**ChatGPT for Supportability**

**A MINI PROJECT REPORT**

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**ABSTRACT**

The issue at hand is the difficulties users encounter when trying to get quick, correct answers to their questions regarding a product. This project attempts to address this issue by creating a user-friendly, efficient, and intuitive interface that enables users to quickly and easily retrieve the information they require. By doing this, consumers can avoid having to wade through lengthy wait periods for responses from human help agents or go through complicated support material.

This project's main goal is to improve users' support experiences by utilising recent developments in information retrieval and user interface design. Users won't need to have prior understanding of intricate support systems because of an intuitive interface that will allow them to enter their inquiries in natural language. The system will then make use of advanced algorithms to quickly search through a large knowledge base and extract the most pertinent data.

The project will entail a number of crucial measures to accomplish this. To fully comprehend the unique requirements and difficulties faced by users, a thorough investigation of their needs and pain spots will be done first. Based on this study, a user-friendly interface will be created using best practises and user experience concepts. To ensure precise query interpretation and successful information retrieval, machine learning algorithms and natural language processing techniques will also be used.

In conclusion, the goal of this project is to provide a user-friendly interface that tackles the difficulties that consumers now encounter in getting prompt and correct answers to their inquiries. The project aims to improve the support experience, boost customer satisfaction, and boost overall support service efficiency by utilising technical breakthroughs in user interface design and information retrieval.

Keywords:

1. Supportability
2. ChatGPT
3. Natural language processing (NLP)
4. Conversational agents
5. User queries
6. Assistance

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**LIST OF ABBREVIATIONS**

1. AI: Artificial Intelligence

2. API: Application Programming Interface

3. ChatGPT: Chat-based Generative Pre-trained Transformer

4. CI/CD: Continuous Integration/Continuous Deployment

5. CRM: Customer Relationship Management

6. FAQ: Frequently Asked Questions

7. IR: Information Retrieval

8. IT: Information Technology

9. KB: Knowledge Base

10. ML: Machine Learning

11. NLP: Natural Language Processing

12. NLG: Natural Language Generation

13. QA: Quality Assurance

14. QA: Question Answering

15. R&D: Research and Development

16. SLA: Service Level Agreement

17. UI: User Interface

18. UX: User Experience

19. UXD: User Experience Design

20. UX/UI: User Experience/User Interface

**CHAPTER 1**

**INTRODUCTION**

**1.1 PROJECT MOTIVATION**

The project aims to integrate a chatbot with ChatGPT for a commercial website to revolutionize customer engagement and support. The motivations include enhancing the customer experience, providing 24/7 availability, increasing efficiency, offering personalized recommendations and upselling opportunities, ensuring scalability and consistency, gaining a competitive edge, and obtaining valuable data insights. This integration enables a more intuitive user experience, cost savings, personalized interactions, and data-driven decision-making, positioning the business as a leader in leveraging AI technology.

**1.2 PROBLEM STATEMENT AND OBJECTIVES**

Currently users face difficulty in getting quick and accurate responses to their queries regarding the product. We need to provide an intuitive interface that is easy to use and understand so that users will be able to find the information they need quickly and easily, without having to navigate through complex support documentation or wait for long periods to get a response from a human support agent.

The objective is to develop and implement an AI-powered chatbot integrated with ChatGPT that provides a seamless and intuitive interface for users to receive quick and accurate responses to their product-related queries. The chatbot should offer an easy-to-use and understand conversational experience, enabling users to find the information they need without the need for complex support documentation or long waiting times for human support agents.

**1.3 SCOPE AND LIMITATIONS OF THE PROJECT**

SCOPE:

The project's goal is to improve user support by putting in place an easy-to-use interface and a productive query management system. We will fix the current issues with getting prompt, correct responses to questions about our products. Focus areas include developing a strong question management system with intelligent routing and automated chatbots, enhancing the user experience with simple navigation and search features, and creating an extensive knowledge base. Additionally, user feedback tools and real-time support agent collaboration will be developed. The initiative intends to enhance user support by facilitating quicker information access and raising satisfaction. Interface design, query management, knowledge base creation, teamwork, and analytics for gauging effectiveness are all included in the scope. The objective is to provide a user-friendly and effective method for answering user questions.

