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A SMART CHATBOT SYSTEM FOR DIGITIZING SERVICE MANAGEMENT TO IMPROVE BUSINESS CONTINUITY

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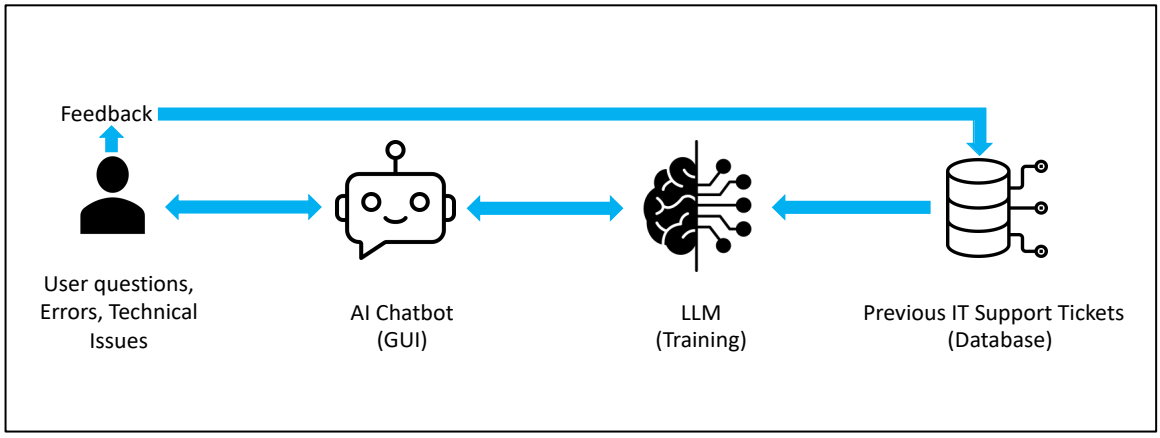

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Cover: Developing AI Chatbot for the IT support

(Photo: By Asraa Mohammed Yousef Albeshr)

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Declaration of Original Work

I, Asraa Mohammed Yousef Albeshr, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled "*A Smart Chatbot System for Digitizing Service Management to Improve Business Continuity*", hereby, solemnly declare that this is the original research work done by me under the supervision of Dr. Fady Alnajjar, in the College of Information Technology at UAEU. This work has not previously formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

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Abstract

Chatbots, also called digital systems that require a natural language-based interface for user interaction, are increasingly being integrated into our daily lives. These chatbots respond intelligently to voice and text and function as sophisticated entities. Its functioning includes the recognition of multiple human languages through the application of Natural Language Processing (NLP) techniques. These chatbots find application in various areas such as e-commerce services, medical assistance, recommendation systems, and educational purposes. This reflects the versatility and widespread adoption of this technology. AI chatbots play a crucial role in improving IT support in IT Service Management (ITSM) for better business continuity. By automating routine tasks, these chatbots significantly help streamline operations, improve overall service delivery, and ensure efficient and effective support to users. This integration of AI into ITSM not only increases the speed of problem resolution, but also contributes to a more seamless and responsive IT environment, ultimately promoting smoother business operations. Research on the digitization of manual processes is critical to gain insights into their impact, identify opportunities and challenges, guide policies and decisions, promote innovation, and improve education and training. In this context, the integration of chatbots is proving to be an important component in the digitalization of processes, offering companies and organizations numerous advantages. In this research, I introduced a model designed to refine chatbot responses to user questions, making it an invaluable asset for study. The model performed admirably, achieving an accuracy rate of 90%. Moreover, I conducted a survey involving IT officers from the same organization to assess the effectiveness of the chatbot system more accurately and identify areas for refinement. Based on the outcomes of both the model and the survey evaluation, the proposed model shows promise in digitizing service management, thereby enhancing business resilience.

Keywords: Digital transformation, IT service management, customer-centric approach, bsiness continuity, AI.

Title and Abstract (in Arabic)

