



Students Innovative Project Report

DESIGN AND IMPLEMENTATION OF INTELLIGENT TEACHING CHATBOT

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BONAFIDE CERTIFICATE

It is certified that this project report titled “**DESIGN AND IMPLEMENTATION OF INTELLIGENT TEACHING CHATBOT**” is submitted by **Ms. Sanmuga Mithra P. S., Mr. Shriram G and Ms. Shruthi G. S.**, who carried out the work under our supervision. It is certified further to the best of our knowledge the work reported herein followed all the guidelines prescribed by the University during and after implementation of the project.

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CHAPTER-1

INTRODUCTION

1.INTRODUCTION

1.1 PREAMBLE

Natural Language Processing (NLP) is a field of study that focuses on the interaction between computers and humans using natural language. The goal of NLP is to enable computers to understand, interpret, and generate human language, which is vital in various fields, including linguistics, computer science, and artificial intelligence.

NLP tools and applications have been developed to assist users in processing large volumes of text data. These tools can perform tasks such as text classification, question-answering and summarization. They use algorithms and machine learning techniques to analyze and extract insights from text data.

In recent years, there has been a significant increase in the development and use of NLP tools. These tools have various applications in industries such as healthcare, finance, e-commerce, and customer service. NLP tools can help businesses to analyze customer feedback, monitor brand reputation, and improve customer engagement.

Overall, NLP has proven to be an essential field of study in the digital age, where vast amounts of unstructured data are generated daily. As technology continues to advance, NLP tools and applications are expected to become more sophisticated, providing even more significant benefits to businesses and individuals alike.

1.2 OBJECTIVES

The objectives of this chatbot are:

- To provide relevant means for users to automatically extract summarized content from the input data.
- To auto evaluate answers from data provided.
- To allow authors of textbooks and literary documents to utilize the chatbot to provide a brief answer to questions under a given context and allow users to efficiently navigate their material.
- To be able to reply to users in real-time.

- To ask the user for more information if their intent is not clear enough.
- To request human intervention when appropriate, if software is released and controlled by a provider to the student.
- To allow tuning of the bot's responses with additional data.

1.3 PROJECT SCOPE

Designing and implementing an intelligent teaching chatbot can be a complex and challenging project. The following is an overview of the project scope:

- **Goal and objectives:** To provide NLP services to the end users, primarily in academics, in a user-friendly manner that will enhance the user's learning experience and automate rote daily tasks that can be solved via NLP algorithms.
- **Research and analysis:** Conduct research and analysis on existing NLP algorithms and how they may be utilized and augmented to suit our needs and objectives.
- **User requirements:** Define the user requirements for the chatbot, including the target audience, user goals, and the types of questions the chatbot should be able to answer.
- **User interface design:** Design the user interface for the chatbot, including the platform, language, and visual design. Ensure that the interface is user-friendly and intuitive.
- **Natural language processing (NLP):** Implement NLP technologies to enable the chatbot to understand user queries and provide relevant responses. This may involve building a machine learning model or using pre-built APIs.
- **Content creation:** Create a database of knowledge and information that the chatbot will use to answer user queries. This could involve developing a curriculum, compiling a set of FAQs, or integrating with existing educational resources.
- **Testing and validation:** Test the chatbot thoroughly to ensure that it meets user requirements and works as intended. Validate the accuracy of responses manually and make necessary improvements.
- **Deployment and maintenance:** Deploy the chatbot and ensure that it is running smoothly. Monitor the chatbot's performance and make updates and improvements as necessary.

1.4 NEED FOR STUDY

There are several reasons why there is a need to study the design and implementation of intelligent teaching chatbots:

- **Scalability:** Intelligent teaching chatbots can be scaled to reach a large number of students simultaneously. This can be particularly useful for schools and universities with large student populations.
- **24/7 availability:** Chatbots can be available 24/7, providing students with instant access to learning resources and support. This can be particularly helpful for students who are studying in different time zones or who have other commitments that make it difficult to attend traditional classes.
- **Productivity:** Menial tasks such as information retrieval, plagiarism checking, evaluation of objective answers etc., can be streamlined and completed with minimal amount of time.
- **Automation:** It automates tasks that would otherwise require extensive manual intervention and time that could be utilized for other purposes.