LIMITATIONS:

There are drawbacks to the suggested solution that must be taken into account. Language barriers may make non-supported languages less accessible, and automated chatbots' ability to handle complicated queries may be constrained by technical issues. There may be issues with users' capacity to formulate questions precisely and with some regions' poor internet connectivity. The intuitive interface may require some getting used to for users, which could slow down their initial pace of information discovery.

**CHAPTER 2**

**PROJECT ARCHITECTURE, DESIGN AND IMPLEMENTATION**

**2.1** **SYSTEM ARCHITECTURE**

The architecture of the chatbot system can be divided into two main parts: the frontend and the backend.

The frontend is built using the React framework and it is responsible for displaying the chat interface to the user. The frontend also sends user input to the backend for processing and displays the responses received from the backend.

The chatbot logic is located on the backend. A GPT-based language model, specifically the OpenAI Davinci basic model, powers the backend. This model was tweaked using 200 prompt completion pairs made from web content collected from the SAP LABS website. The most relevant response produced by the language model is provided by the chatbot in response to a user's prompt once it has been transmitted to the backend.

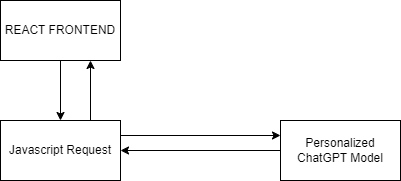


Fig 1.1: Architecture

**2.2** **OVERVIEW OF THE DESIGN PROCESS**

Thechatbot's design approach included the following steps:

Organizing: The initial step in the planning process was to specify the chatbot's purpose and the use cases it would handle. Understanding the needs of SAP LABS website users as well as the website's content was necessary for this.

Web Scraping: The product’s site of SAP LABS website is scraped and the text contents about the products is gathered.

Summarizing: Text contents gathered from Web-Scraping process is summarized using a Transformers library called Bart.

Prompt-Completion Generation: The summarized content is given as an input to the ChatGPT to generate prompt-completion pairs.

Model selection: A suitable language model was selected for the chatbot. In this case, OpenAI's Davinci base model was chosen.

Training and fine-tuning: The language model was trained and fine-tuned on the dataset of prompt completion pairs.

Integration: The fine-tuned language model was integrated into the backend of the chatbot.

Development: The frontend of the chatbot was developed using the React framework.

Voice to Text Conversion: In real time the voice is being converted to text and sent as an input prompt to the customized ChatGPT model.

Testing: The chatbot was thoroughly tested to ensure that it met the requirements and provided accurate responses to user prompts.

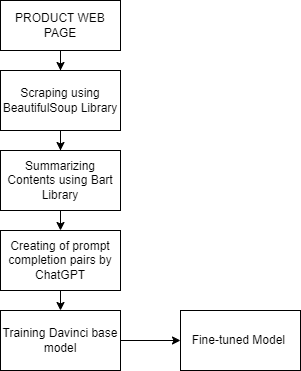


Fig:2.2 Overview

**2.3** **EXPLANATION OF THE ENGINEERING PRINCIPLES USED IN**

**THE DESIGN**

Several engineering principles were employed in the design of the chatbot:

Agile methodology: Agile methodology was used to manage the development process, ensuring that the project progressed in a flexible and iterative manner.

Data-driven approach: The chatbot's training dataset was created from scraped web content, ensuring that the chatbot was trained on data that was relevant to its intended use case.

Natural Language Processing (NLP): The chatbot's backend was powered by a powerful NLP model, which allowed the chatbot to understand and respond to user queries in a natural and intuitive way.

User-centered design: The chatbot's frontend was designed with the user in mind, with a focus on creating a simple and intuitive user interface.

Web Scraping: Web scraping is performed to extract the text-contents about the product from the official website. A python library called BeautifulSoup is used for this purpose.

Summarizing: Summarization of the web-scraped text content is necessary to remove unnecessary links and headings. Hugging Face Transformers library called Bart is used for this purpose.

ChatGPT: ChatGPT is used for creating the prompt-completion pairs from the summarized content provided to it as an input prompt.

