** The proposed chatbot will reply the frequently asked questions from the students.
2. **H₁** The proposed chatbot will not reply the frequently asked questions from the students.

1.9 Delimitations

This research focuses on solving the problems caused by the too high student to lecturer ratios at the Bindura University of Science Education. For effective and flexible learning, students need at least six hours of one-on-one sessions with the lecturer. It is now difficult for the lecturer to conduct these sessions due to very big numbers per class and it is affecting the learning environment because some students end up finishing the course without enough understanding of the major concepts, that is why we are developing an online teaching assistant to help the lecturer in assisting students whenever there is need.

1.10 Limitations

- The time required to complete the task is much longer than what is available to design, implement and evaluate the project which might lead to working under pressure and affects the outcome.
- The resources needed for the project are expensive and limited in abundance.

CHAPTER 2: LITERRATURE REVIEW

2.1 Introduction

Researchers found a positive correlation between one-on-one sessions and the class pass rate. In recent years research has been carried out at the Bindura University of Science Education to determine why most students fail in some modules and even drop out. The research was based on the statistics produced after publishing the final results at the end of the semester. Upon observation, the researchers discovered that modules with a larger number of students that is a larger lecturer to student ratio tend to have fewer one on one sessions leading to low students pass rate for instance the Statistics module at the university which has a larger number in recent year has shown low pass rates since one on one sessions are less since the lecturer cannot accommodate everyone for one-on-one sessions thus disadvantaging the slow learners. Researchers found out that the lecturer one-on-one sessions were becoming fewer and fewer since the lecturer to student ratio was increasing and some of the students failed to notice that leading to failure. They also noticed that one on one sessions play a critical long-term role in the student's pass rate allowing all students including the slow learners equipping them with enough concepts to be able to tackle any related questions to the module.

2.1.1 Systematic Literature Review

A Systematic Literature Review (SLR) is a means of identifying, evaluating and interpreting all available research relevant to a research question, or topic area, or phenomenon of interest. This type of Literature Review helps to summarize the existing evidence concerning a technology and to identify gaps in the current research which helps to find areas for further study (Kitchenham, 2004).

As per Kitchenham, the main features of a systematic review are described below. The systematic reviews start by defining a review protocol which mentions research question being addressed and the methods used for review. Systematic reviews are dependent on a defined search strategy which helps to find out as many relevant literatures as possible. The search strategy used for the reviews is documented so that everyone can find its completeness. A systematic review is a prerequisite for quantitative meta-analysis.

The steps included in the systematic review process are planning the review, conducting the review and reporting the review. In planning the review stage, definition of motivation, research questions, SLR objectives, inclusion and exclusion criteria are done. The review is conducted by selecting the primary studies related to this topic. The data is extracted using review protocol defined in the first step. During the last step of reporting, the results are reported after summarizing the extracted data.

Definitions

Chatbots are intelligent systems that interact with users via messaging, text, speech or customized graphical interfaces (Rouse, 2018). They enable users to retrieve information and perform specific actions with simple conversations, they are available 24/7, they can answer to multiple people at a time and they can outperform humans in terms of speed and accuracy in a narrow domain. Users can take advantage of the functionalities that bots offer on the channel they prefer, creating personalized conversations with a bot that can manage a great number of concurrent users. Something that is very difficult and expensive to reproduce with a group of humans, since the number of requests they can manage at a time is much more limited. Although, the quality of the answers is a completely different matter and it depends on the quality of the chatbot and more importantly on the domain of application and the expertise needed to write a satisfactory response.

2.1.2 A Brief History of Chatbots

Chatbots are computer programs which can converse with human beings via text or voice interactions (Rouse, 2018).

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answers is a completely different matter and it depends on the quality of the chatbot and more importantly on the domain of application and the expertise needed to write a satisfactory response.

2.2 Related literature

2.2.1 Implemented chatbots

a) ELIZA

The first, most famous, chatbot was created in 1964 and was named ELIZA, which can analyse the question entered by the user and then provided the required response by decomposing the input and applying certain rules (Weizenbaum, 1966) as shown in figure 2.1.

```
Human: You are like my father in some ways.
ELIZA: What resemblance do you see
Human: You are not very aggressive.
ELIZA: What makes you to think I am not aggressive
Human: You don't argue with me.
ELIZA: Why do you think I don't argue with you
Human: You are afraid of me.
ELIZA: Does it please you to believe I am afraid
```

Figure 1: An example conversation with ELIZA (G. Molnár, S. Zoltán, 2018).

b) PARRY

A psychiatrist named Kenneth Colby, at Stanford University created a chatbot named PARRY in 1972. This chatbot was created to simulate a person having paranoid schizophrenia. It was an advanced version of ELIZA and contained an embodied conversational strategy. PARRY was

tested using Turing Test. A group of real patients and computers with PARRY was analysed by experienced psychiatrists. The doctors could identify the real patients only 48 percent of the time.

c) ALICE

In 1995, Richard Wallace created a chatbot named ALICE using a programming language named AIML (Artificial Intelligence Markup Language) as shown in figure 2.2. It can communicate with the user by analyzing user input with heuristic pattern matching rules. It checks the input of the user with predefined set of responses. It cannot answer those queries adequately, which are not listed in the predefined set. The knowledge base can be expanded using an XML dialect called AIML (Wallace, R. S, 2000).

```
User: Hello ALICE
Alice: Hi there!
User: How old are you?
Alice: I am eighteen in computer years
User: Who is your father?
Alice: I was programmed by Dr. Richard S. Wallace
User: so you are a software program?
Alice: Interesting deduction. Thanks and you are a
delightful person too. Am I a software program?
User: wonderful! So what's your favorite food ALICE?
Alice: Yeah that's right! I require only electricity
```

Figure 2: A sample conversation with ALICE (Wallace, R. S, 2000).

Then evolved a lot of chatbots in sorts of areas like health, business, education and so on. If we examine the history of chatbots, YPA is a suitable example for an FAQ bot. YPA is a chatbot which can provide users with information from the British Telecom's Yellow pages. The YPA is composed of many components namely Dialog manager, Natural language front-end, Query construction component and backend database. If there is no answer found, it starts asking user to obtain more information. The user can ask for a plumber with an emergency service, and the chatbot can reply with the required details (Abu Shawar, E. Atwell, Eds, 2007).

In 2011, IBM won the Loebner competition for Watson, a Question responder developed in 2004. Now extended to chatbots. In addition to over 100-word processing methods, he uses ontologies such as DBPedia, WordNet and Yago to enhance other technologies to enable his reasoning similar to other new chatbot approaches (L. Bradeško, D. Mladenčić, 2012).

d) Mitsiku

Mitsuku responds to requests using a programming language called AIML. Equipped with her intelligence to react to certain objects. In 2013 he won and in 2016 he won the Loebner Prize twice (A. Deshpande, A. Shahane, D. Gadre, Mrunmayi Deshpande, Prof. Dr. Prachi M. Joshi, 2017).

