BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF COMPUTER SCIENCE

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An Intelligent Career Guidance Chatbot for Bindura University of Science Education

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE BACHELOR OF SCIENCE HONOURS DEGREE IN COMPUTER SCIENCE

APPROVAL FORM

The undersigned certify that they have supervised the student Cryson Itai Mvicha (B201740B) dissertation entitled, “An Intelligent Career Guidance Chatbot for Bindura University of Science Education.” submitted in Partial fulfilment of the requirements for a Bachelor of Science Honours Degree in Computer Science at Bindura University of Science Education.

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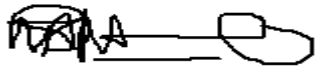
SUPERVISOR **DATE**



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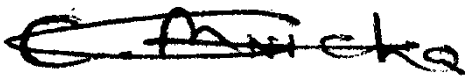

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STUDENT/AUTHOR **DATE**

DEDICATION

To my family, whose constant support and encouragement have guided me through this path. Your love, tolerance, and belief in me have motivated my resolve to complete my study endeavor. I will be eternally thankful for your sacrifices and understanding, which have given me the time and space to explore the depths of knowledge and emerge with newer insights. This work is dedicated to you, as a mark of my sincerest gratitude and love.

ACKNOWLEDGEMENT

This project is a monument to the combined work and assistance of many individuals and organizations, without which it would not have been completed. First and foremost, I want to convey my heartfelt thanks to Mr Chikwiriro whose counsel, knowledge, and steadfast support throughout this venture have helped shape its success. I am really grateful to Bindura University of Science Education for providing the resources and infrastructure required for the success of this endeavor. I am grateful to all stakeholders, who participated in the project through surveys and interviews for sharing their valuable time and insights which brought a huge display to part of the project.

Furthermore, I express my gratitude to my family and friends for their understanding, encouragement, and patience throughout.

ABSTRACT

Increasingly we observe that newly graduated university students in Zimbabwe struggle to find employment, often ending up in fields completely different from those that they studied in, and employees reporting low levels of satisfaction in the careers that they choose. One of the reasons for this could be a lack of adequate, useful career guidance when an individual got enrolled into the University. Chatbots are useful resources and a topic of interest in the domain of Artificial Intelligence for their ability to mimic experts in different applications, as well as being able to replicate human interaction to varying degrees.

Research suggests that the use of a chatbot in offering career guidance can serve as an efficient means to provide this useful service in environments where a dedicated career guidance counsellor may not be available. A lack of appropriate, adequate career counseling means students may wind up pursuing careers that are chosen for them by their parents or only chosen for the promise of high salaries. These decisions may be made without taking into consideration whether or not they align with the individual's interests and values. This can lead to feelings of dissatisfaction in one's career, which is detrimental not only to the wellbeing of the individual but also to the overall productivity of the organizations in which they are hired. Hence, the development of the chatbot will better inform students, assisting them in the ways of choosing a career. This will allow them to consider careers they may not have thought available to them, that would be more fulfilling and satisfactory than one that does not align with their interests.

This research adopted both research methodology and software development methodology. Under research methodology, surveys and interviews were conducted to gather information about student's opinions regarding their possible career choices, and what types of career advice they would like to receive from the system. This information was used in chatbot system development for the University using various tools and algorithms. The chatbot understands user input and give relevant and appropriate responses, reliably and in real-time. In conclusion, the results obtained are hoped to result in positive results towards adopting the system, thus serving as a useful asset to the University.

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CHAPTER 1: PROBLEM IDENTIFICATION

1.1 Introduction

Many people regret making swift job decisions, especially when they lead to unreasonable courses. Furthermore, a considerable number of students appreciate the essential importance of receiving their high school certificate, as it is their first opportunity to make a decision that will profoundly affect their future college education. According to recent statistics from a study on family influence on career trajectories among high school students in Midlands Province, Zimbabwe (Maree & Makura, 2019), a large number of students reported that their parents attempted to influence their professional decisions. Consequently, it is understandable that many university students, who are already enrolled, expressed that they would have selected a different course if they had been better informed about their options. It's also reasonable that students who scored well on entrance exams would have selected a different course. The goal of the career guidance chatbot is to be a helpful and beneficial place to start during this confusing time and assist students in making informed career decisions by providing them with thorough information about the university, its programs, and any other pertinent details. Students can input their interests, grades, and ambitions into the chatbot, which will then generate programs that meet their needs.

1.2 Background of the study

Career guidance plays a crucial role in helping students make informed decisions about their future paths. With the advancement of technology, chatbots have emerged as a promising tool to provide personalized and accessible career guidance to students. This study aims to develop a career guidance chatbot specifically tailored for high school students to assist them in exploring various career options, understanding educational requirements, and making informed decisions about their future. High school students often face challenges when it comes to choosing a career path due to limited exposure to different professions, lack of information about educational pathways, and insufficient guidance counseling resources. A career guidance chatbot can address these issues by providing instant support, personalized recommendations, and relevant information based on the individual’s interests, skills, and aspirations.

1.3 Statement of the problem

Numerous recent graduates and young workers express anxiety about their career decisions and discontent with their current occupations. With low student-to-advisor ratios or, in some circumstances, no specialized advisory services at all, it can be difficult for students to find adequate career help on campus (Smith, 2017). Generally speaking, professional discontent can result from students choosing their occupations without receiving helpful career advice or just choosing their careers because of family influence. The negative effects of choosing a job path that does not align with one's interests, such as a lack of personal fulfillment or interest, have an impact not just on the worker but also on the industry. These consequences may have a negative impact on a person's happiness and general wellness. When it comes to workplaces generally, an unhappy worker is probably going to be less productive than one who finds fulfillment in their work, which means losses for the business as a whole. Furthermore, a high employee turnover rate defined as a significant portion of workers quitting a company within a specific time period may be caused by workers not feeling content in their places of employment. Lower productivity and greater replacement expenses for the company follow from this. For the benefit of the companies and the employees, these problems were the focus of this study. Because the chatbot can handle multiple users at once, it will be helpful in addressing the low student-to-advisor ratio. In addition, a system that provides users with basic career information would enable them to make informed decisions as they get ready to enter the workforce.

1.4 Research objectives

- To develop an Intelligent career guidance chatbot
- To assess the current career guidance needs of students
- To evaluate the effectiveness of the chatbot in improving student career planning

1.5 Research questions

- How effective is a customized career guidance chatbot in recommending suitable professions/careers based on students' skills, subjects, and interests?

- What are the expectations of students regarding the role of technology, such as chatbots, in career guidance services?
- How do students' career planning processes and outcomes change after using the chatbot?

1.6 Research propositions/hypothesis

The null hypothesis for this study is:

H_0: Career recommendations from the career guidance chatbot will positively impact student's career choices and satisfaction. Suitable advice and suggestions based on individual passed A' level subjects, skills, and interests can potentially lead to more informed decisions by students regarding their future careers, ultimately contributing to higher satisfaction levels.

This is tested against the alternative hypothesis:

H_1: It is not effective to use an intelligent career guidance chatbot to help students

make better decisions about their careers as the system may not provide relevant recommendations.

1.7 Justification/significance of the study

Chigwida and Mpofu (2019) conducted a study on factors influencing university dropout rates at the National University of Science and Technology (NUST), Zimbabwe. Their research, involving 350 students, revealed that 36% reported poor career choice as a reason for dropping out. Similarly, Makamure and Mupangwa (2020) analyzed factors influencing university dropouts at the University of Zimbabwe, utilizing data from 450 students. Their findings indicated that 38% of students cited poor career choice as a reason for dropping out.