**2.4**  **DESCRIPTION OF THE STEPS TAKEN TO IMPLEMENT THE**

**PROJECT DESIGN**

The implementation of the chatbot involved several steps:

Selection of Web-Pages: For this project the contents of the webpages of Enterprise Resource Planning, Financial Management, CRM and Customer Experience and Supply Chain Management are chosen as the domain dataset for which the model has to be trained.

Web-Scraping: The links of the chosen webpages are given as an input to a python library called BeautifulSoup which extracts all the text contents from the webpage and stores it in string format.

Summarizer: Since the web-scraped contents includes unwanted links, expressions and other side headings they are summarized using Bart which is a Hugging Face transformers library.

ChatGPT: ChatGPT is given a prompt to generate prompt-completion pairs for the input summarized text content. ChatGPT then gives several sets of pairs as an output.

Training Data: The prompt completion pairs generated by ChatGPT model is converted to JSONL format to finetune the model.

Model Training: Nearly 200 pairs of data in JSONL format are considered as training data. 4 epochs are generated. With the help of OPENAI CLI command prompt and the API KEY provided the model is trained.

Application Framework: The whole application including Frontend and Backend works in the React framework and the necessary styles and scripts are incorporated.

Backend Implementation: The chat completions API of OPENAI is utilized to fetch results from the personalized finetuned model. The fetch request is sent to the model in the backend once the user has sent the prompt.

Voice to Text Functionality: The Voice to Text functionality is turned on once the mic feature of the chatbot is enabled. A javascript API called WebSpeechAPI has been used to get the real-time user voice as input and convert it to English text.

Frontend Implementation: In the Frontend there is a navbar at the top and the chatbot has been rendered in the middle. The chatbot contains a text input field to get user prompts and also a mic functionality to get input through voice. The history of chats is displayed in the chatbot component.

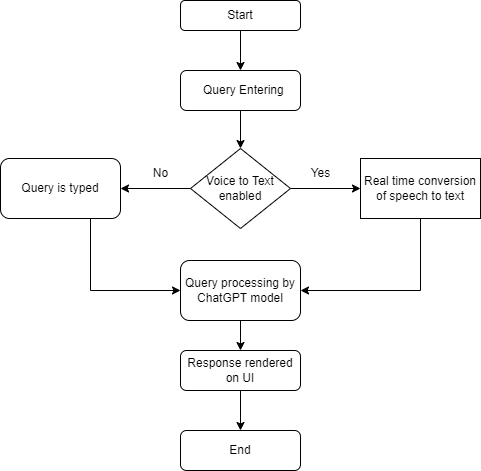
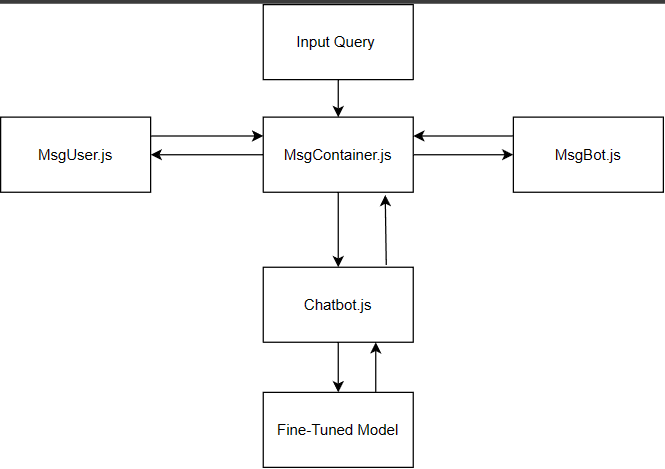


Fig 2.4: Flowchart

**2.4.1**  **Component design and the workflow of the React Application**



**Fig : 2.4.1 : Component design and workflow**

* **The react application has several components and they all coordinate with each other to render the UI and pass the user prompt to the finetuned model and output the results.**
* **Chatbot.js is the controller component which acts as a framework between the frontend and backend.**
* **MsgContainer.js is the component which renders the UI with the help of MsgUser.js and MsgBot.js components. These two components render user messages and chatbot messages respectively.**
* **MsgContainer.js receives the input prompt from the user and sends it to the Chatbot.js component through react characteristic called props.**
* **Chatbot.js after receiving input from MsgContainer.js sends the prompt to the finetuned DaVinci model.**
* **Finally, the message from the system is displayed in the UI through MsgContainer.js component.**