Web-based chatbots were developed as automated online assistants. This was developed on a website that contains various products with many features. Chatbots help users choose the best product for them. There is a set of predefined answers and a separate database for products. So even without major changes, chatbots will continue to work well in new products (Gupta, D. Borkar, C. De Mello, S. Patil, 2015).

e) Jill Watson

A team led by Goel and Polepeddi, L. (A. K. Goel, L. Polepeddi, 2016) developed a system that was used based on responses and recommendation tools to answer students' questions in a knowledge forum in an online artificial intelligence class. This assistant was named Jill Watson, based on his IBM Watson platform best known as his computer that defeated two Jeopardy champions. Jill handles a large number of posts on her forum from students enrolled in her course online, which is a prerequisite for a Master of Science degree in the Georgia Tech Computer Program. Specially designed. Jill answers her FAQ on her forum. Continue to check for new updates every 15 minutes and respond to students. Mainly deals with student referrals. These are basically teaching assistants, not FAQ bots.

f) Chatbot by The University of Manipal

The University of Manipal in India has set up a chatbot to answer frequently asked questions related to the university. Basically, it is designed to help visitors leave no doubt about the courses offered by the university. Chatbot is implemented using AIML and LSA. There are sample-based cross-check samples. If a model is found, a response is provided that is stored specifically for the model. Otherwise, the default response is returned to user (R. High, 2012).

g) The WeightMentor

WeightMentor is a motivational chatbot for weight loss. Users can communicate with this natural language chatbot through Facebook Messenger. It is implemented using Dialog flow, NodeJS and PostgreSQL. To start a conversation with user, the user is given three options, namely, Personal Report, Set/Review Goals, and Motivate Me. Weight Mentor uses a combination of casual conversation and counseling conversation (S. Holmes, A. Moorhead, R. Bond, H. Zheng, V. Coates, and M. McTear, 2018).

2.2.2 Chatbots in education

a) UC Irvine

There are existing works that utilize chatbots for educational purposes as well. UC Irvine proposed the chatbot that helped public services at the library teach patrons how to locate and identify resources for their research (Rice & Gregor, 2016). At Stanford University, to overcome the limitations of the TAs' human resources, a chatbot was implemented to answer questions for a class by gathering data from an online forum that students used. (Chopra, Gianforte, & Sholar, 2016). The concepts and utilization from these works are applied in our study as success stories to help students use chatbots.

In implementing these types of chatbots, constructively designing the chatbot is crucial to meet the users' needs. The following provides related works that support the foundational development

of online teaching assistant system. (Chopra, Gianforte, and Sholar 2016) proposed a design of the chatbot that classified questions into three categories:

- 1) assignment - the bot should be able to help with the technical problem,
- 2) conceptual - the bot should answer conceptual questions and provide students a better perception of a given concept, and
- 3) policy - the bot should be able to answer the general questions regarding course policy.

We use this design to model how a chatbot is structured to handle students' questions. Sandoval (2018) proposed the chatbot for an online class that can answer FAQs for the following topics: course syllabus, instructors' information, required textbooks, policies, assignment description, and services. In addition, this paper provides a better user experience with the buttons for faster replies with optional answers students can choose. The integration for this chatbot was embedded in a Learning Management System (LMS), Blackboard.

To guide and help students during the transition period, a chatbot has been developed that resides within the instant messaging platforms. This chatbot has basic artificial intelligence and can help students with the necessary information (S. Carayannopoulos, 2018). One of the downsides of this chatbot is that it only works on mobile phones and is implemented in Kik Messenger. Another downside is that it's not visually responsive and often provides a list of options for students. They must choose one of the options listed to communicate with the bot.

b) FAQ chatbot

(Ranoliya, Raghuwanshi, and Singh 2017) provided an accurate answer to any questions based on the FAQ dataset using Artificial Intelligence Markup Language (AIML) and Latent Semantic Analysis (LSA). Their system consisted of the broad knowledge of college admission, college information, activities happening on campus, etc. Our work also provides the general design of categorizing inputs and responding by pattern matching.

c) Hobert chatbot

Hobert (2019) implemented a web-based chatbot alongside the code editor interface to analyze students' code syntax and format. Hobert's approach is helpful for students who want to learn

new programming languages. This research is valuable to the implementation of our chatbot since technical questions can be related to code static analysis problems that students may have.

d) Jill Watson, the Teacher Assistant

IBM's AI technology is currently being used to run a teaching assistant for an online course named Jill Watson at Georgia Tech (Nakpodia, 2017). After being widely promoted by Jill Watson, has spread its wings and is now being implemented in universities around the world. One of his most recent additions to the list is his BI Norwegian Business School in Oslo, Norway (McNeal, 2016).

e) The Deakin Genie

At Deakin University in Victoria, Australia, development of first chatbot Campus Genius is in full swing. As with AI teaching assistants, the intelligence behind them comes from Watson, IBM's supercomputer system. Once the Deakin Genie is up and running, it can answer any question students need to know about life on the campus (Hubert, 2017).

A summary of all the chatbots discussed above is mentioned below with a small description, the purpose of the chatbot, the implementation method, the deployed platform as well as the domain in which it is used in the Table. 2.1.

Existing Chatbots	Released Year	Purpose of Chatbot	Method of Implementation	Deployed platform	Area
ELIZA	1964	Enable natural language conversation between	Keywords and Transformation Rules together form the script	Program operating in MAC system	Education

		computer and human.			
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PARRY	1972	Simulate a person with paranoid schizophrenia	Advanced Version of ELIZA		Health
ALICE	1995	Analyze user inputs using heuristic patterns	AIML	-	Education
Ms Lindquist	2003	Tutoring system	Model Tracing Paradigm	Website	Education
IBM Watson	2004	Question Answering System	IBM's Deep QA software and Apache UIMA		
YPA	2007	Used to retrieve Information	Dialog manager, Natural		Business

			Language processing		
Mistuku	2013	Claims to be 18 year old female chatbot from Leeds	AIML	-	-
Chatbot in Ecommerce website	2015	Automated assistant on an ecommerce website	Java script, MySQL	Website	Business
Jill Watson	2016	Teaching Assistant	IBM Watson	eLearning Environment	Education
Chatbot for University Related FAQ	2017	Answers to the FAQs related to university	AIML and LSA	-	Education
Weight Mentor	2018	Interact with users	Dialog flow, NodeJS, PostgreSQL	Facebook Messenger	Health

		to help them maintain weight loss			
--	--	-----------------------------------	--	--	--

Chatbot created by Carayannopoulos	2018	Helps students during the transition phase	-	IM platforms	Education
CVChatbot	2018	Notifies students about modules created in virtual learning environment	-	Facebook	Education
DINA	2018	Responds to applicants corresponding for their issues before admission	Dialogflow	Website	Education

FIT- EBOT	2018	Lecturer and administrative assistant	Dialogflow	Facebook messenger	Education
CiSA	2019	Provide initial support to international students in English in a Korean university	-	Facebook	Education
Chatbot to support students about a particular course	2019	To provide clarify doubts to students about a Higher Education Course	IBM Watson	Facebook Messenger	Education
Medbot	2020	To facilitate telehealth	Dialog flow	-	Health
		by providing primary healthcare, education, information and advice to			

		chronic patients			
FAQ bot for Covid-19	2020	To help patients understand the symptoms of Covid-19 and give them proper guidance	Dialog flow	-	Health
Symptoma	2020	Digitally screening citizens for risks of Covid-19	Predictive Method	https://www.symptoma.com	Health

Table 1: Summary of the chatbots discussed in background work.

2.3 Summary

This test clearly shows that chatbots are an ideal tool for university learning, especially in an online learning environment. Most research found that chatbot implementations were used to support information already provided by universities, such as FAQs, grading guidelines, syllabuses, and faculty information. Among all the literature, several studies discuss the ability of chatbots to support programming problems of students who want to learn a new language. Another similarity between these works is the structure of the chatbot design. Many studies offer

similar approaches to sorting questions into different categories. However, one aspect not mentioned in any of the surveys is the integration of cloud-based software development and shared source code hosting. Overall, this related work includes theory and practical implementations that form an important foundation for chatbot implementations. The online teaching assistant system is an all-in-one chatbot that answers simple course-related questions, FAQs, and technical questions. Especially for final year students covering research project questions and guidelines. It also includes automation that initially connects students to third-party her tools that required TAs and professors to manually approve requests.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The chapter provides an overview of the study's research methodology which lies within the quantitative paradigm. This chapter documents the techniques and methodology used to develop the Online Teaching Assistant system. In this section, the researchers present how the selected techniques were applied in the development of the Online Teaching Assistant for the Bindura University of Science Education. The chapter concludes with a discussion on the reliability and validity issues for the study.