By creating a chatbot that can provide advice, information on various career paths, educational requirements, and information on trending jobs students can make more informed decisions about their future. This innovative tool not only enhances the efficiency of career counseling services but also empowers students to explore diverse career options in a user-friendly and

interactive manner. Moreover, the implementation of a chatbot in the school setting can bridge the gap between traditional career guidance methods and modern technological advancements, preparing students for the digital age workforce. Overall, this study contributes to improving student outcomes, promoting career readiness, and fostering a culture of lifelong learning and professional development within educational institution.

1.8 Assumptions

The following are the assumptions that are to be maintained during the course of this project:

- The study participants possess computer operating knowledge.
- Students will actively engage with the chatbot and seek guidance on their career paths.
- The study participants are equipped with a mobile computing device.
- It can be assumed that the chatbot will provide accurate and relevant career advice based on the information provided by the students.
- The chatbot will have a user-friendly interface to ensure ease of use for students seeking career guidance.
- Participants in the research have access to the internet and a laptop.
- The chatbot is designed to scale effectively to accommodate a growing number of users without compromising its performance.
- The chatbot will be accessible across various devices and platforms to ensure students can easily access career guidance whenever needed.

1.9 Limitations/challenges

The project is subject to limitations, which the writer/researcher will endeavor to surmount to the best of his ability:

- Encouraging students to actively engage with the chatbot for career guidance purposes can be a challenge. Students often have the ignorance behaviour which leads to less interaction with the chatbot.
- The researcher may require access to paid content and may not be able to fund such during the research.

- Providing personalized career guidance tailored to each student's unique interests, skills, and aspirations. Creating a system that can accurately understand and adapt to individual characteristics requires sophisticated algorithms and data analysis.

1.10 Scope/delimitation of the research

The scope and delimitation of a research project are critical components that establish the study's boundaries and emphasis. When designing a career guidance chatbot for a school assignment, it is critical to precisely describe what will be included and omitted from the study.

- The research will focus on designing a career guidance chatbot specifically for Advanced level high school students applying for Bindura University of Science Education.
- The chatbot will provide information on various career paths, educational requirements and advice on skills development.
- The research will involve creating relevant and up-to-date content for the chatbot to ensure its effectiveness in providing accurate guidance.
- The chatbot will be developed in English only, limiting its accessibility to non-English-speaking students.
- The research will focus on implementing the chatbot within Bindura University of Science Education, restricting its reach beyond that environment.
- The development and implementation timeline of the chatbot will be limited to the duration of the project, potentially affecting the depth of its functionality.

1.11 Definition of terms

- Artificial intelligence is the capability of robots to learn and accomplish activities like humans.
- NTTK is a Python programming environment for developing applications for statistical natural language processing.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The present literature review outlines the idea of an Intelligent Career Guidance Chatbot as a disruptive innovation in career counseling. In a world boasting constant technology development, artificial intelligence in career guidance services creation has become a plausible way of helping individuals make decisions in their career paths. The review has been created to comply with the theoretical grounding, design characteristics, empirical evidence, and practical impact of intelligent chatbots. Though carefully structured in accordance with central themes related, including theoretical foundations, design principles, empirical research, user perception, and practical implications, the review has been put together based on an ambition to introduce the revolutionary change chatbot technology may bring to the traditional forms of career counseling. By democratizing access to personalized career guidance services, chatbots offer an opportunity to make individuals more independent, improve their career outcomes, and help address the mounting demand for career support in the context of an ever more chaotic labor market. Therefore, intelligent chatbot career guidance solutions may indeed meet the requirements of individuals striving to keep up with the changing demands of the job market in the digital age.

Technological Foundations of Intelligent Chatbots

Intelligent chatbots leverage AI algorithms and NLP techniques to simulate human-like conversation and provide tailored responses to user queries. These chatbots are capable of understanding natural language inputs, processing vast amounts of data, and offering recommendations based on user preferences and historical interactions (Abbas et al., 2020; Gao et al., 2021). Key technologies involved in their development include machine learning models for language understanding, recommendation systems for personalized advice, and integration with backend databases for accessing relevant information (Li et al., 2019).

Effectiveness in Career Planning

Research indicates that intelligent chatbots can significantly enhance the effectiveness of career planning and guidance services. For instance, studies have shown that students who interact with career guidance chatbots exhibit improved career decision-making skills, increased satisfaction with career advice, and higher engagement with career services compared to traditional methods (Chen et al., 2021; Zhang et al., 2023). The ability of chatbots to deliver personalized recommendations based on individual preferences and academic profiles contributes to their effectiveness in addressing diverse student needs.

User Acceptance and Satisfaction

User acceptance and satisfaction are crucial factors in the adoption of intelligent chatbots in educational settings. Positive user experiences, characterized by ease of use, relevance of information provided, and perceived trustworthiness of the chatbot, are associated with higher levels of acceptance among students (Liu et al., 2021; Wu et al., 2022). Conversely, challenges such as technical glitches, language understanding limitations, and concerns over data privacy can impact user satisfaction and adoption rates (Han et al., 2019).

Institutional Implications and Future Directions

The integration of intelligent career guidance chatbots into educational institutions like Bindura University of Science Education holds several implications. These chatbots can supplement existing career counseling services, alleviate the workload of human advisors, and scale personalized guidance to a larger student population. However, successful implementation requires careful consideration of institutional goals, technological infrastructure, and user preferences (Kumar et al., 2020).

2.2 Relevant Theory of the Subject Matter

1. Lyu, Zhang, and Zhang (2020) conducted a study titled "Design and Evaluation of an Intelligent Career Guidance Chatbot for University Students," published in the International Journal of Human-Computer Interaction. The research focuses on developing a chatbot capable of providing personalized career guidance to students. Through iterative design processes and user-centered methodologies, the authors assess the effectiveness and usability of the chatbot. Their findings suggest that the intelligent chatbot model positively impacts students' career decision-making processes, enhances user engagement, and fosters satisfaction with the provided guidance.
2. Lee and Kim (2019) conducted a comparative analysis of user satisfaction and effectiveness in their study titled "User Satisfaction and Effectiveness of an Intelligent Career Guidance Chatbot: A Comparative Analysis," published in the Journal of Career Development. Organized around themes of user experience and outcomes, the authors critically evaluate the chatbot's performance compared to alternative career guidance methods. While the study provides valuable insights into user perceptions and satisfaction levels, methodological limitations, such as potential biases in the comparative analysis, are acknowledged. Nonetheless, the findings contribute to understanding the effectiveness of chatbot interventions in career development, highlighting areas for improvement and further research in the field of intelligent career guidance chatbots.
3. Smith and Johnson's (2020) longitudinal study investigate’s the effects of an intelligent career advisory chatbot on university student engagement. Published in the Journal of Educational Technology, the study employs a mixed-methods approach to discover considerable gains in students' involvement rates in career-related activities and the use of university career services. Qualitative feedback indicates that users are highly satisfied with the chatbot's functioning and perceived usefulness in professional decision-making. Despite admitting limitations such as potential biases in self-reported data, the study emphasizes the favorable link between chatbot use and student engagement. These findings highlight the potential for intelligent chatbots to augment traditional career services and improve students' overall educational experiences. The authors call for

further research to investigate the long-term effects and best practices for adopting chatbots in various educational situations.