Overall, the design and implementation of intelligent teaching chatbots has the potential to transform the way that students learn and engage with educational content. By increasing engagement, and offering 24/7 availability, chatbots can help to improve student outcomes and provide valuable data-driven insights to educators.

CHAPTER-2

LITERATURE REVIEW

2. LITERATURE REVIEW

Natural Language Processing (NLP) is a rapidly evolving field that enables machines to understand, interpret, and generate human language. Chatbots are one of the most common applications of NLP, which allow users to interact with machines using natural language.

Chatbots have been deployed across various domains such as customer service, education, healthcare, and e-commerce to provide personalized and efficient assistance. This literature review aims to provide an overview of the current state-of-the-art in NLP chatbots and their potential applications.

A chatbot for an interactive interface to access documents as opposed to a search method was studied and implemented by *Rachana et al.* It was implemented with the potential of customizing the chatbot easily with the organization's dataset and ease of integration on any platform. Change of interface could be done seamlessly for any organization using the same model.

A chatbot for the purpose of management of operations of a library was done via the 'BCNYPYLIB' chatbot. However, it only serves as a notification and reminder service and delivers responses to FAQ's (Frequently Answered Questions), to reduce the time spent on manual question clarification and divert resources for other activities. *Nannaphat Thalaya et al* note that it involves an extensive manual method of updating a question and answer dataset.

A laboratory equipment troubleshooting system was implemented by Shih-Hsiung Lin et al, used to to diagnose issues purely via text input of the errors thrown by the equipment. However, it is only capable of fixing issues based on an FAQ related system with an input text classification algorithm and logs the error in the database.

Linear Support Vector Machines algorithms for Multiclass Intent Classification across many domains was experimented by *Amir Fazamin et al.* It was found that the Linear SVC achieved highest accuracy in classification.

Intent classification plays a crucial role in building a chatbot so that the user's intent may be identified. However, it is severely limited in its scope of use and does not work in non-linearly separable boundaries, which is the case in much of the real world informal text data.

The Jaicob chatbot developed jointly by Daniel et al utilized Google's DialogFlow to create a chatbot with the desired results in developing a conversational AI agent. However, this does not provide an open source implementation that may be customized according to the user expectations if dynamic changes are necessary. Moreover, DialogFlow is a paid chatbot creation

service and is third party software that does not expose its code to the end user and only provides the model output.

There is a dire need for proper channelization of all services across an institution to streamline all the functions of the institution and present a unified functioning interface and enhance upon single purpose usage that above chatbots provide.

A combination of multiple services with modern Transformer architectures available as open source code marketed to institutions is the need of the hour.

Hence it is vital that a chatbot providing a variety of NLP services integrated with all the institutions departments, functionalities, etc is implemented to keep up with the ongoing AI digital transformation services available with proper integration towards everything.

CHAPTER 3

DESIGN METHODOLOGY

3. DESIGN METHODOLOGY

3.1 INTRODUCTION

The basic idea behind this web app is to provide users with basic NLP (Natural Language Processing) services such as summarization, question-answering, plagiarism analysis, etc.

NLP is a field of computer science and artificial intelligence that deals with the interaction between computers and human language. With the increasing amount of text data available on the internet, there is a growing need for tools that can help individuals and organizations to process and understand this data quickly and efficiently.

The application will be designed to be user-friendly and accessible to individuals who may not have a technical background in NLP or programming. Users will be able to enter text or upload a document, and the web app will provide them with a summary of the key points or sentiment analysis of the text.

This will be particularly useful for professionals who need to quickly analyze large amounts of text data, such as journalists, researchers, or business analysts.

3.2 TOOLS USED

3.2.1 HARDWARE REQUIREMENTS

For this project, we will be using a Raspberry Pi 4 Model B as for small scale testing purposes. The Raspberry Pi is a small and affordable single-board computer that is commonly used for projects that require low-power computing and does not provide support for advanced Machine Learning libraries and large scale computing.