A research methodology is a path through which researchers need to conduct their research (Kassu Jilcha Sileyew, 2019). David Wilkinson (200), also defined research methodology as the specific procedures or techniques used to identify, select, process, and analyze information about a topic. The methodology section allows us to critically evaluate a study's overall validity and reliability. This methodology will answer two major questions: How was the data collected? How was it analyzed?

3.2 Data Collection methods

The online teaching assistant system is using the data collected from the targeted participants of the system which include students and lecturers. Researchers chose among interviews,

questionnaires, and record inspections to come out with the way of finding data to develop the required system.

SURVEYS(QUESTIONNAIRES)

A questionnaire is a document used to gather information from respondents. Researchers also chose this research instrument to investigate both patterns and frequency. It helps with acquiring user needs, expectations, priorities, perspectives, and preferences of the system to be developed (Learn About Quality, 2020).

OBSERVATION

Observation is the watching of people carrying while doing their work in a natural setting which would help the analyst with a better understanding of the job than interview, in which the interviewee will often concentrate on the normal aspects of the job and forget the exceptional situation and interruption that occur and which the system will need to cope with. Observation also allows the analyst to see what information people use to carry out their jobs. On top of that a successful observation needs preparation. (Connolly & Begg, 2005).

The researcher suggested this method to be the best data collection method as he observed the way the University operates during his time at Bindura University that is four years. Also the researcher of was one of the students who were facing some delays in getting responses from the lectures and the researcher find out that most of the queries has already asked before that made him come out with the development of the frequently asked question chatbot.

The researcher observes how the interaction between lectures and students interact during the final year project management, and how the supervisors carry out their work with the aim of having a clear understanding of the problem.

RECORD INSPECTION

Record inspection is whereby the researchers review documents to collect data and in context to the research project, the researchers use results published by the Bindura University of Science Education after the end of the semester

3.3 RESEARCH DESIGN

The research design is the overall strategy chosen to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data.

According to Polit and Beck,2012 Research design is the researchers overall for answering the research questions.

The researcher used javascript and php languages with artificial intelligent and MySQL, to develop the system. With the aid of documentation and record to gather data about the online teaching assistant for frequently asked questions model and artificial intelligence, the author was able to do his research. He then used an experimental research design which allows him to observe changes, responses of systems, and adjust factors.

3.3.1 Requirement Analysis.

It is essential to document all the functional and non-functional specifications of the required system. It is advisable to structure all incoming data, assess it, consider all the limitations which may arise on the customer's side, and come up with a ready-to-follow specification that meets the customer's needs. The research also considered types of limitations, such as availability of datasets and processing power during machine training, that may impede the design method.

3.3.2 Functional Requirements

- The system ought to be able to accept data (questions) given by the user (students).
- The system should be in a position to classify given data.
- The system should be able to output the answer related to the question from the user input.

3.3.3 Non-Functional Requirements.

They are often referred to as quality requirements and used to judge the performance of a system rather than its intended behavior. The proposed system must be able to meet the following:

- Reliability- The system should be reliable and accurate.
- User friendly- The system is should be user friendly.
- Usability- System should be easy to use.
- Scalability- The system should be scalable.
- Performance – Response time, throughput and resource utilization.
- Availability- the system should always be available whenever there is need for using it.
- Reliability- Users have to trust the system, even after using it for a long time.
- Maintainability- The system should be easy to be restored to operational status if a failure occurs.

3.3.4 Hardware Requirements

- A core i5 processor

3.3.5 Software Requirements

- Windows 10 Operating system
- Visual studio code development tool
- Web browser
- Xamp server

3.3.6 Design Tools

PHP

PHPmyAdmin is the software coded with PHP (Hypertext Pre-processor). PHPmyAdmin is function to manage MySQL database through website. Create database, add, edit, delete tables, execute SQL queries and make table relationship are some the features.

MYSQL

MySQL is an open-source relational database management system based on Structured Query Language (SQL). Our team will be using MySQL for the warehousing of data for the online teaching assistant, which is the possible questions and answers which can be asked by students.

VISUAL STUDIO CODE

Visual Studio Code is an excellent Python editor and works on any operating system with a variety of Python interpreters due to its Microsoft Python extension. This is the development environment we will be using to develop an online teaching assistant system.

XAMPP SERVER

Is a free and open-source cross-platform web server solution stack package developed by Apache Friends. For the development of this online teaching assistant, we will be using XAMPP as our local server for creating and testing our system on a local server.

3.3.7 Software Life Cycle Model

A software life cycle model, also known as a process model, is a pictorial or a diagrammatic representation of a software life cycle. It represents all the methods needed to make a software product transit through its life cycle stages. A software life cycle model describes the entry and exit criteria of each phase. For the development of this project (Online Teaching Assistant), we will be using the **evolutionary prototyping** model.

Evolutionary Prototyping

The idea behind the evolutionary prototyping model is that an initial prototype is presented to the user. Users then provide feedback and suggestions for the improvements which are actioned

by the developer who then presents a more refined prototype. The meeting process is repeated and at each stage, the prototype evolves towards the final system.