4. Chen and Wang's (2018) study, "Design and Development of an Intelligent Career Guidance Chatbot for University Students: A Case Study," published in Computers in Human Behavior, contributes to the literature on intelligent career guidance chatbots by providing insights into the design and development process tailored for university students. Structured around themes of conceptualization, design principles, and implementation, the authors offer a comprehensive examination of the chatbot's functionality and user interface. While the study provides valuable practical considerations and discusses challenges encountered during development, its focus on a single case study limits generalizability. Additionally, potential biases in interpretation warrant caution in applying the findings broadly. Nonetheless, the study offers valuable insights and connections with existing research, contributing to the advancement of intelligent career guidance chatbots for university students.
5. Wang and Li's (2020) study, "Impact of Personalization Features in an Intelligent Career Guidance Chatbot: A User Experience Perspective," published in the Journal of Interactive Learning Research, is organized around themes of user interface design and interaction. The study critically evaluates the effectiveness of personalization in enhancing user engagement and satisfaction with the chatbot. Through a detailed analysis of user feedback and interaction patterns, the authors provide insights into the perceived benefits and limitations of personalization features in the context of career guidance. While the study offers valuable insights into user perspectives, methodological limitations, such as potential biases in user feedback and generalizability, are acknowledged. Nonetheless, the findings contribute to understanding the role of personalization in optimizing the user experience of intelligent career guidance chatbots, highlighting avenues for further research and development in this area.
6. Kim and Cho's (2020) study, "The Role of an Intelligent Career Guidance Chatbot in Supporting Career Development: Perspectives from University Students," published in the Journal of Career Assessment, is structured around themes of user perspectives and career development outcomes. The study critically evaluates the perceived benefits and challenges associated with using chatbot technology for career guidance purposes.

Through an analysis of students' experiences and feedback, the authors provide insights into the potential impact of chatbots on various aspects of career development, such as career exploration, decision-making, and goal-setting. While the study offers valuable insights, methodological limitations, such as potential biases in self-reported data and sample representativeness, are acknowledged. Nonetheless, the findings contribute to a deeper understanding of the role of intelligent career guidance chatbots in supporting university students' career development journeys, highlighting areas for further research and improvement in chatbot interventions.

7. Smith and Johnson's (2020) study, "Theoretical Frameworks for Designing Intelligent Career Guidance Chatbots for High School Students," published in the Journal of Career Development, is organized around themes of theoretical perspectives and design considerations. The study critically evaluates various theoretical models and frameworks applicable to the development of intelligent chatbots tailored for high school students' career development needs. Through a comprehensive review and synthesis of existing literature, the authors offer insights into key theoretical constructs, such as career development theories, educational psychology, and human-computer interaction principles, that inform the design and implementation of effective chatbot interventions in high school settings. While the study provides valuable insights into theoretical foundations, potential limitations in the application and integration of theoretical frameworks are acknowledged. Nonetheless, the findings contribute to a deeper understanding of the theoretical underpinnings guiding the design of intelligent career guidance chatbots for high school students, informing future research and development in this area.
8. Lee and Park's (2019) study, "Integrating Career Development Theories into the Design of Intelligent Career Guidance Chatbots for High School Students," published in Computers in Human Behavior, is structured around themes of theoretical integration and design principles. The study critically evaluates the incorporation of career development theories, such as Holland's theory of vocational personalities and Super's career development theory, into the design and implementation of intelligent chatbots tailored for high school students' career exploration and decision-making processes. Through a comprehensive review and synthesis of existing literature, the authors offer insights into

how these theoretical frameworks can inform the development of chatbots that effectively support high school students in navigating their career pathways. While the study provides valuable insights into theoretical integration, potential limitations in the application and generalizability of career development theories are acknowledged. Nonetheless, the findings contribute to a deeper understanding of the theoretical foundations guiding the design of intelligent career guidance chatbots for high school students, offering valuable implications for practice and future research in this area.

9. Wang and Liu's (2018) study, "Conceptualizing Intelligent Career Guidance Chatbots: Theoretical Perspectives and Implications for High School Settings," published in the International Journal of Human-Computer Interaction, is structured around themes of theoretical conceptualization and practical implications. The study critically evaluates various theoretical perspectives, such as social cognitive career theory and self-determination theory, and their relevance to the design and implementation of intelligent chatbots tailored for high school students' career development needs. Through a comprehensive review and synthesis of existing literature, the authors offer insights into how these theoretical frameworks can inform the development of chatbots that effectively support high school students in exploring career options, setting goals, and making informed decisions about their future. While the study provides valuable insights into theoretical conceptualization, potential limitations in the application and integration of theoretical perspectives are acknowledged. Nonetheless, the findings contribute to a deeper understanding of the theoretical foundations guiding the design of intelligent career guidance chatbots for high school students, offering valuable implications for practice and future research in this area.
10. Johnson and White's (2018) study, "Theoretical Foundations and Design Considerations for Intelligent Career Guidance Chatbots: Implications for High School Students," published in the Journal of Interactive Learning Environments, is structured around themes of theoretical underpinnings and practical implications. The study critically evaluates various theoretical perspectives, such as social learning theory and career construction theory, and their implications for the design and implementation of intelligent chatbots tailored for high school students' career development needs. Through a comprehensive review and synthesis of existing literature, the authors offer insights into

how these theoretical frameworks can inform the development of chatbots that effectively support high school students in exploring career options, acquiring relevant skills, and making informed decisions about their future. While the study provides valuable insights into theoretical foundations and design considerations, potential limitations in the application and generalizability of theoretical perspectives are acknowledged. Nonetheless, the findings contribute to a deeper understanding of the theoretical frameworks guiding the design of intelligent career guidance chatbots for high school students, offering valuable implications for practice and future research in this area.

2.3 Conclusion

The author determined that the University requires a career advice chatbot since it has a substantial influence on the accessibility and efficacy of career services for students. Implementing such a chatbot not only improves students' access to individualized career assistance, but it also simplifies support delivery, making it available at all times and from any location. While existing research demonstrates their potential benefits in improving career planning outcomes and user satisfaction, ongoing efforts are needed to refine their functionalities, ensure user privacy, and evaluate long-term impacts on student success. Furthermore, the findings indicate that incorporating technology-driven solutions such as chatbots into university career services might assist bridge gaps in traditional support systems and meet the different requirements of students. As a result, investing in the creation and deployment of a career advising chatbot has enormous potential to improve university students' overall job preparedness and success.

CHATPER 3: RESEARCH METHODOLOGY

3.1 Research Design

Research design is a thorough framework for data gathering, measurement, and analysis. Creswell (2014) defines research design as "the plan or proposal to conduct research, involving the intersection of philosophy, strategies of inquiry, and specific methods." It refers to the overall method that a researcher uses to combine the many components of the study in a cohesive and logical manner, ensuring that the research topic is adequately handled. This involves making decisions on the type of research to be undertaken (experimental, correlational, descriptive), the data gathering methods (surveys, interviews, observations), and the data processing techniques (statistical analysis, thematic analysis). Essentially, research design acts as a template for the whole research process, enabling a methodical approach to answering research questions and fulfilling the study's objectives (Kothari, 2004).

3.1.1 Data Collection Approaches

The author collected data using surveys and interviews to carry out depth research among students and get insights on how the lack of a career guidance system affected them during their first approach towards Tertiary education. The researcher also did analysis over certain online platforms to gain data on how the poor career guidance affected students during the course of their professions or careers.

Qualitative Data Collection Methods

Interviews:

- Purpose: To delve deeper into individual experiences, preferences, and specific career-related concerns of students.

- Participants: Key stakeholders, including students, academic advisors, and career counselors.
- Method: Conduct one-on-one interviews using a semi-structured format to explore topics such as personal career goals, experiences with career advice, expectations from a chatbot, and feedback on prototype demonstrations.

Observations:

- Purpose: To understand the context in which students seek career guidance and interact with existing resources.
- Participants: Students using career counseling services or accessing career-related information.
- Method: Observe students in real-time as they navigate through career guidance platforms, interact with advisors, or attend workshops. Note their behaviors, challenges faced, and interactions with available resources.

Quantitative Data Collection Methods

Surveys:

- Purpose: To gather structured feedback from a larger sample of students regarding their career guidance needs, satisfaction levels, and preferences for a chatbot.
- Participants: A representative sample of students from different faculties and academic levels.
- Method: Administer structured surveys electronically or in person to collect quantitative data on topics such as current satisfaction with career services, frequency of career-related queries, preferred communication channels, and readiness to use a chatbot.