نظام (Chatbot) جديد لرقمنة إدارة الخدمات لتحسين استمرارية الأعمال

الملخص

يتم دمج chatbots، والتي تسمى أيضًا الأنظمة الرقمية التي تتطلب واجهة قائمة على اللغة الطبيعية لتفاعل المستخدم، بشكل متزايد في حياتنا اليومية. تستجيب روبوتات الدردشة هذه بذكاء للصوت والنص وتعمل ككيانات متطورة. يتضمن عملها التعرف على اللغات البشرية المتعددة من خلال تطبيق تقنيات معالجة اللغة الطبيعية (NLP). تجد روبوتات الدردشة هذه تطبيقًا في مجالات مختلفة مثل خدمات التجارة الإلكترونية والمساعدة الطبية وأنظمة التوصية والأغراض التعليمية. وهذا يعكس تنوع هذه التكنولوجيا واعتمادها على نطاق واسع. تلعب روبوتات الدردشة المدعمة بالذكاء الاصطناعي دورًا حاسمًا في تحسين دعم تكنولوجيا المعلومات في إدارة خدمات تكنولوجيا المعلومات (ITSM) لتحسين استمرارية الأعمال. من خلال أتمتة المهام الروتينية، تساعد روبوتات الدردشة هذه بشكل كبير في تبسيط العمليات وتحسين تقديم الخدمات بشكل عام وضمان الدعم الفعال للمستخدمين. لا يؤدي دمج الذكاء الاصطناعي في خدمات إدارة خدمات تكنولوجيا المعلومات (ITSM) إلى زيادة سرعة حل المشكلات فحسب، بل يساهم أيضًا في توفير بيئة تكنولوجيا معلومات أكثر سلاسة واستجابة، مما يؤدي في النهاية إلى تعزيز العمليات التجارية الأكثر سلاسة. يعد البحث حول رقمنة العمليات اليدوية أمرًا بالغ الأهمية للحصول على رؤى حول تأثيرها، وتحديد الفرص والتحديات، وتوجيه السياسات والقرارات، وتشجيع الابتكار، وتحسين التعليم، والتدريب. وفي هذا السياق، أثبت تكامل روبوتات الدردشة أنه عنصر مهم في رقمنة العمليات، مما يوفر للشركات والمؤسسات العديد من المزايا. في هذا البحث، قدمت نموذجًا مصممًا لتحسين استجابات chatbot لأسئلة المستخدم، مما يجعله رصيدًا لا يقدر بثمن للدراسة. كان أداء النموذج رائعًا، حيث حقق معدل دقة يصل إلى 90%. علاوة على ذلك، قمت بإجراء دراسة استقصائية شملت مسؤولي تكنولوجيا المعلومات من نفس المؤسسة لتقييم فعالية نظام chatbot بشكل أكثر دقة وتحديد المجالات التي تحتاج إلى تحسين. واستنادًا إلى نتائج كل من النموذج وتقييم المسح، يظهر النموذج المقترح واعدًا في رقمنة إدارة الخدمات، وبالتالي تعزيز مرونة الأعمال.

مفاهيم البحث الرئيسية: التحول الرقمي، إدارة خدمات تكنولوجيا المعلومات، النهج المرتكز على العملاء، استمرارية الأعمال، الذكاء الاصطناعي.

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Dedication

I dedicate this thesis to my beloved father, Mohammed Yousef Albeshr, whose support has been the guiding light throughout my academic journey. To my family and friends, your love, strong belief, and constant encouragement have continuously pushed me towards this achievement. This thesis stands as proof to the invaluable support, belief, and inspiration each of you has shown me throughout the journey.

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List of Abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
IT	Information Technology
ITSM	IT Service Management
LLM	Large Language Model
ML	Machine Learning
NLP	Natural Language Processing

Chapter 1: Introduction

1.1 Overview

Chatbots also called digital systems that requires a natural language-based interface for interacting with users, are used more and more in our daily lives (Viduani et al., 2023). A chatbot responds as an intelligent entity when spoken via speech or text. This digital system recognizes more than one human languages with the help of Natural Language Processing (NLP) techniques (Sansonnet et al., 2006). The thought is to recreate human discussions wherein one end is client, and another end is a machine. E-commerce services, medical assistance, recommender systems, and educational purposes are just a few of the many areas where these bots have found use. Different terminologies used for chatbots are virtual agent, chatterbot, conversational user interface. These chatbots are publicly accessible through an integrated messaging service. Messaging services are often text based, making it more convenient for users to interact with the chatbot system. Rule based chatbots are based on dialogues. This type of chatbot generates dialogs based on some predefined rules. Smart chatbots, on the other hand, use Artificial Intelligence (AI) algorithms that understand the information and respond quickly to the user (Hussain et al., 2019).This way, chatbots are accessible in the form of websites and software.