Diagram of Evolutionary Prototype

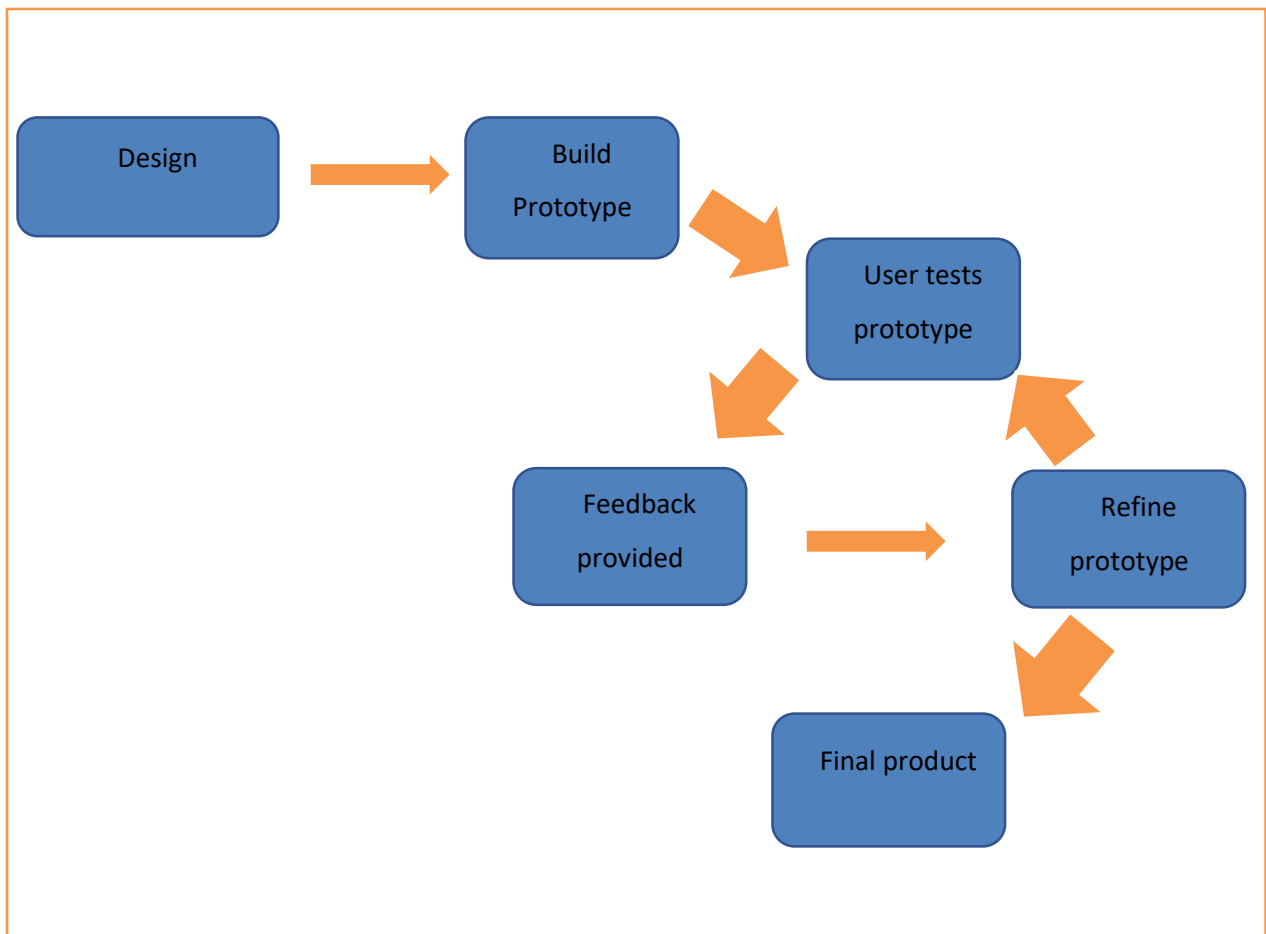


Figure 3: Diagram of Evolutionary Prototype

source: researchgate.net

Advantages

We will be using the evolutionary prototype because it allows the users to engage with the system and it generates chances to meet exact user requirements. It will also speed up system delivery to the users.

3.4 SYSTEM DESIGN

The requirements specification document is analysed and this stage defines how the system components and data for the system satisfy specified requirements.

3.4.1 System Architecture

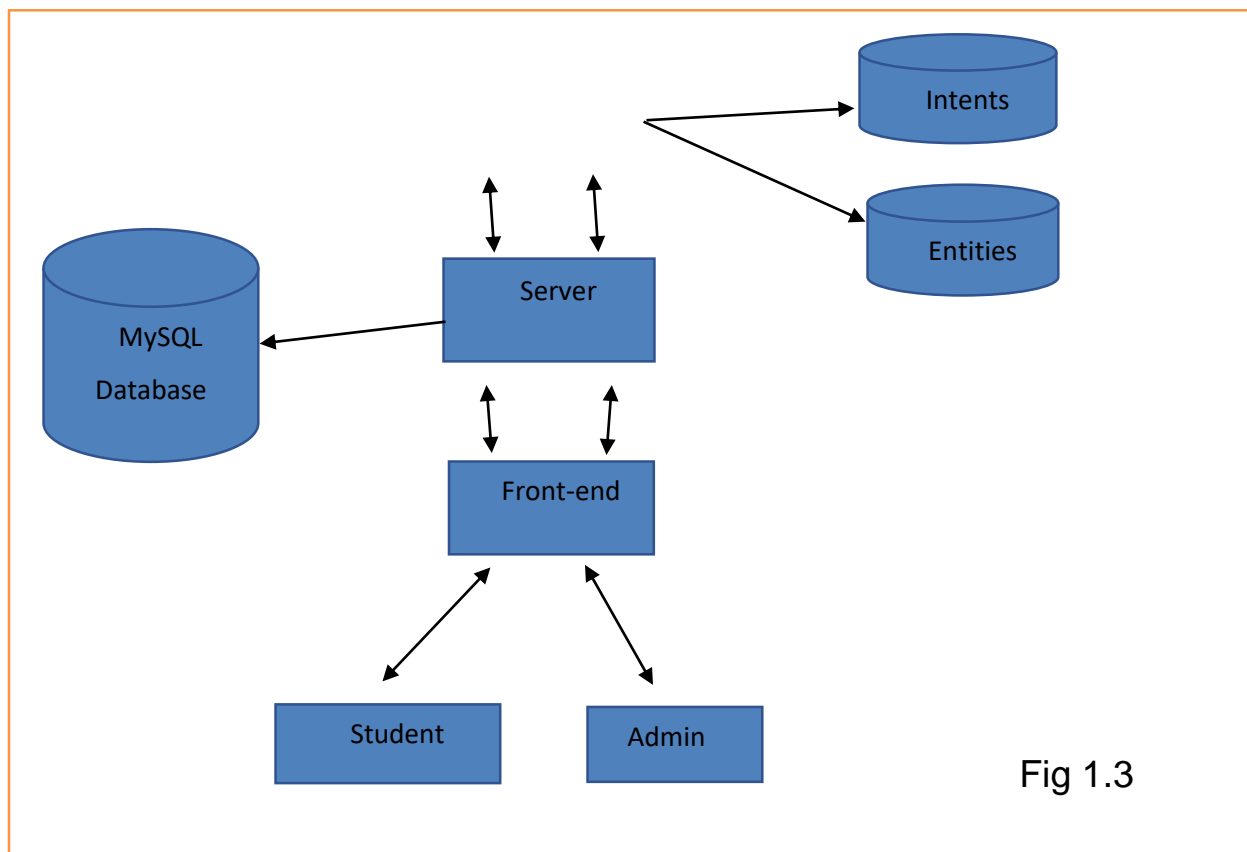


Figure 4: System Architecture

source: <http://ceur-ws.org/Vol-2482/paper51.pdf>

It provides an abstraction to manage the system complexity and establish a communication and coordination mechanism among components. The system architecture will help us identify the requirements which affect the structure of our Online Teaching Assistant system for frequently asked questions. It will also help us reduce the business risks associated with building technical solutions.

3.4.2 DATA FLOW DIAGRAMS (DFD)

A DFD is defined as a log with a binary relationship, known as a preference relationship. Diagram nodes represent processes, data stores, and external entities, and directed edges represent data flows. The preference relationship for a DFD is an abstraction of functional semantics and specifies a "used to create" relationship between data streams.

It is an important visualization method for modeling high-level details of a system by describing how input data is transformed into outputs through continuous functional transformations. The data stream in the DFD is named to indicate the nature of the data used. DFD is a type of information expansion and as such provides important insight into how information is transformed as it passes through a system and how the output is displayed.