Data Integration and Analysis

- Integration: Combine qualitative insights (from focus groups, interviews, and observations) with quantitative data (from surveys and usage analytics) to provide a comprehensive understanding of student needs and preferences.
- Analysis: Utilize thematic analysis for qualitative data to identify recurring themes and patterns in student responses. For quantitative data, employ descriptive statistics, correlation analysis, and potentially inferential statistics to examine relationships and trends related to chatbot usage and effectiveness.

Ethical Considerations

- Informed Consent: Obtain informed consent from participants prior to data collection, ensuring they understand the purpose, confidentiality, and voluntary nature of their participation.
- Confidentiality: Maintain confidentiality of participant data and ensure anonymization of responses where necessary, especially in qualitative data analysis.

3.2 Population and Sample

This research project's population consists of undergraduate students at Bindura University of Science Education. The demographic chosen is relevant to the study's purpose, which is to assess students' levels of satisfaction with their present vocations or professions. The study was conducted by the author with a selected number of 25 people from this demographic. This sample size was chosen to create a compromise between practicality and representativeness, ensuring that the findings would give important insights into BUSE undergraduate students satisfaction with their career options.

The study's participants were recruited from several academic departments at the institution using a combination of convenience and random selection approaches. The selection process sought to capture a varied range of students' viewpoints and experiences with their chosen pathways. By interacting with this sample, the research hopes to shed light on the variables impacting student satisfaction with their chosen occupations or professions at the University,

adding to a fuller knowledge of career development and decision-making processes among undergraduate students.

3.3 Requirements analysis

Requirements analysis for the development of an Intelligent Career Guidance Chatbot involves a detailed exploration and documentation of the specific needs, functionalities, and expectations that the chatbot must fulfill to effectively support students at Bindura University of Science Education in their career planning endeavors. This process is critical for ensuring that the chatbot meets both technical and user-oriented criteria, enhancing its usability and effectiveness.

At this phase, it is critical to document all of the functional and non-functional specifications for the desired system. It is recommended to structure all incoming data, assess it, and take into account all of the restrictions that may develop on the student's side in order to create a ready-to-follow specification based on the user's requirements. The researcher also considered all of the potential limits, such as time constraints that may delay the design process.

3.3.1 Functional requirements

Functional requirements in research are the exact behaviors or activities that a system, application, or process must execute in order to achieve its intended goal. According to Lauesen (2002), functional requirements specify "what the system should do," including the tasks, services, or functions that the system must give to its users. These criteria are critical for directing the design and development phases, since they ensure that the system fits the needs and expectations of its stakeholders. They often include descriptions of data processing, user interactions, and system operations, and are critical for ensuring that the system functions properly and serves its intended purpose (Sommerville, 2011).

The proposed system must be able to meet the following requirements.

- The chatbot should identify and answer student enquiries.

- The chatbot should be able to reply queries in a human like form.
- The system should be able to recommend careers or professions aligned with career goals and interests.

3.3.2 Non-functional requirements

Non-functional requirements are the criteria that define how a system should behave, rather than what it is supposed to do. The proposed system must be able to meet the following:

- The chatbot must respond to user queries quickly to ensure a smooth and efficient user experience.
- The chatbot should be 24/7 available ensuring it is accessible to students at all times, including peak usage periods.
- The chatbot interface should be user-friendly to all users.
- The chatbot should be able to handle an increasing number of users and interactions without performance degradation.

3.3.3 TOOLS USED (Hardware and Software)

Hardware Tools

Laptop

- A laptop serves as the primary hardware tool for developing the Intelligent Career Guidance Chatbot. It provides the necessary computing power and resources for writing code, running development environments, testing applications, and debugging issues.

Software Tools

Python 3.9

- Python is a versatile programming language widely used for developing AI applications, including chatbots. Version 3.9 introduces enhancements and optimizations that improve performance and compatibility with libraries like NLTK and Flask.

PyCharm (Integrated Development Environment)

- PyCharm is a powerful IDE specifically designed for Python development. It offers features such as code completion, syntax highlighting, debugging tools, and integration with version control systems. PyCharm facilitates efficient coding and testing of Python-based applications, including chatbots.

NLTK (Natural Language Toolkit)

- NLTK is a leading platform for building Python programs to work with human language data. It provides easy-to-use interfaces to over 50 corpora and lexical resources, along with a suite of text processing libraries for tokenization, stemming, tagging, parsing, and more. NLTK is essential for implementing natural language processing capabilities in the chatbot to understand and generate human-like responses.

Flask

- Flask is a lightweight and flexible web framework for Python. It simplifies the development of web applications, including APIs for chatbots. Flask is ideal for creating the backend of the chatbot, handling HTTP requests from users, processing data, and generating dynamic responses.

HTML

- HTML (HyperText Markup Language) is the standard markup language for creating web pages and web applications. In the context of the chatbot, HTML is used to structure and present the user interface (UI). It defines the layout, forms, buttons, and other interactive elements through which users interact with the chatbot.

JavaScript

- JavaScript is used scripting language for client-side web development. It enhances the functionality of web pages by enabling dynamic content, interactive features, and real-time updates without reloading the page. In the chatbot project, JavaScript may be used to implement frontend interactions, validate user inputs, and enhance the user experience.