To understand user input and generate relevant responses, chatbots utilize NLP and ML techniques. The earliest chatbots were created in the mid-twentieth century (Adamopoulou & Moussiades, 2020). In 1991, the term "Chatterbot" made its debut, starting with a TINYMUD virtual player that became favoured for chatting among real human players (Mauldin, 1994). Dr. Sbaitso, introduced in 1992, demonstrated the capabilities of sound cards by functioning as a straightforward chatbot psychologist. In 1995, ALICE inspired by ELIZA, relied on pattern-matching but initially lacked in-depth conversational abilities (Wallace, 2009; Bruno et al., 2013). The creation of AIML distinguished ALICE from its predecessors. A significant milestone occurred in 2001 with SmarterChild as discovered by Molnar and Szuts (2018) offering practical assistance to users. Smart personal voice assistants like Siri, the Watson assistant, the Google Assistant, Cortana, and Alexa entered the scene connecting to the Internet and delivering meaningful responses (Apple, 2023; IBM, 2020; Google, 2019; Microsoft, 2023; Bizzaco et al., 2023).

although they occasionally grappled with nuances in spoken language (Hoy, 2018). In 2016, the rise of social media allowed for the creation of brand specific chatbots, resulting in 34,000 such chatbots by the end of the year, spanning a multitude of fields (Powton, 2018). Numerous text based chatbots were also developed for messaging platforms, industries, and research.

Almost 88% of chatbots rely on rules to communicate with users and the rest chatbots use AI to reply to users. AI was able to generate human like responses for users, making it more useful to include AI in chatbot conversations. AI algorithms used in chatbot development are Machine Learning (ML) algorithms and NLP algorithms (Abdul-Kader & Woods, 2015). ML algorithms work on the principle of training and testing data. In chatbot systems, these algorithms learn from previous conversations, understand the newly entered data, and generate an appropriate response (Alhassan et al., 2022).Whereas, NLP is another branch of AI that helps us understand natural language. NLP algorithms are able to understand the input, identify the input patterns and generate appropriate responses (Jha et al., 2022). Nowadays, chatbots are using AI algorithms and are becoming an important part of the chatbot application development process. Chatbot are a key tool in digitalization efforts because they can automate routine tasks and provide instant, personalized assistance to customers.

In addition, chatbot can help businesses gather valuable data about their customers, such as their preferences and purchasing habits. This data can be used to improve marketing efforts and product development (Vaidyam et al., 2019). Chatbots can quickly answer customer questions without needing humans. This can make customer service better and save staff time. But sometimes, customers don't like how chatbots work. They might give wrong answers, and this difference between what customers want and what the chatbot does can make customers behave in a way companies don't like, like not following the rules. One of the biggest challenges chatbots have nowadays been that they struggle with understanding and using natural language effectively. Sometimes, they can't understand what someone is saying, which leads to confusion and frustrating interactions.

ITSM encompasses all the managerial aspects of IT businesses (Brás et al., 2023; Bharadiya, 2023). Nowadays, nearly every software company has a dedicated team of IT

experts responsible for addressing the issues faced by other employees within the company. In the traditional process, when an end user encounters any problem, issue, or question, they create a ticket. This ticket is then placed in a queue and assigned to an ITSM department employee (Powton, 2018). The end user must wait until their query is assigned to an ITSM employee, which can sometimes take several days, causing delays in their work. Once the ticket is assigned, the ITSM employee communicates with the end user to resolve the issue, and once resolved, the ticket is closed.

To make IT support better in ITSM, AI chatbots plays an important role in ITSM and business continuity by automating routine tasks, improving overall service delivery, and providing users with efficient and effective support to make their operations run more smoothly. Moreover, in the context of business continuity, chatbots and AI technologies can also be used to evaluate and understand data from IT systems and find potential risks and weaknesses. For example, companies can use chatbots to watch their IT systems for strange behavior and notify IT staff of possible dangers. Additionally, AI algorithms can be used to look at data from IT systems and find possible threats like malware or attempts to steal information through phishing. Ultimately, integrating chatbots and AI technologies into ITSM and business continuity can help organizations optimize their processes, improve customer service, and lessen the impact of disruptions (Miklosik et al., 2021). AI chatbot can support ITSM change management by automating routine tasks like planning and approval workflows and providing status updates to stakeholders. Additionally, AI chatbot can be used to collect and store knowledge from a variety of sources, including documentation, blogs, and forums. These knowledge sources can then be used to provide users with relevant and accurate answers to ensure knowledge management. In general, AI chatbot can contribute to ITSM by providing faster and more effective support to users, reducing the workload of IT support staff, and increasing the quality of service. They can also help reduce costs and improve business continuity by automating routine tasks and offering real-time support (Viduani et al., 2023).This can be especially crucial in times when disruptions like the COVID-19 pandemic may cause businesses to have fewer employees or fewer hours. Also, due to pandemic, organizations can deliver remote services. Organizations can utilize chatbots to deliver services remotely, enabling consumers to communicate with them anytime, from any place continuity (Mora et al.,

2014). This not only furnishes a service that is more convenient and reachable but also assists enterprises to adjust to variations in the choices and actions of customers. By enabling remote service delivery, collecting valuable data, and providing prompt and dependable customer service, chatbots can serve as a digital solution and aid in business.