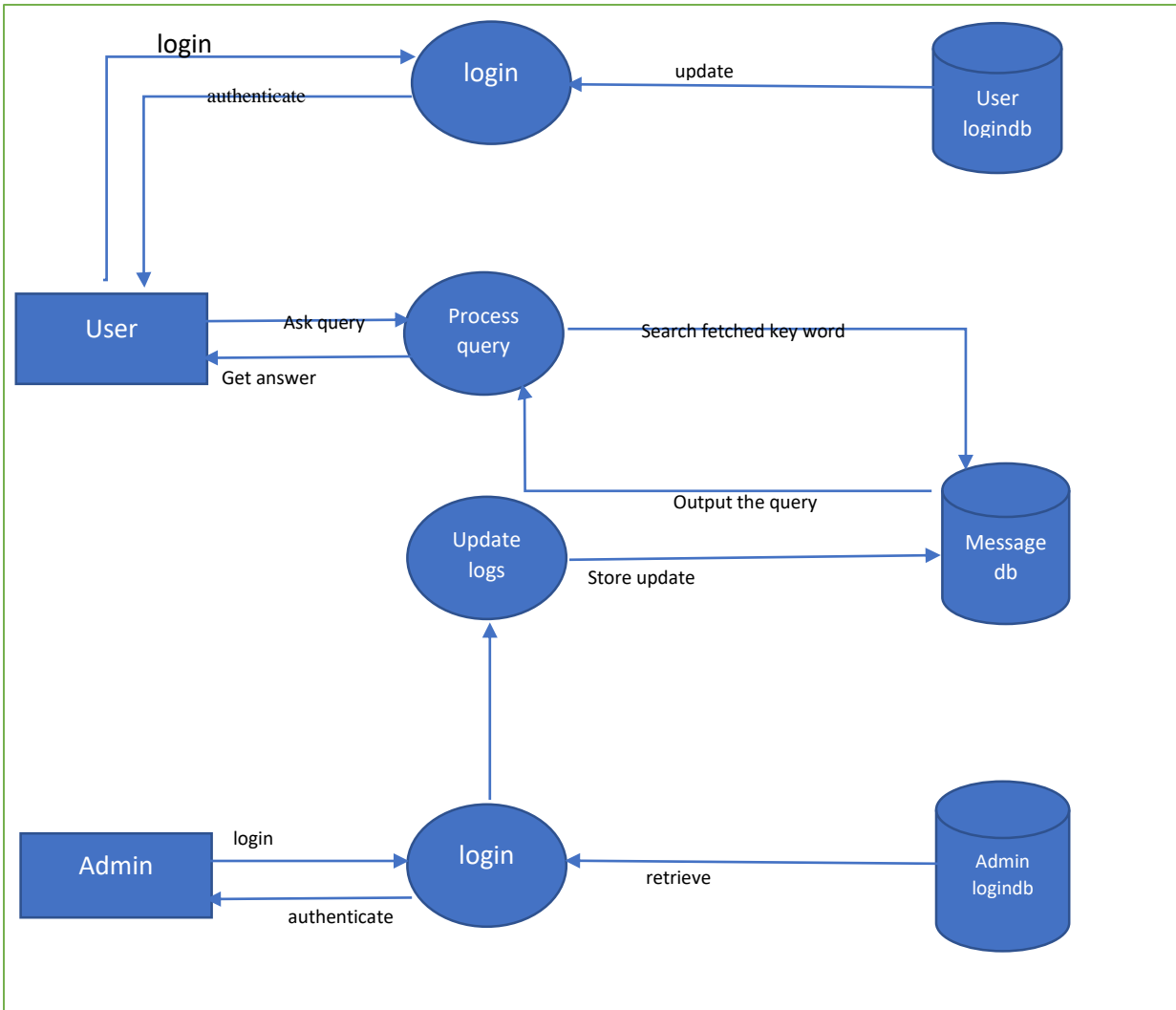
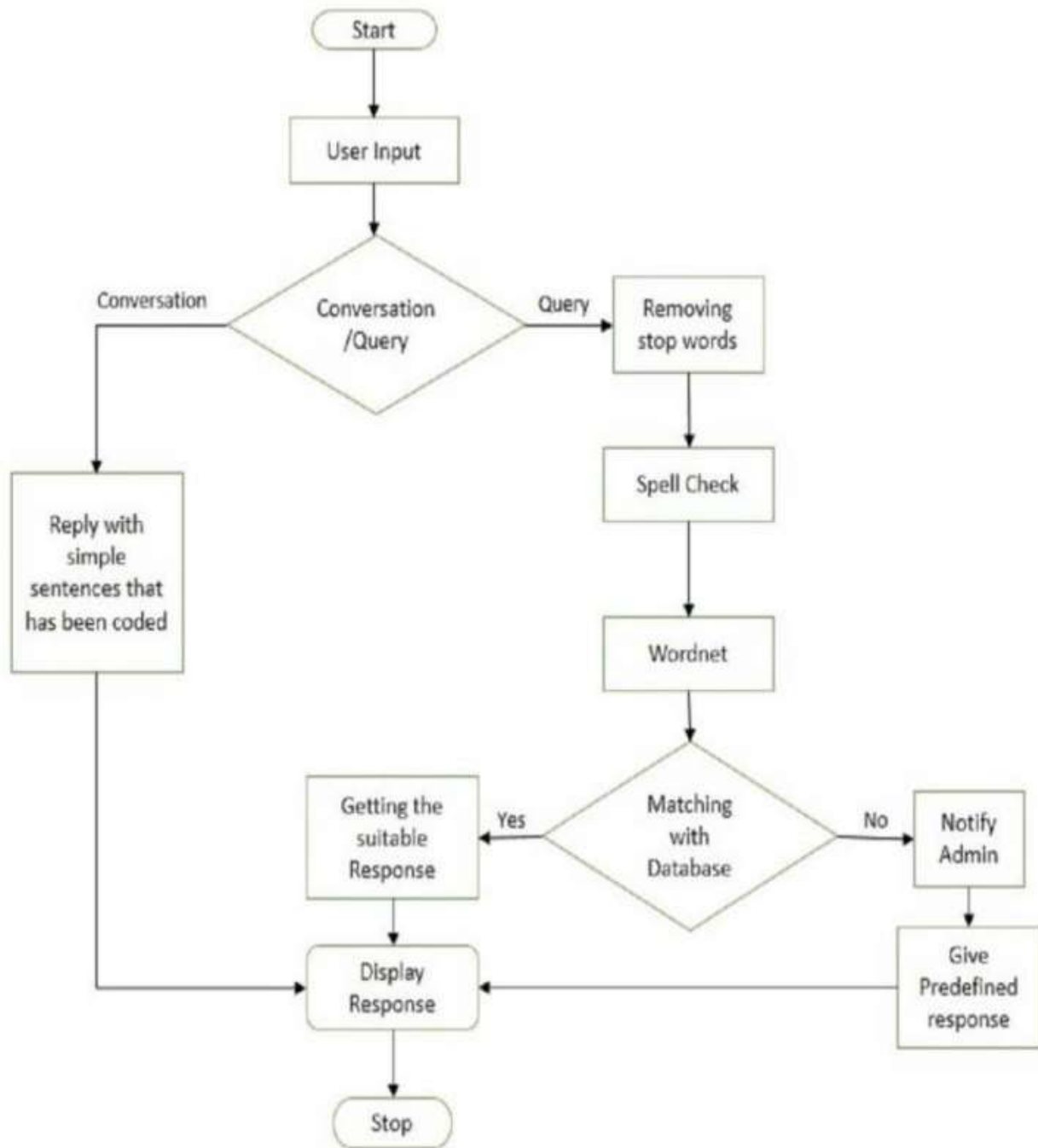


Figure 5: Data flow diagram

3.4.3 FLOW CHART FOR THE PROPOSED SYSTEM

Flowcharts are an efficient way of bridging the communication divide between programmers and end users. They are flowcharts specialized in distilling a significant amount of data into comparatively few symbols and connectors.

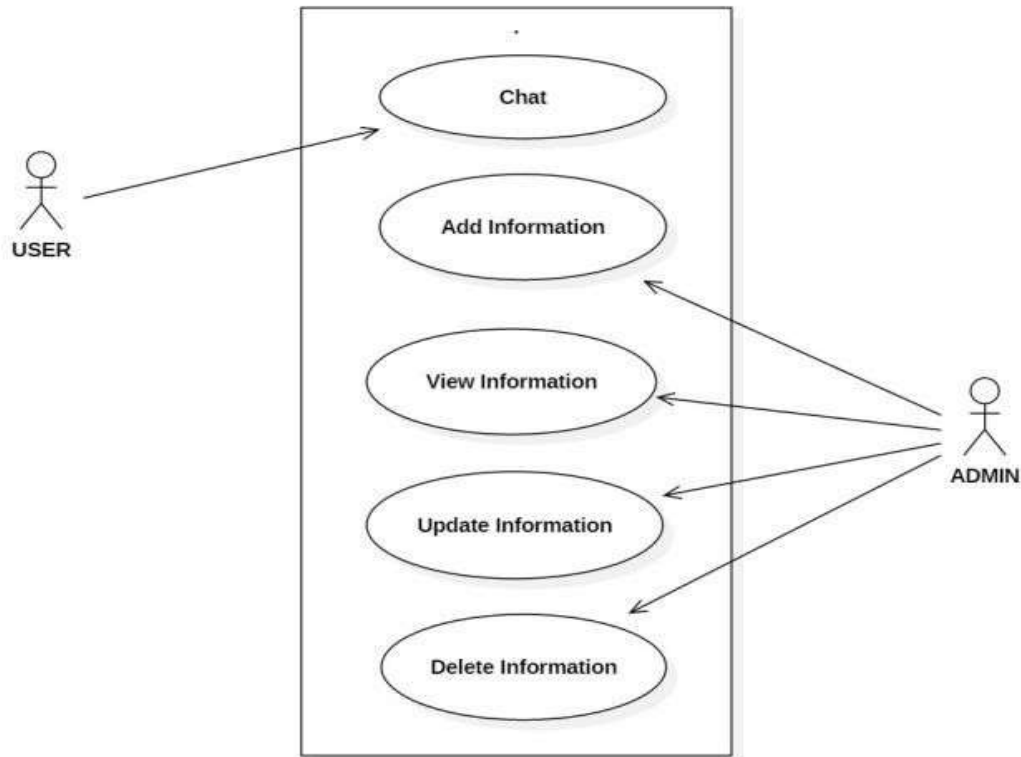


<https://www.irjet.net/>

Figure 6: system flow chat

3.4.4 USE CASE DIAGRAM FOR THE PROPOSED SYSTEM

A use case diagram is a graphic depiction of a user's possible interactions with a system. It also, shows different users of the system as well as functions that they can perform on the system.