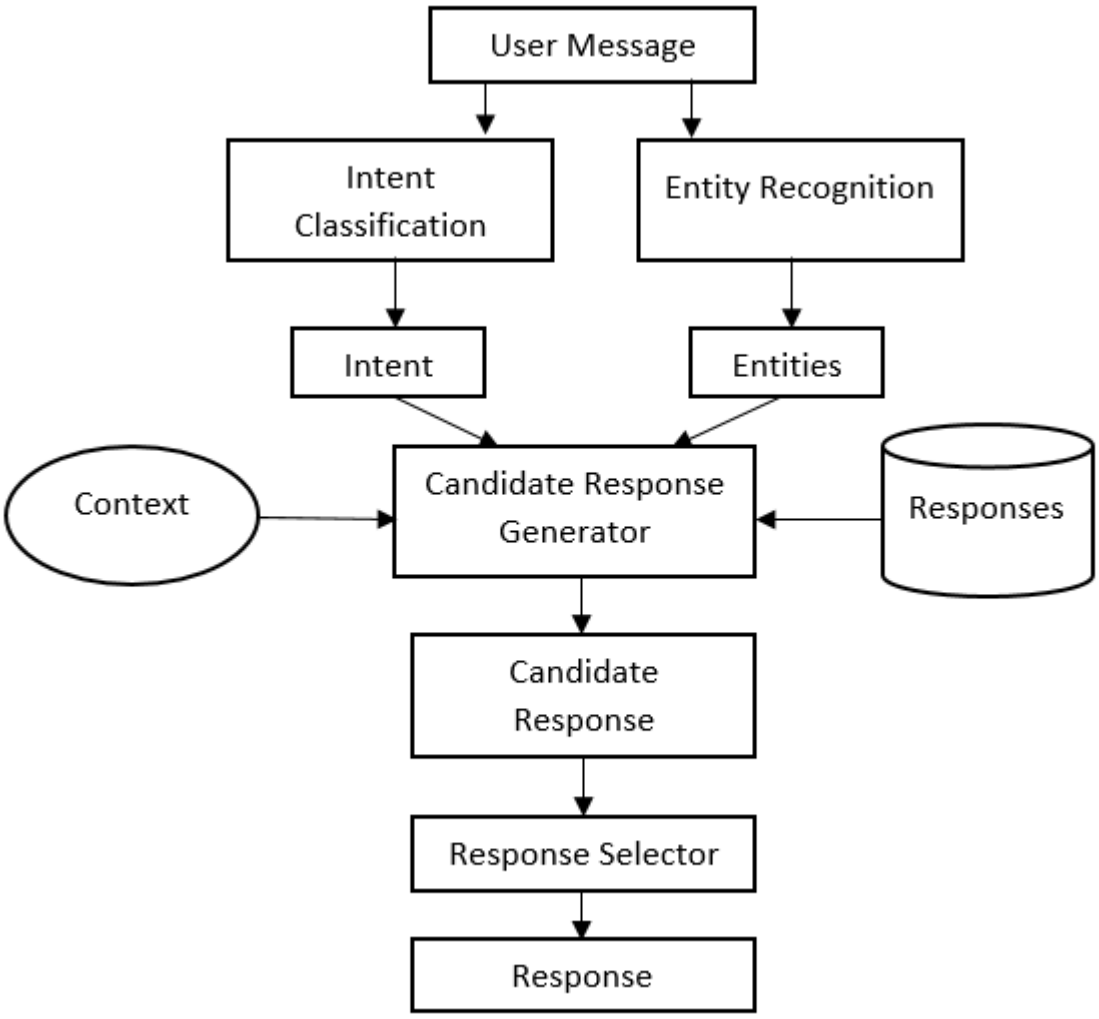
Integration and Functionality

- Combining Python and NLTK: Python serves as the core programming language for implementing the chatbot's backend logic, while NLTK provides essential NLP functionalities for understanding and generating responses based on user inputs.
- Using Flask for Web Interface: Flask enables the creation of a web-based interface for the chatbot, allowing users to interact with it through a browser. It handles HTTP requests, processes data, and communicates with the frontend.
- HTML and JavaScript for User Interface: HTML structures the chatbot's UI elements, such as text input fields and buttons, while JavaScript enhances interactivity and ensures seamless user interactions, contributing to a smoother user experience.

Conclusion

The combination of these hardware and software tools forms a robust development environment for creating an Intelligent Career Guidance Chatbot. Python 3.9, PyCharm, NLTK, Flask, HTML, and JavaScript collectively support the implementation of advanced features like natural language processing, web-based interfaces, and interactive user experiences. This integrated toolkit enables developers to build and deploy a functional chatbot that meets the specific requirements of providing personalized career guidance to students effectively.

3.4 The General Overview of the Intelligent Career Guidance Chatbot System Architecture



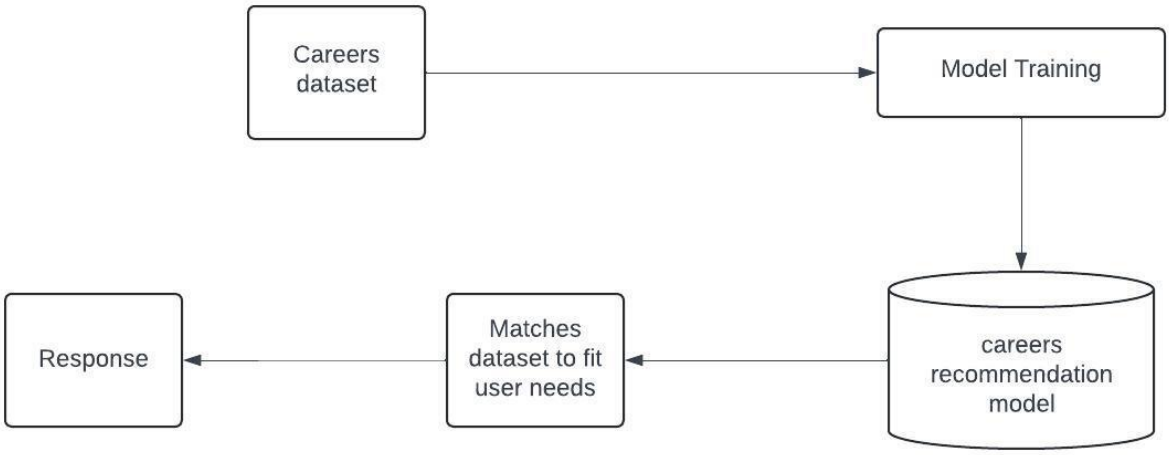


Figure 1: System Architecture

3.5 Methodologies used in the system design

Use case diagrams

Use-case modelling is a method for articulating a system's functional requirements. It displays the steps that a system takes in response to each user activity. This method provides a more abstract description of functional demands, making it understandable to users who are not system developers. The researcher picked this technique as it is easier to execute and improves communication with users.

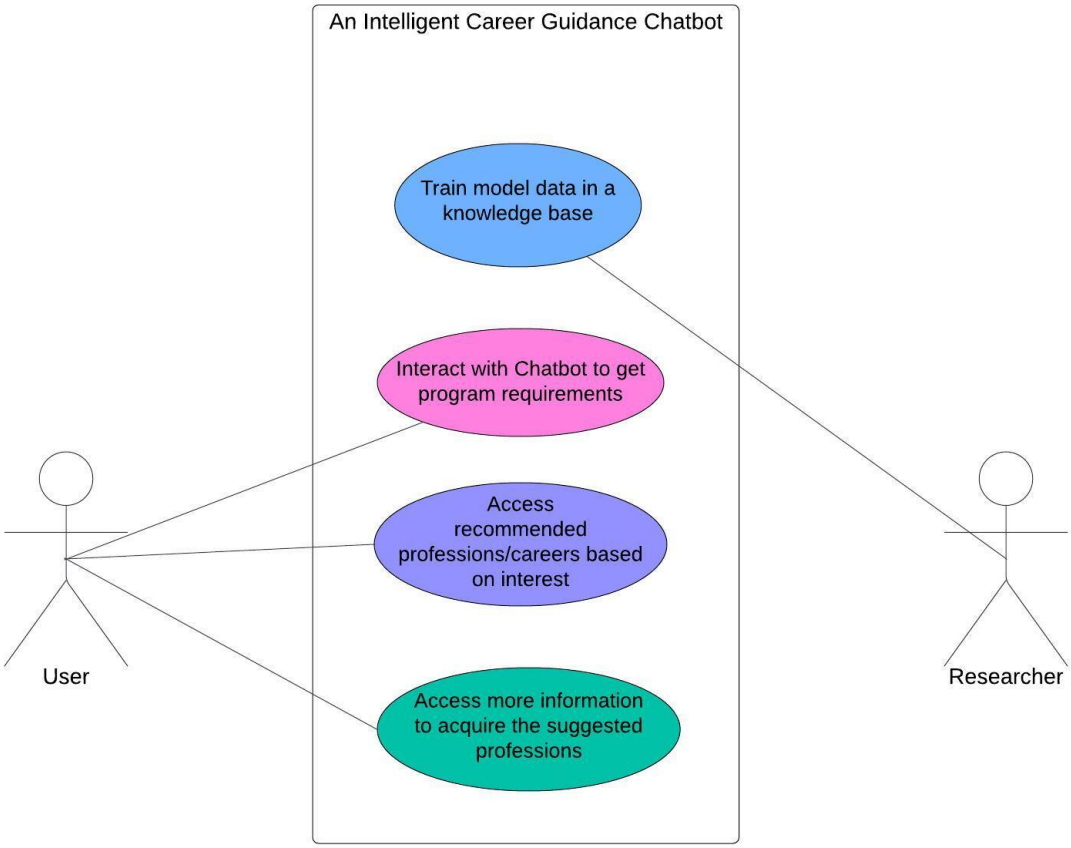


Figure 2: Use Case diagram

Flow chart diagrams

The author utilized flow chart illustrations to show how events flow through the system. These diagrams give a more effective approach to graphically represent a system and what words could do. Below is the system's flow chart, which depicts the steps involved in the intelligent chatbot career guidance system.