However, as a testing server it can be used to validate smaller models and test API responses to external requests, to measure server response latency and functionality.

The Raspberry Pi 4 Model B used in this project has 8 GB of RAM capacity and uses a 32 GB MicroSD Card. The MicroSD card would be flashed using the Raspberry Pi OS Imager with the Raspbian OS.

A USB cable would be used to provide power supply. The board also has an ethernet/LAN port and a Wi-Fi module. This allows the board to be interfaced with laptops and Desktop computers over wired and wireless networks to program and configure as we wish.



Raspberry Pi Model 4 B

3.2.2 SOFTWARE SPECIFICATIONS

LANGUAGE USED

The Python Programming Language was used for the execution of the project. Python is a popular programming language for natural language processing (NLP) tasks, and is an excellent choice for this project. Here are some reasons why Python is well-suited for this project.

Here are some reasons why Python is well-suited for this project:

Large number of ML libraries: Python has a rich set of libraries for ML tasks, including Scikit-Learn, Tensorflow, Sentence_Transformers, Pytorch and Scipy among others.

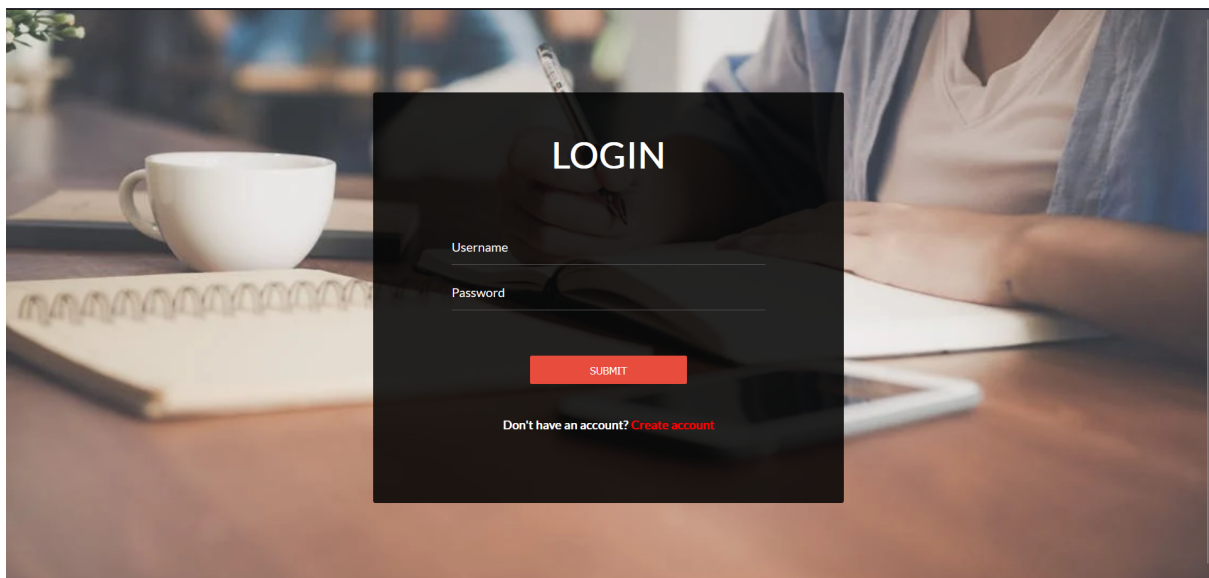
These libraries provide pre-built functionality for tasks such as text preprocessing, sentiment analysis, and summarization, which can save development time and effort.

- **Ease of use and readability:** Python is known for its simple syntax and easy-to-read code, making it accessible to developers of all levels. This makes it easy to develop and maintain the codebase for the web app, even as it grows and evolves over time.
- **Availability of web frameworks:** Python has a number of popular web frameworks, such as Flask which can be used to build the web app. These frameworks provide a solid foundation for building web applications, with support for features such as routing, request handling, and templating.
- **Cross-platform compatibility:** Python can be run on a variety of platforms, including Windows, Linux, and macOS. This means that the web app can be easily deployed on a variety of systems, including servers running on the Raspberry Pi.