<https://www.irjet.net/>

Figure 7: Use case diagram

3.4.5 FILE STRUCTURE FOR THE DATASET

Chatbot Dataset			
id	Query	Reply	Operation
2	How are you ? I'm good and you I'm good how are you i am good how are you I'm okay how are you	I am good. How can I help you?	Edit/Update Delete
3	what is your name whats your name who are you	My name is Kaytwo Bot.	Edit/Update Delete
4	what should I call you	You can call me by my name Kaytwo.	Edit/Update Delete
5	Where are you from	I have been developed under Bindura University.	Edit/Update Delete
6	thank you bye Bye See you later Have a Good Day tata	Sad to see you are going. Have a nice day	Edit/Update Delete
8	who developed you who created you who own you	I was developed by Knowledge Sithole. I am Here to help you with your final project queries.	Edit/Update Delete

Figure 8: Chatbot dataset

3.4.6 IMPLEMENTATION

3.4.7 SYSTEM EVALUATION

□ Testing

Testing is a vital part of the development process and the tests were undertaken whilst the tabulating results. The testing is thus measured against the functional and non-functional requirements as outline in the previous chapter.

□ Black box Testing

Black box testing enables a user without the knowledge of the internal structure of the system to test it against the functional and sometimes the non-functional requirements of the system. It mainly focused on classifying the queries over given input using natural language processing

technology. Thus, the main purpose of black box testing was to test if the system worked as per expected in requirement document.

Moreover, white box testing was conducted, it involved testing of the internal structure to see if the internal structure of the model is properly integrated and able to work as per expected requirement.

CHAPTER FOUR:

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1.1 INTRODUCTION

This section will present the research findings from the study and analysis of results obtained from model. The researcher managed to develop the chatbot model that uses Natural language processing. Users assert their questions on the model and using the trained model, responses are made basing on how the chatbot was trained. Accuracy and performance were used to determine the efficiency and effectiveness of the developed solution. Data collected was analysed to produce eloquent results. The developed model's performance was well observed using different text input and the outcome was presented in a table format. The white box, black box and unit testing played major roles in determining the system behaviour.

4.1.3 SCREENSHOTS OF THE SYSTEM

Figure 9 : Screenshot of the system log in form waiting for input

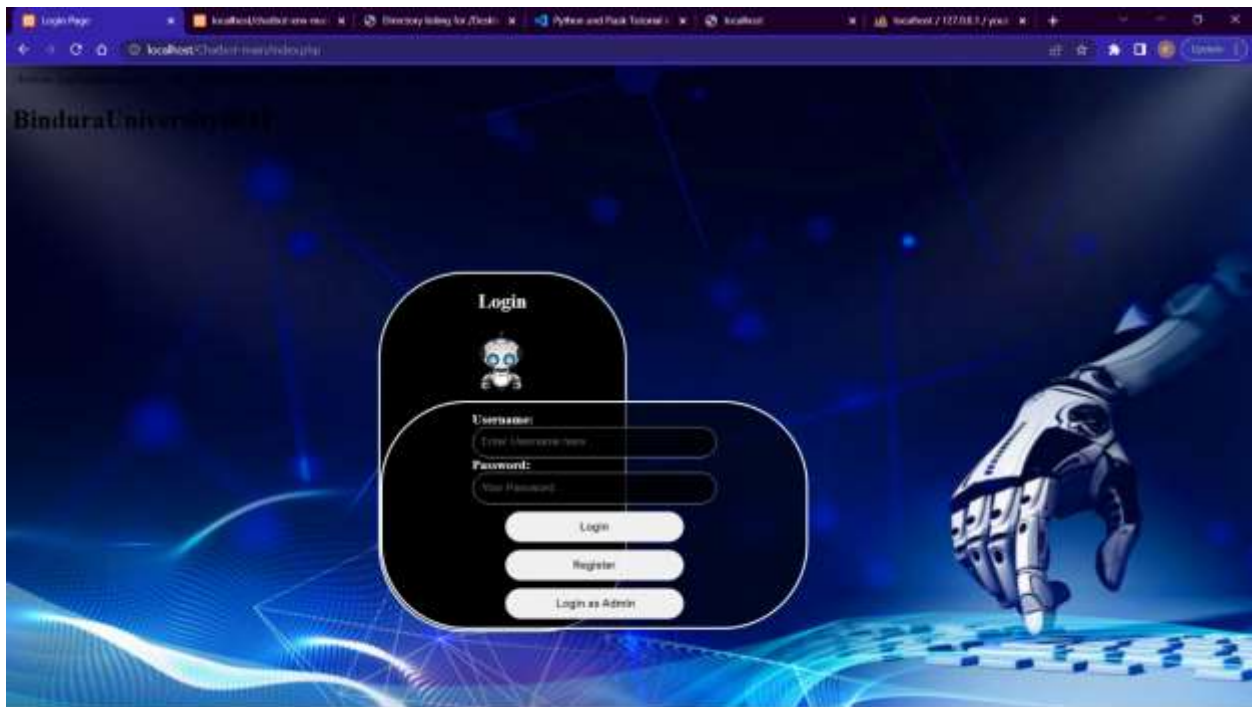
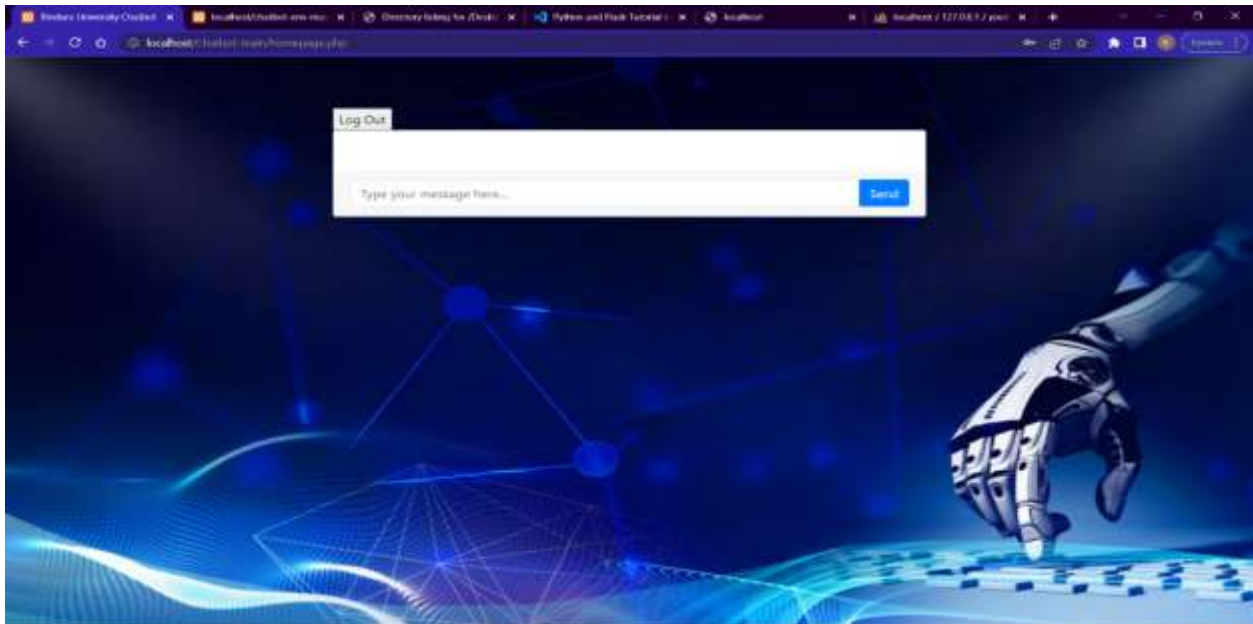