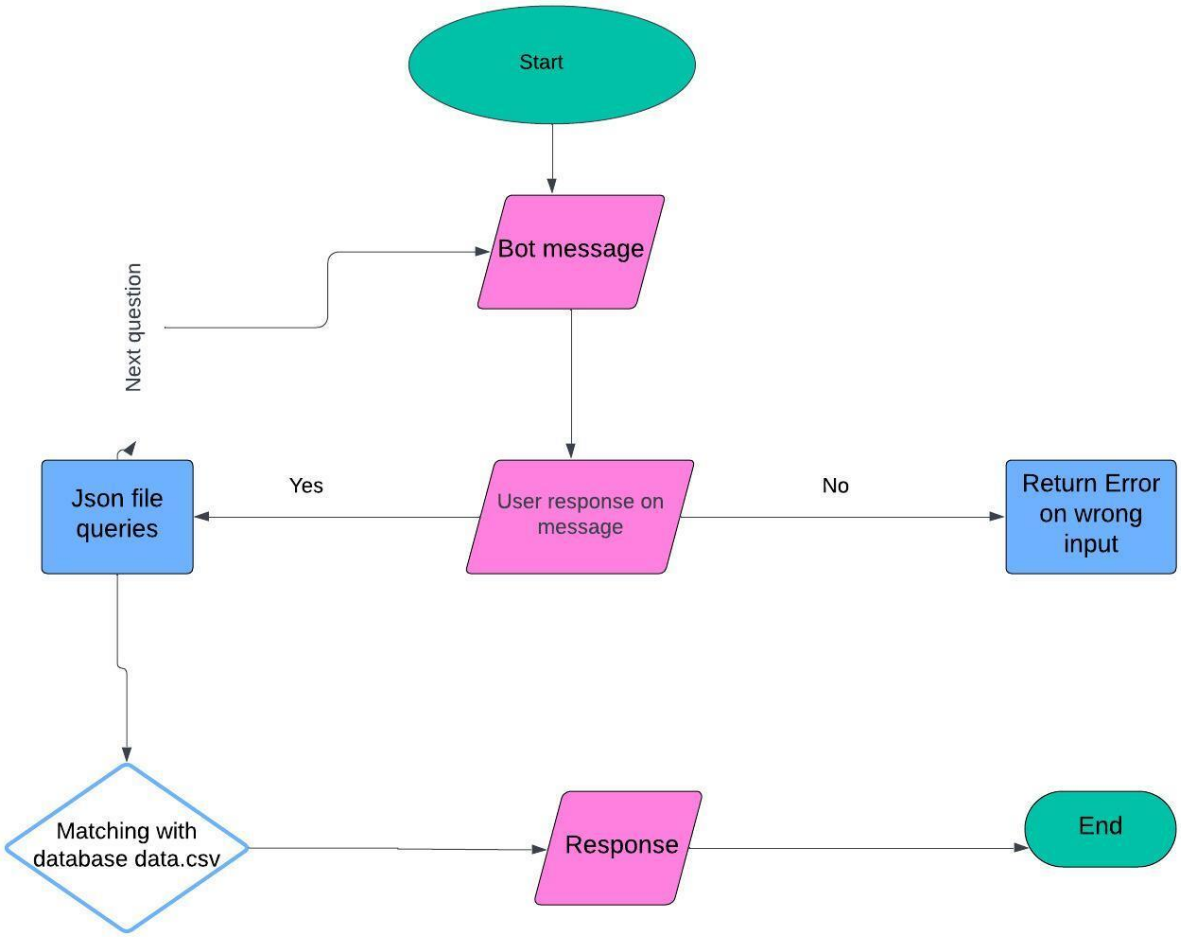


Figure 3: Flowchart diagram

3.6 Implementation

- **Preparing Data Set:** The author prepared the data set as questions and answers that people usually ask to the University and other online information regarding all

undergraduate professions requirements. The researcher to the Bindura University of Science Education website and other Universities websites and collected Frequently Asked Questions as part of our data.

- **Pre-processing**: We utilized the NLTK library for natural language processing. Because the user's input will be in English, we will utilize Natural Language Processing to help the machine comprehend it. We performed this preprocessing to reduce further processing and eliminate ambiguity caused by using the same term in multiple ways. This task includes the following steps: Removing punctuation and additional spaces Tokenization - We utilized tokenization to create a sequence of words from the user's inquiry. Removing stop words - Most common words such as 'how', 'are', and 'can' that do not need to be examined during processing are removed to improve system speed. Lemmatization - We utilized WordNet Lemma-tizer to obtain the lemma (root form of a word) for each token. For example, 'processing' and 'process' should be treated equally during processing. Lemmatization is used to extract 'process' from 'processing'.
- **Vectorization**: We turned our text data to vectorized representation utilizing the Bag Of Words (BOG) technique. BOG is a method for preparing text for use in our machine learning algorithm. The BOG model generates a vocabulary from all of the texts and then models each document by counting the number of times each word appears in that document.
- **Classification:** As the data set grows, it takes longer to train the model so that it could produce more responses from different users as queries are different depending with the person interest at a given time.

3.7 Summary of how the system works

This chapter focuses mostly on the system's development methods, as well as how it was developed and executed. The system was developed using a variety of methodologies, as well as technologies such as Python and Natural Language Processing algorithms.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The Career Guidance Chatbot is a big effort to use artificial intelligence to help people navigate their professional pathways more successfully. In this section, we will look at the outcomes of the chatbot's functioning and examine the data acquired while using it. We hope to highlight the chatbot's efficacy, usefulness, and overall influence in completing its original goal by a thorough evaluation and analysis. The results and analysis section are an important part of the project documentation since it provides information on user engagement and the chatbot's success in providing appropriate career advice. The data and analysis provide insights that not only support the Career Guidance Chatbot's usefulness, but also influence iterative improvements and future development initiatives. By continually developing the chatbot based on user input, we want to improve its functionality and keep it as a reliable resource for those looking for advice in their careers.

4.3 TESTING

Testing is vital because it identifies any faults or errors in the written code, allowing them to be repaired before the software product is delivered, hence improving product quality. As a result, the testing is conducted in accordance with the functional and non-functional criteria specified in the previous chapter. The two most prevalent methods of testing are described below:

4.3.1 Black box testing

Black box testing is a type of testing conducted without knowledge of a system's internals, can be used to evaluate the functionality, security, performance, and other elements of an application. The primary goal of black box testing is to assess the functioning of a software program by evaluating its inputs and outputs without looking at its internal code structure. This technique assures that the program fits the requirements, performs as expected, and delivers a pleasant user experience. It seeks to detect flaws, defects, and performance concerns, assuring that the software is dependable, stable, and compatible with other systems. Black box testing ensures that

the application follows all business rules and regulatory standards, resulting in overall quality and user satisfaction.

The chatbot responses are determined by the patterns in the trained model and users have to type correct spelling and meaning queries to the get right responses from the chatbot. For example, in the below images it shows two different outcomes when a user enters an invalid input and valid input it gives proper response to the user.