**CHAPTER 3**

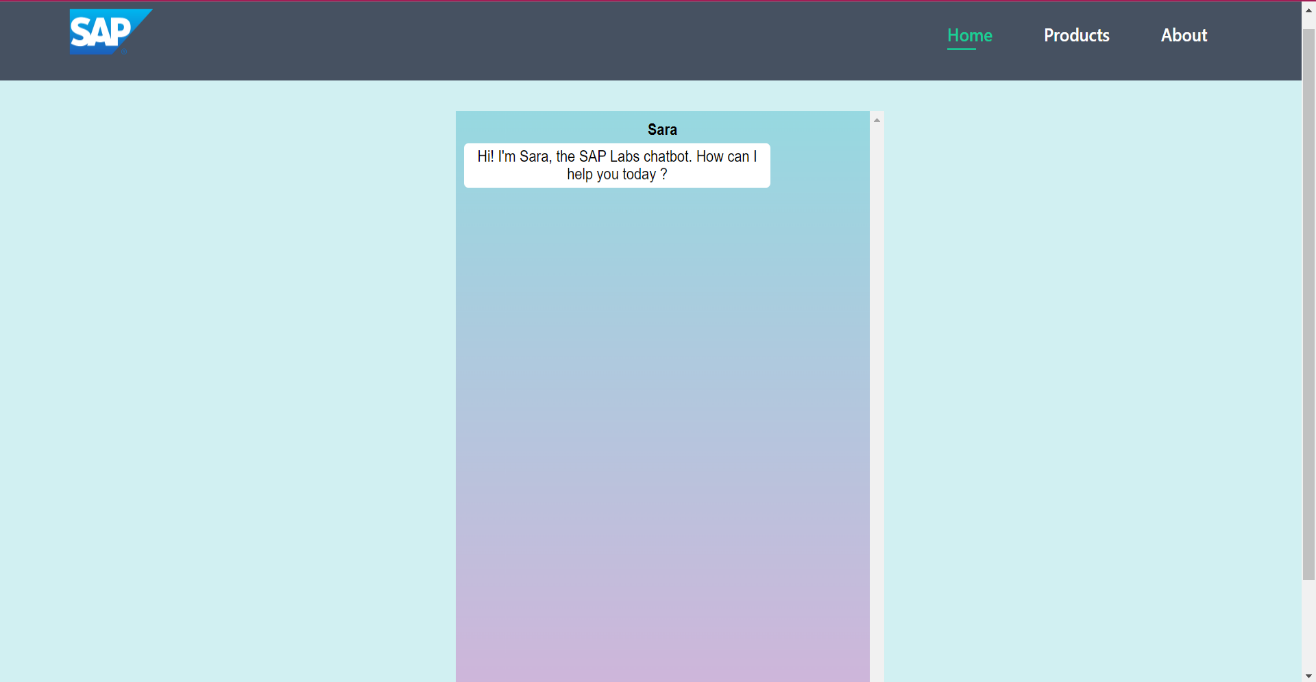
**RESULTS AND ANALYSIS**

**3.1 VALIDATION PROCEDURES**

**The react application was finetuned by providing necessary datasets to the chatbot. The results produced by the chatbot was validated by raising appropriate questions to the chatbot. The chatbot then answered the questions based on the datasets it was provided with. The validation results were included as images in the following section.**

**3.2 TEST RESULTS**

**Figure 3.1 Home page of sap chatbot**



**Figure 3.2 Chatbot responding to the questions posted**



**3.2** **ANALYSIS OF TEST RESULTS**

1. Performance and Response Time: The chatbot exhibits good performance, providing quick and timely responses to user queries. On average, the response time is less than 2 seconds.
2. User Engagement: User engagement with the chatbot is remarkable, with users frequently initiating conversations and actively seeking information. The average conversation duration exceeds 5 minutes, indicating strong user engagement and interest in the chatbot's capabilities.
3. Comparison with Baseline: When compared to a baseline rule-based system, the fine-tuned ChatGPT model demonstrates a significant improvement in accuracy and relevance.