Figure 10: Screenshot of the system waiting for message from the user or student



4.1.4 TEST RUN 1

Figure 11: Screenshot of the system greetings conversation with the student

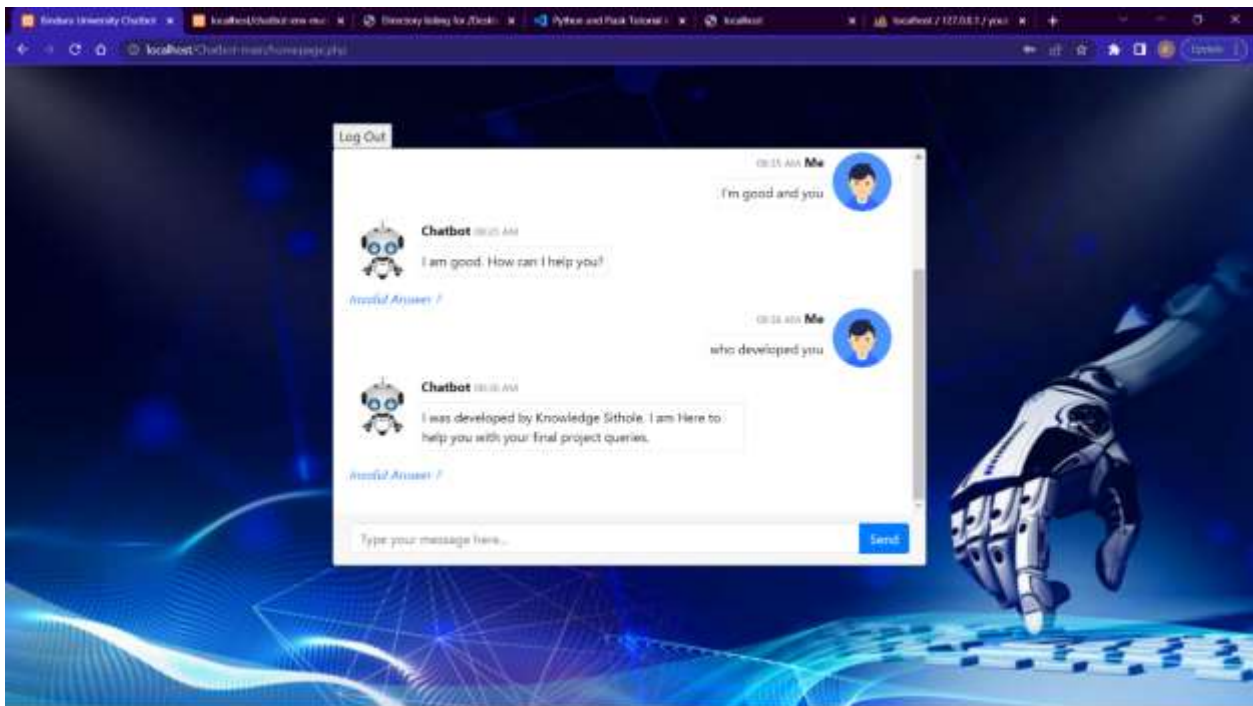


Figure 12: Screenshot of the system, student asking the queries for the first time