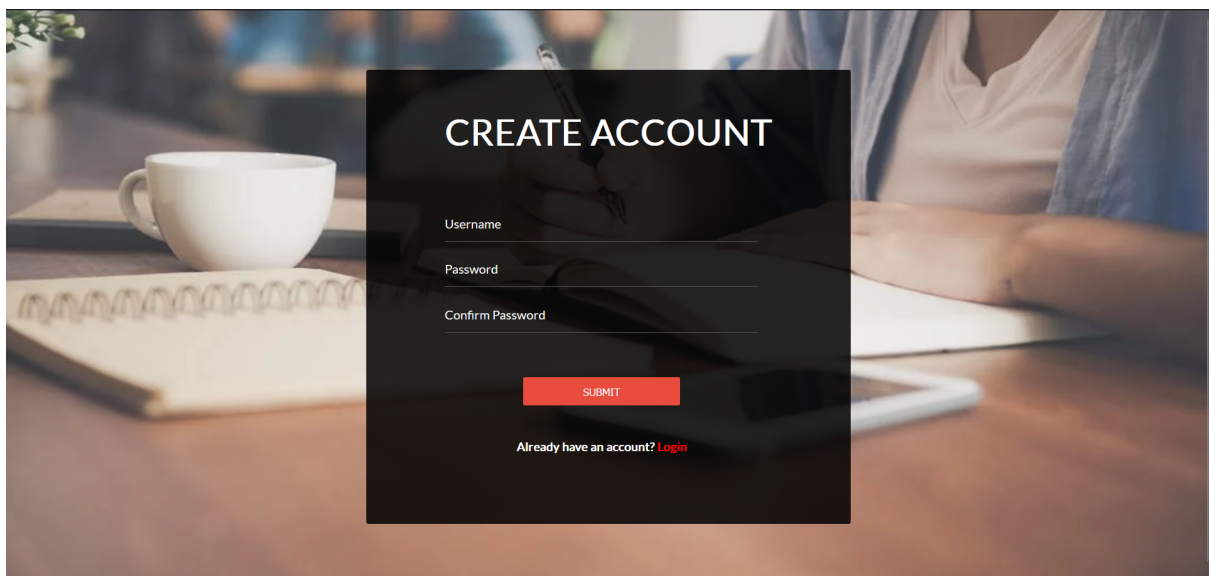
SUPPORTING SOFTWARE PACKAGES

- **Flask:** Flask is a popular Python web framework that we used to build the web app. It provided routing, request handling, and templating capabilities, among other features.
- **Flask-Login:** Flask-Login is used to implement authentication services for user login functionality
- **Flask-SQLAlchemy:** Flask-SQLAlchemy is used for configuring the user database for the application
- **PyPDF2:** PyPDF2 is a Python library that provides tools for working with PDF documents. We used it to extract the text content from PDF files and prepare it for processing by the summarization and other NLP services.
- **PyTorch:** PyTorch is an open-source machine learning library that we used to save and load the trained Machine Learning Models dynamically
- **TensorFlow:** TensorFlow is an open-source machine learning library that the Machine Learning Models were built upon and are required to run the model with the relevant software library dependencies.