In the proposed study, I will create a chatbot that can seamlessly work with any ITSM application which is robust, accurate, and efficient as compared to traditional methods, which are more costly and time consuming as it shown in Figure 1. Users won't have to raise a ticket whenever an issue arises. They can instead take part in a two way text conversation with the chatbot. Diverse natural language model trained for the development of smart ITSM chatbot. Users can input their concerns in everyday language, and the chatbot will process this using NLP.

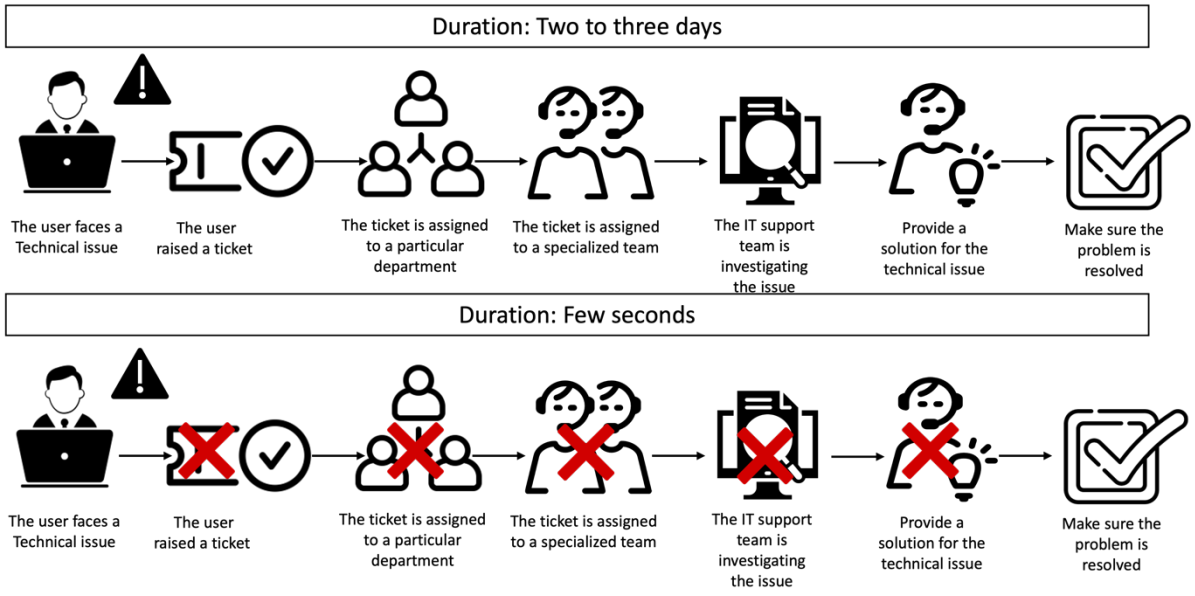


Figure 1: Rapid Technical Issue Resolution

1.2 Research Objectives

The main objective of this research is to use the natural language model algorithms for ITSM chatbot development to understand user input in the form of text and understand the context of the input and respond accordingly. Thus, the research objectives of proposed study are:

- Development of smart chatbot system for the digitization of service management and business continuity in such a way that it can be integrated into existing IT systems and processes, such as incident management system.
- Effective chatbot system to ensure, it is trained using natural language model algorithms that allow it to learn from interactions with users and improve over time.
- Implementation of text communication between chatbot and user using NLP techniques.
- Customized and adaptable chatbot that utilizes historical data collected from a sample organization to automate ITSM processes. Chatbot model will learn from over 2000 recorded datasets of how IT service officers have resolved customer issues over the past three months. The chatbot can access relevant data and provide accurate and timely responses to service requests.

All told, an optimally planned chatbot system for computerizing service operations can improve operational consistency and provide productive replies to service petitions, reducing service disruption, and helping enterprises to run fluently.

1.3 Research Questions

Based on the above motivation and issues discussed, there is need to find the answers to the following research questions:

RQ1: How effectively can the new chatbot system be integrated into existing service management tools and what challenges arise?

RQ2: What are the strengths and weaknesses of the smart chatbot system compared to traditional service management approaches in ensuring business continuity?

RQ3: To what extent does the implementation of the chatbot system help improve business continuity in service-oriented organizations?