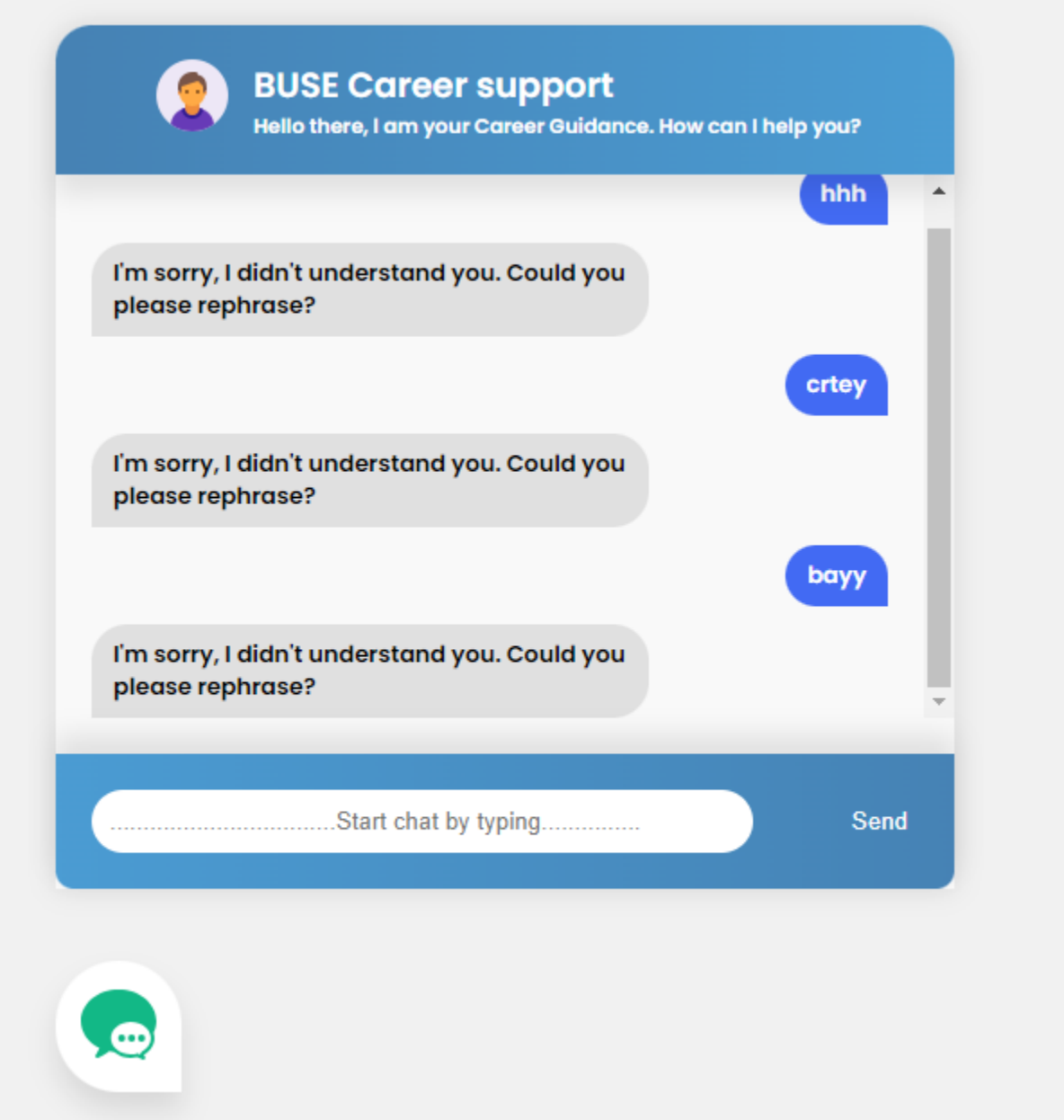


Figure 5: Result 1

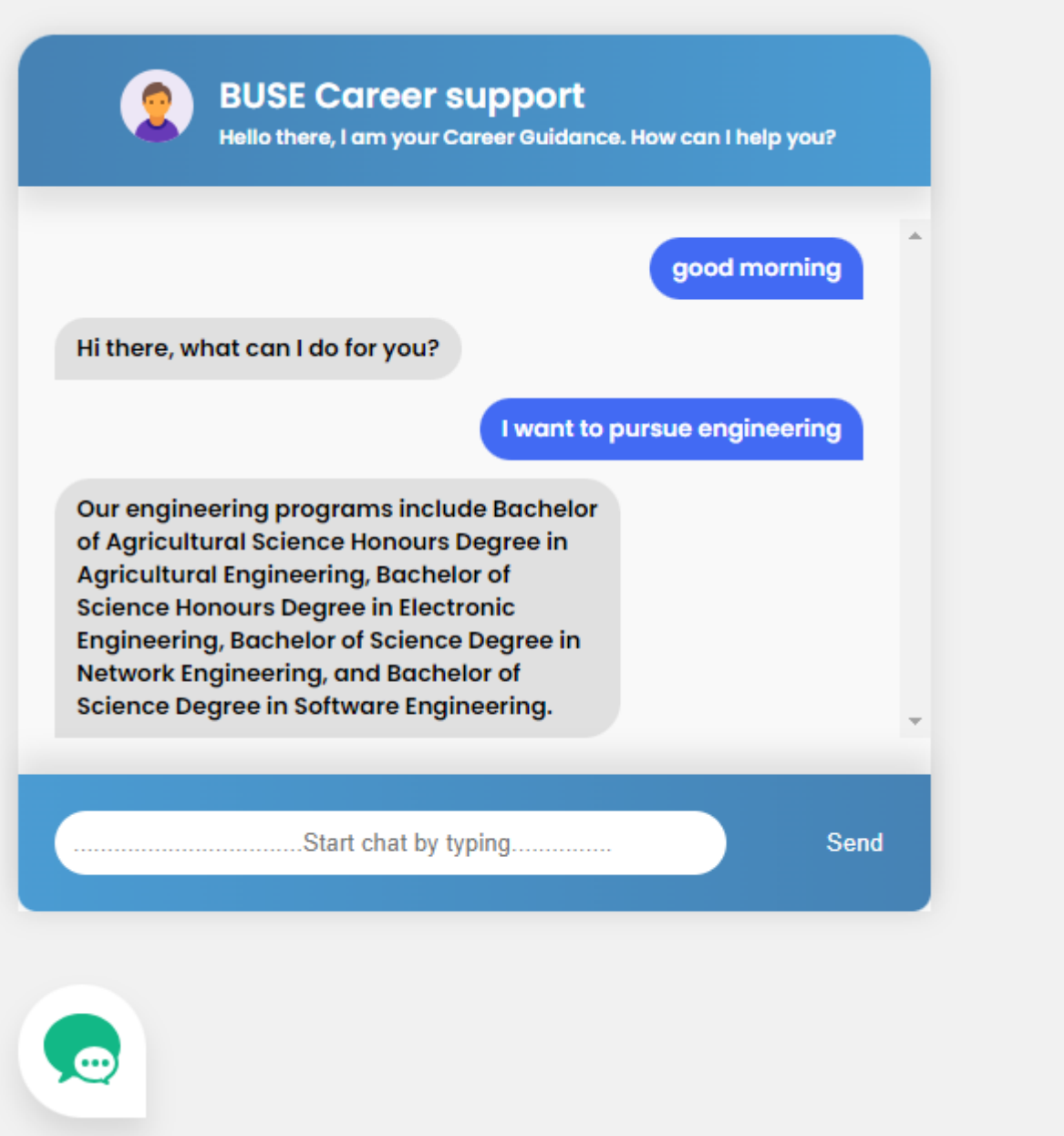


Figure 6: Result 2

4.3.2 White box testing

White box testing, also known as clear box or glass box testing, involves examining the internal structures or workings of an application, including its code, algorithms, and logic. The primary

purpose of white box testing is to ensure that the internal operations of a system function as intended, identify security vulnerabilities, improve code efficiency, and validate internal paths, conditions, and loops. This method allows testers to detect hidden errors, optimize performance, and ensure thorough coverage of the code base, leading to more robust and secure software.

The below image shows the author ensuring that all errors were removed for the chatbot to function well without any barriers, testing the working of a particular section of the code so that it meets the required objectives.