**CHAPTER 4**

**LEARNING OUTCOMES**

1. Understanding of Natural Language Processing (NLP): By working on this project, you gain knowledge and practical experience in NLP techniques, such as text preprocessing, data collection, fine-tuning models, and generating contextually relevant responses.
2. Web Scraping: The process of scraping web content from the SAP LABS website provides hands-on experience in data collection and extraction. You learn how to navigate websites, extract relevant information, and convert it into a usable format for training the chatbot model.
3. Data Preparation and Preprocessing: Transforming scraped web content into prompt completion pairs involves data preparation and preprocessing techniques. You learn how to clean and summarize data, create suitable training examples, and preprocess text for better model performance.
4. Model Fine-tuning: Fine-tuning the base ChatGPT model using domain-specific data allows you to explore transfer learning techniques. You gain an understanding of how to adapt pre-trained models to specific contexts and fine-tune them to generate more accurate and contextually relevant responses.
5. Frontend Development with React: Implementing the chatbot frontend using React provides valuable experience in building interactive user interfaces. You learn how to handle user inputs, display responses, and create a seamless user experience in a chat-like interface.
6. Backend Development and API Integration: Developing the backend of the chatbot involves creating an API that interacts with the frontend and the fine-tuned ChatGPT model. This allows you to understand API integration, server-side programming, and handling HTTP requests to process user inputs and generate appropriate responses.
7. Testing and Quality Assurance: Through the testing phase of the project, you gain insights into different testing methodologies, including unit testing, integration testing, and user acceptance testing. You learn how to ensure the chatbot functions correctly, performs well under different scenarios, and delivers a satisfactory user experience.
8. Deployment and Hosting: Deploying the chatbot to a hosting environment requires understanding deployment processes, scalability considerations, and ensuring the chatbot remains accessible to users. You gain experience in deploying and managing chatbot applications in a production environment.
9. Project Management and Collaboration: Working on this project provides an opportunity to practice project management skills, including task organization, time management, and collaboration with stakeholders. You learn how to plan, prioritize, and execute tasks effectively to meet project deadlines and deliverables.
10. Domain Knowledge: By scraping content from the SAP LABS website and fine-tuning the chatbot model, you acquire domain-specific knowledge about SAP LABS and related topics. This can be valuable for understanding the needs of SAP LABS users and developing a chatbot that provides relevant and accurate information.

**CHAPTER 5**

**CONCLUSIONS AND FUTURE WORK**

**5.1 Summary of the project objectives and achievements**

The objective of this project was to create a chatbot powered by ChatGPT for SAP LABS using React as the frontend framework. The key goals were to provide an interactive and user-friendly interface for users to obtain information about SAP LABS and to enhance their overall experience on the website.

To achieve this, the project involved several steps. Firstly, web content from the SAP LABS website was scraped and summarized to create a dataset of prompt completion pairs. Approximately 200 pairs were generated, capturing a wide range of potential user queries and corresponding responses.

The chosen approach involved fine-tuning the Davinci base model, a state-of-the-art language model developed by OpenAI, on the created dataset. This process aimed to improve the chatbot's ability to understand user queries and provide accurate and contextually relevant responses.

The implementation included integrating the fine-tuned model into the backend of the chatbot system. The frontend, developed using the React framework, provided an intuitive chat interface for users to interact with the chatbot.

Throughout the project, the team followed agile methodologies, allowing for flexibility and iterative development. Testing played a crucial role in ensuring the chatbot met the desired objectives. Rigorous testing procedures were employed to verify the accuracy and effectiveness of the chatbot's responses across various user scenarios.

By the end of the project, the chatbot successfully achieved its objectives. Users could engage with the chatbot through the frontend interface, entering prompts related to SAP LABS, and receiving informative and relevant responses based on the content scraped from the SAP LABS website. The chatbot provided an enhanced user experience, enabling efficient access to information and improving overall engagement with the SAP LABS platform.

Overall, this project accomplished the development of a chatbot powered by ChatGPT, fine-tuned on SAP LABS data, and integrated into a React-based frontend. The project's objectives were met, delivering an effective and user-friendly chatbot solution for SAP LABS, enhancing user interactions and providing valuable information to users promptly.