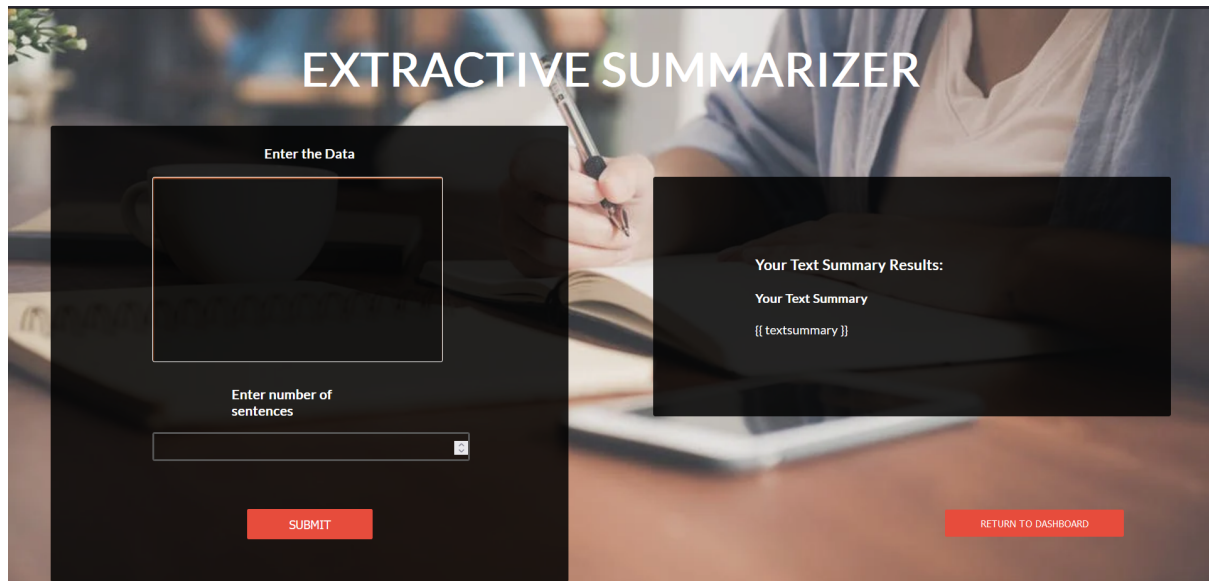
- **SciPy:** SciPy is a Python library that provides tools for scientific computing, including optimization and linear algebra. It is used to perform certain tensor operations otherwise unavailable in other libraries.
- **Raspberry Pi OS Imager:** Used to write the Raspbian OS to the MicroSD Card
- **Raspbian OS:** The Raspbian OS is written to the MicroSD card and runs the Raspberry Pi Model 4 as a full-fledged Operating System. All program libraries are installed and run in the Raspbian OS



Sample Login Page



Account Creation



Summarizer Page

MACHINE LEARNING MODELS USED

- The BERT Open Source Transformer Model and Architecture published by Google is used in this project. It has a vast ecosystem of pre-trained transformers with millions of parameters that can be customized for our purposes.
- The Sentence_Transformer package is utilized to encode text data for checking with Cosine Similarity of both text vectors
- The Bert-Extractive-Summarizer Model is utilized for providing extractive summarization capabilities.
- The Transformer Package is utilized along with the SpanBERT Machine Learning Model for the purpose of designing the Question-Answering System.

- Scikit-Learn Support Vector Machine Models are used for developing a text based recommendation system that can be customized as per the user's wish based on the data they wish to supply to the model to augment for their purposes. In this project, a recommendation system for insert material, grade and profile of machining tools is implemented.

CHAPTER 4

CONCLUSION

4. RESULTS AND CONCLUSION

The project functions as an optimized tool tailored to the purposes of student usage as a web service to all students in need of NLP tools to aid and assist them in their learning curve for quick summarization and revision of concepts, clarification of queries with the input knowledge that the student has supplied to the NLP model. In conclusion, the chatbot is a service that uses emerging Artificial Intelligence technology known as “NLP”, which will provide answers to the analyzed queries and assist the user in multiple other regards.

The main purpose of building this web service is to make the chatbot faster, easier and highly customizable to the end users who are primarily students and faculty of educational institutions. This web service tries to break this barrier and allows the user to utilize NLP services to the utmost in a broad spectrum of domains for learning purposes.

REFERENCES

1. Chatbot_Application_in_Laboratory_Equipment_Management_and_e-assistant *by Shih-Hsiung Lin et al.*
2. JAICOB: A Data Science Chatbot, *Daniel Carlander-Reuterfelt et al.*
3. BCNPYLIB CHAT BOT: The artificial intelligence Chatbot for library services in college of nursing by *Nannaphat Thalaya and Kitti Puritat et al.*
4. Edu-bot: An AI based Smart Chatbot for Knowledge Management System *by Rachanna G Kumar et al.*
5. Multiclass Intent Classification for Chatbot Based on Machine Learning Algorithm *by Amir Fazamin et al.*