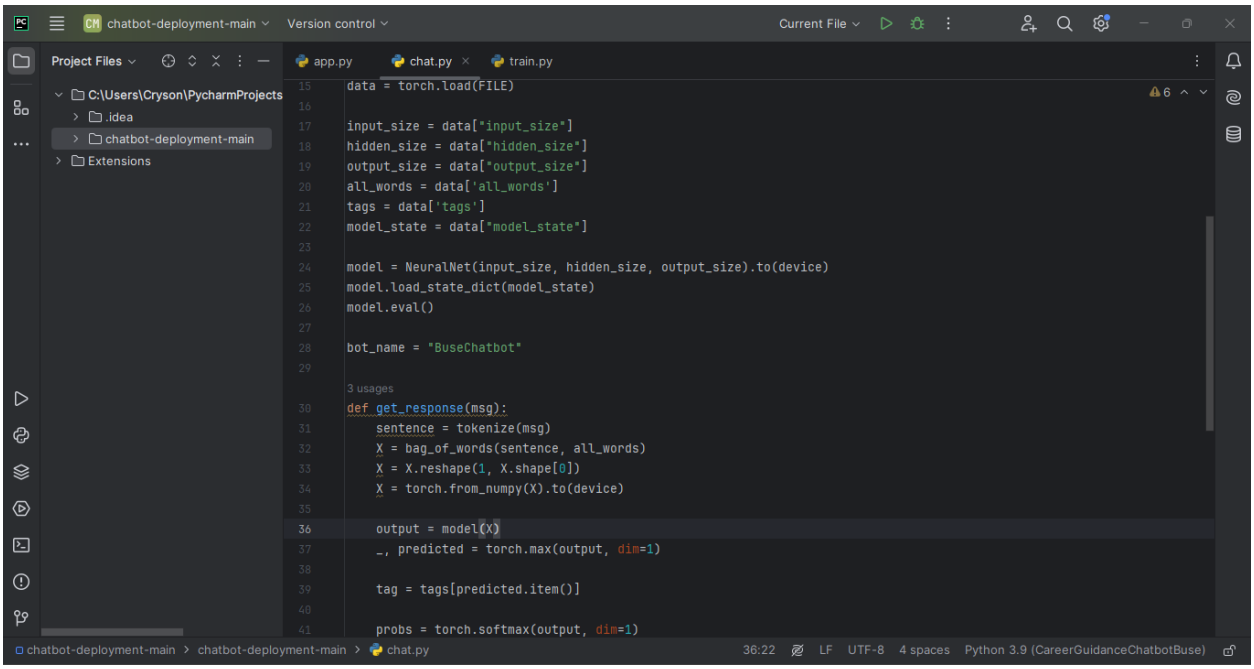


Figure 7: Testing 1

The below image shows the code of training the model ensuring that data is trained well and provide accurate results to the users of the system without producing wrong results.

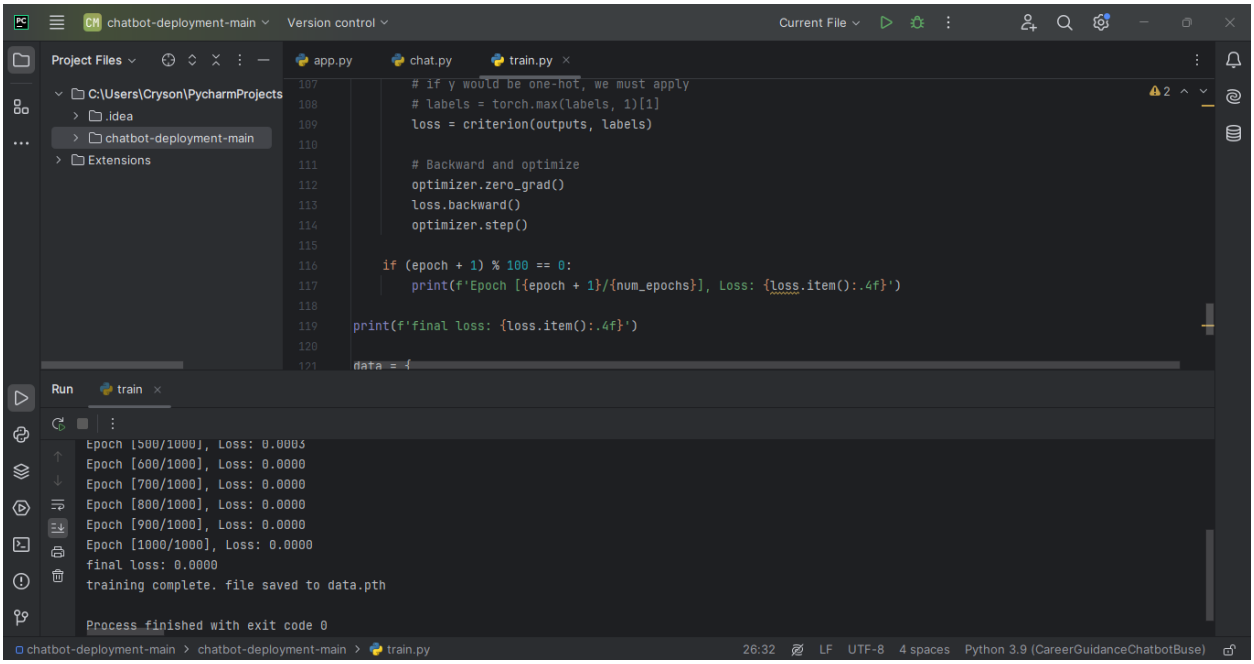


Figure 8: Testing 2

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The emergence of artificial intelligence has greatly revolutionized career coaching, overcoming conventional counseling restrictions such as resource limits and accessibility. The Career Guidance Chatbot intends to make career guidance more accessible by providing suited assistance around the clock. The chatbot, built with breakthrough Artificial Intelligence technology, understands difficult inquiries and provides exact answers, aided by a constantly updated database of educational paths and skill needs. High user engagement and pleasure demonstrated the chatbot's efficacy and scalability, making it an affordable tool for institutions. This chapter highlights the deployment findings, highlighting the chatbot's position in current career assistance, and makes strategic recommendations for future improvements to satisfy changing user demands.

5.2 Major conclusions drawn

- The research allowed for substantial personal and professional development, including the researcher's competence in AI applications, python programming language, JavaScript and algorithms. Conclusively, the study's success represents both the attainment of objectives and significant learning experiences.
- Scalability of the chatbot can support numerous users at once at the University, indicating its potential for bigger installations. Scalability is an important factor to consider in the development process of system so that expansion can be made easily without affecting the current functionalities of the system.
- The chatbot improved resource efficiency by reducing the burden of human career counselors, allowing them to focus on complicated issues.
- The chatbot delivered accurate and up-to-date career information, enhancing user confidence.
- The chatbot's 24/7 availability facilitated career assistance for those with flexible schedules. The availability of the system allows users to access it anytime from anywhere

and get information without delays or system breakdowns which increases users satisfaction and product quality.

5.3 Recommendations

- Continuous updates of the database to reflect current educational routes which gives room for accurate results and proper decisions to be made by users while choosing their profession or careers.
- User Education by offering lessons or onboarding sessions to assist users fully utilize the chatbot's features so that users can have better understanding of how it works and its use in providing better results.
- Increase Language Support offer several languages to appeal to a wider user base. The chatbot was developed to accept only English language input, so by implementing Ndebele language it would create more users engagement at the University.
- The University needs to accept changes by developing a mobile application for students to improve efficiency as mobile phones have large numbers and high engagement compared to laptops. Optimizing the chatbot for mobile devices to improve accessibility.
- The chatbot was created in a small scope of chatbot development using limited tools so investing in Artificial Intelligence advancements to improve the chatbot’s understanding of complex queries and refined career advice.
- Promote the chatbot through various channels to reach a wider audience, students need to know the University has a career guidance chatbot before they apply for a particular profession or career.

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