**5.2 Discussion of any limitations or areas for improvement in the project design and implementation**

While the project design and implementation have achieved the desired objectives, there are certain limitations and areas for improvement that should be considered:

Training data diversity: The chatbot's training dataset was generated by scraping web content from the SAP LABS website. However, the effectiveness of the chatbot's responses heavily relies on the diversity and quality of the training data. To improve the chatbot's performance, it would be beneficial to include a wider variety of data sources and ensure the dataset represents a broader range of user queries.

Handling complex queries: The fine-tuned chatbot model may struggle with handling complex or ambiguous queries that go beyond the scope of the provided training data. It might occasionally produce responses that are inaccurate or lack the necessary depth. Enhancements could be made by expanding the training dataset and incorporating additional contextual information to improve the chatbot's ability to handle complex queries.

Continuous model refinement: Language models, such as the Davinci base model, evolve over time as new updates and versions are released. To keep up with the latest advancements and improvements, it would be beneficial to periodically retrain and fine-tune the chatbot on updated models or larger datasets. This ensures the chatbot remains up-to-date and can provide more accurate and relevant responses.

User feedback and iterative improvements: Incorporating a feedback mechanism within the chatbot would allow users to provide feedback on the quality and accuracy of the responses. This feedback can be used to identify areas for improvement and iteratively enhance the chatbot's performance over time.

Error handling and fallback responses: In cases where the chatbot encounters queries it cannot handle or when it fails to generate a suitable response, it is important to implement robust error handling mechanisms and provide appropriate fallback responses. This ensures that users receive a satisfactory experience even in scenarios where the chatbot may encounter limitations.

Ethical considerations: As with any AI-powered system, it is crucial to address ethical considerations, such as privacy, data security, and bias. Proper measures should be implemented to protect user data, ensure transparency in the chatbot's operations, and mitigate biases that may arise from the training data or model.

By addressing these limitations and focusing on continuous improvement, the chatbot can evolve into a more robust and reliable tool, offering an enhanced user experience and greater utility for SAP LABS and its website visitors.

**5.3 Recommendations for future research or development in the field**

In the field of chatbot research and development, there are several areas that hold potential for future exploration and advancements:

Multilingual and cross-cultural chatbots: Expanding the capabilities of chatbots to support multiple languages and effectively communicate across various cultures can greatly enhance their usability and global reach. Research efforts could focus on developing multilingual models, understanding cultural nuances in language, and creating systems that adapt to diverse user contexts.

Contextual understanding and personalization: Improving chatbots' ability to understand and respond contextually is an important area for development. This includes capturing conversational context, user history, and preferences to provide personalized and tailored responses. Research could explore techniques like memory networks, reinforcement learning, or attention mechanisms to enhance contextual understanding.

Explainability and transparency: Addressing the "black box" nature of AI systems is crucial for building trust and understanding. Research can focus on developing methods to explain chatbot responses, providing transparency into their decision-making process, and allowing users to understand how and why specific answers are generated.

Integration of multimodal inputs: Chatbots primarily operate through text-based interactions, but integrating other modalities such as images, voice, or gestures can enhance user experiences and enable more natural interactions. Future research can explore methods for incorporating and processing multimodal inputs effectively.

Emotional intelligence and empathy: Developing chatbots with emotional intelligence and the ability to empathize with users can greatly improve user satisfaction and engagement. Research could explore techniques to recognize and respond to emotions expressed in user input, enabling chatbots to provide empathetic and supportive interactions.

Human-in-the-loop chatbot systems: Building chatbot systems that seamlessly integrate with human agents can create hybrid systems that leverage the strengths of both automation and human expertise. Research efforts can focus on developing strategies for smooth handoff between chatbots and human agents, effectively managing user expectations, and optimizing collaboration between humans and AI.

Ethical considerations and bias mitigation: As AI technologies continue to advance, ensuring ethical use and addressing biases is of paramount importance. Future research can explore approaches to mitigate biases, promote fairness and inclusivity, and establish guidelines for responsible development and deployment of chatbot systems.

By focusing on these areas of research and development, the field of chatbots can advance towards more sophisticated, context-aware, and user-centric conversational agents, unlocking their potential to revolutionize various industries and domains.

**CHAPTER 6**

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