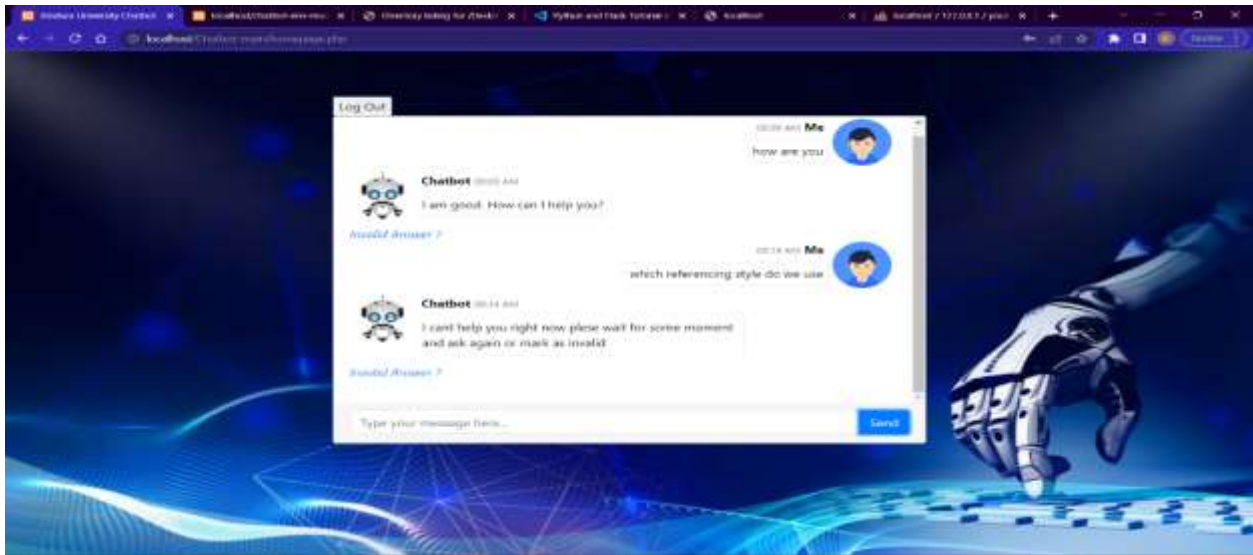
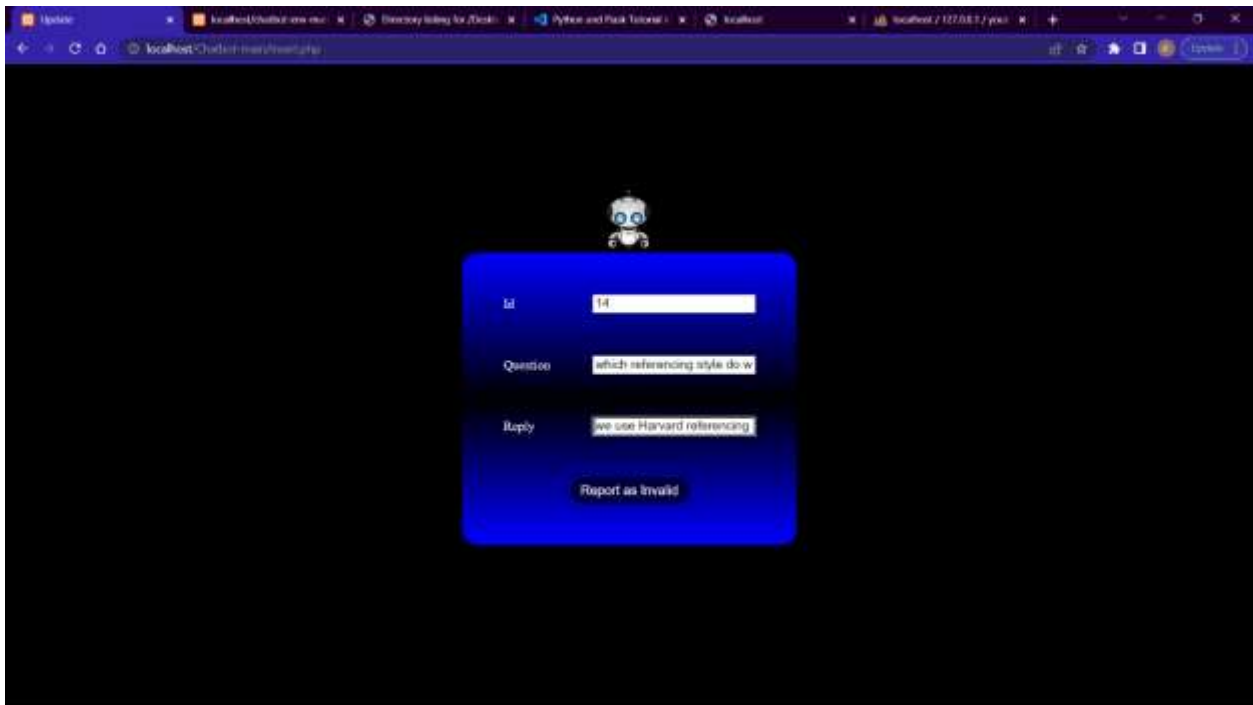
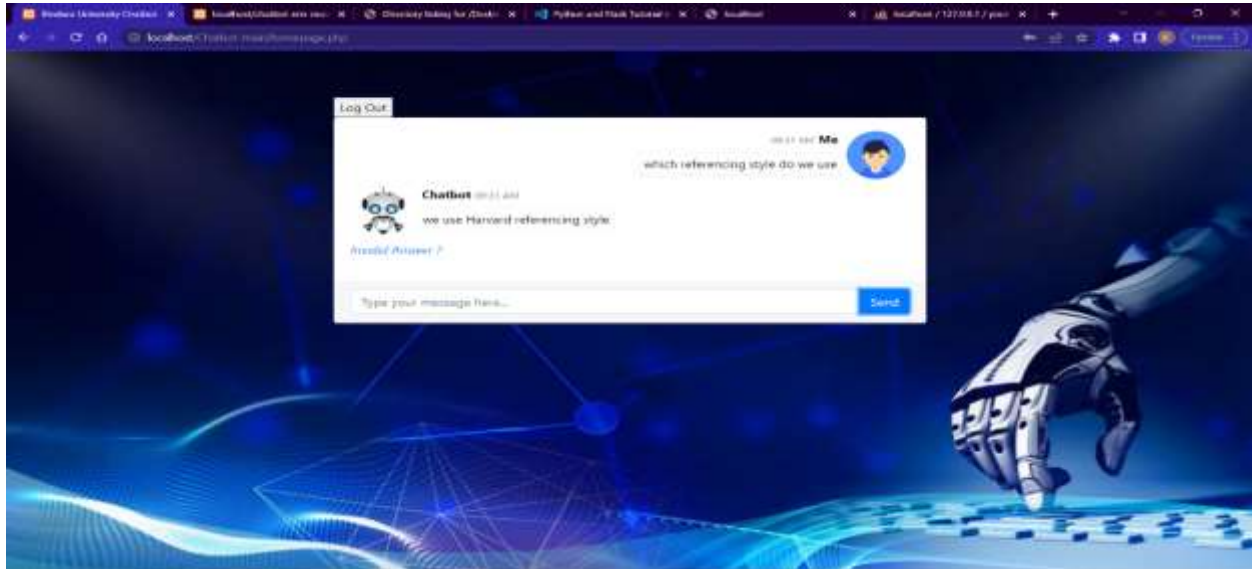


Figure 13: Screenshot of the system's admin portal updating queries from the students



4.1.5 TEST RUN 2

Figure 14: Screenshot of the system, student asking the queries for the second time



4.2.7 SYSTEM RESULTS

The following results were obtained after testing the system with different queries and it retained the answers.

CHAPTER FIVE:

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The author has focused on presenting and analyzing the results collected from the research in the previous chapter. This chapter focuses on the recommendations, conclusions, and future work of the Online Teaching Assistant FAQ. In addition, this chapter examines the pitfalls that researchers encounter during the implementation of the research system under consideration.

5.2 AIMS AND OBJECTIVES REALIZATION

The main aim of this study was to develop an online teaching assistant application that will help and complement the lecturer and students by replying frequently asked questions hence enhancing effective E-learning which is currently adopted in the nation.

The aim was partially achieved. The objectives set by the researcher were also accomplished. The first one, was to allow the students to send their queries in the form of text and this objective was achieved in chapter four when tests were done. Followed by will helping in attending the students by giving replies to their repetitive queries then finally, allow the lectures to view questions from the students and update with correct answers. The query answering process will be more accurate and much faster, with less cost than finding the lecturer physically or using WhatsApp platform

5.3 CONCLUSION

The increasing use of chatbots in daily life is changing and changing the way students learn and absorb information. In this article, we discussed the relevant literature and found the increasingly

diverse uses of chatbots in education. We conducted an exploratory survey to understand the needs of students and their perception of using chatbots. Finally, we implemented a chatbot system, named Kaytwo Bot, and conducted a usability assessment that found that students found the new system to be very easy to use and learn. In the future, we will review and evaluate the level of humanity and proactiveness in our chatbot design, in addition to its ethical aspects. Now that course information is uploaded to chatbot in a semi-automatic way, implementing a fully automated process can make more efficient and easier for teachers and admin users. To improve our chatbot, a new feature will be added to that will allow students to give feedback on chatbot feedback based on relevance. This will allow us to measure the number of student inquiries that have been successfully resolved.

5.2 Future Work

Kaytwo bot is just an initial version of creating a bot to answer students' FAQs and requires a lot of improvement in different areas to have the performance of a commercial chatbot which we can see in certain sites. A bot can perform well only if it is updated on a day-to-day basis with the latest details available.

The main future work for this bot is to incorporate the suggestions of the students who have used chatbot (Kaytwo bot). Students suggested that they prefer Kaytwo bot to be incorporated as a popup at the bottom of the page to facilitate usability. As answers for certain queries links were provided so that students can find a detailed answer for their question. Once the link is clicked it is opened on the same chat window. But students prefer to have the link opened in a new page. One of the main suggestions from the students was to provide an option to contact a human tutor within the chat window itself in case it doesn't have the right answer for the students' query.

Tutors also had suggestions to improve the performance of Kaytwo bot. One of the main suggestions from the tutors were to improve the graphical user interface of the bot to make it more attractive for the students. They also suggested to add more synonyms for searching the keywords within the bot to find answers for students' questions. Another suggestion was to

enhance the dataset of the bot and continuously update the bot so that it will be able to answer more queries precisely.

5.3 CHALLENGES FACED

Developing a project on a new topic or new area requires overcoming many challenges. we too Several difficulties and challenges had to be overcome in order to carry out and complete the research. Here we discuss some of the inevitable challenges we face.

- 1. Information gathering:** Chatbots basically work with informative databases. When a database is a collection of data. We have made great efforts to collect data relates to our beloved university.
- 2. Database design:** Managing large databases requires an interactive database design the lot of data. The database should be familiar with the destination for a better experience information gathering.
- 3. Searching for a suitable interface:** Interfaces are very important for software products. And it's difficult to develop a good UI that meets students' needs.
- 4. Data accuracy:** Data accuracy is one of the components of data quality. The chat bot provides a lot of information that can be helpful for the students. The researcher is so much conscious about the data integrity
- 5. Data integrity:** Data integrity is also very important when it comes to deployment publication of data or information. Our chatbot gives you as much information as you can useful for students and users. we know the data majesty.

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