1.4 Motivation of the Study

In the United Arab Emirates, the use of manual methods by certain organizations may lead to issues such as inaccuracies, inefficiencies, and delays, owing to the absence of rigorous controls and supervisory systems. Furthermore, manual operations may be

more susceptible to fraudulent or abusive activities. Consequently, the UAE should continue to prioritize the digitization of operations and decrease reliance on manual techniques to ensure better governance and efficiency.

Conducting research on the digitalization of manual processes is imperative for comprehending its impact, identifying opportunities and challenges, informing policy and decision making, fostering innovation, and improving education and training. The integration of chatbot is a vital component in the digitalization of processes as they offer various benefits to businesses and organizations. Their deployment facilitates the transition from manual processes to digitalized ones.

Additionally, the method that I am implementing is smart, which is building chatbot using open AI. Moreover, research will increase the knowledge and awareness about the benefit of digitization. It will depict that automation and efficiency is possible by digitalization, which can result in higher productivity. Furthermore, the adoption of digital technology enables businesses to innovate and respond rapidly to shifting market conditions, perhaps increasing their competitiveness.

1.5 Risk and Challenges

The research may be subject to certain risks, notably errors in the system that may result in work delays. Strategies to mitigate this risk involve taking care and attention while working with the system and ensuring that the codes employed are correct. Another potential challenge pertains to data cleaning, which is time consuming and resource intensive. To avoid this, IT support users will be requested to participating in providing the clear, thus facilitating the process of training the system.

1.6 System Overview

In proposed study, I will explore the literature review, methodology of study, experiment, and results and then discussion and conclusion of study in detail as illustrated in Figure.

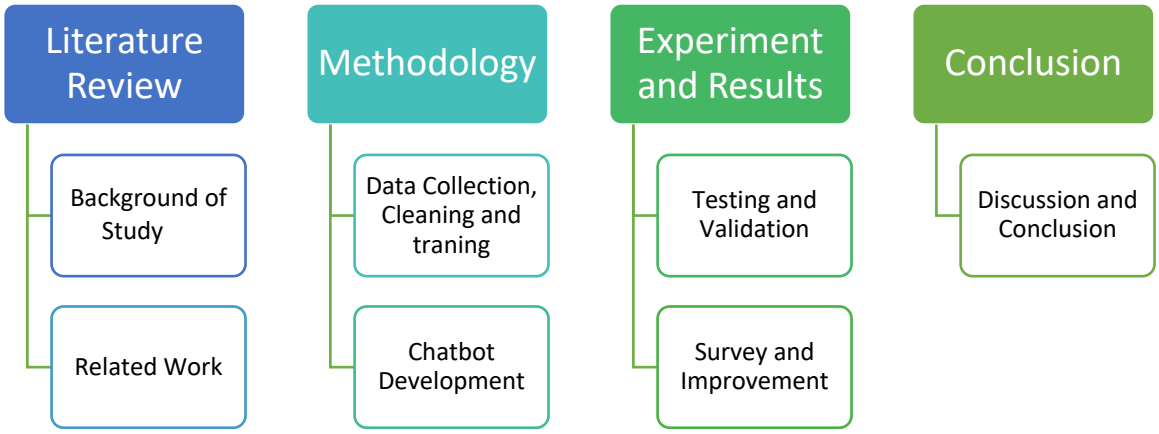


Figure 2: System Overview

In the first phase, I will do the literature research on available technologies for ITSM. In second phase, I will define the methodology proposed for the system. The research process will commence with data collection, followed by data cleaning involving the elimination of redundancies and missing values. Additionally, AI tools such as neural networks and ML algorithms are essential for the chatbot to comprehend and interpret user input and generate appropriate responses. Cloud based servers, data storage options, and API connectors with other applications are also necessary to host the chatbot and enable its functioning. Moreover, a programming background is crucial for planning, testing, and developing a successful chatbot. Factors such as user experience, conversational flow, and answer accuracy must be carefully considered, and testing with actual users is crucial to identifying and addressing problems. Once the data is prepared, the chatbot will be constructed using a large language model LLM trained on the collected datasets. In third phase, I will perform experiments and validate the results. The chatbot will then be tested, and users from the IT support domain will be invited to use the system and provide feedback via a survey to assess their experience with the new system. The accuracy of the chatbot will be verified, and any necessary improvements or developments will be identified. In the last phase of study, I will discuss the results and conclude the study.

Chapter 2: Literature Review

In today's era, creating a conversational chatbot no longer demands advanced coding expertise, as numerous platforms enable users to construct lead generation chatbots without having to write code themselves. These chatbots can be seamlessly integrated into various communication channels and rapidly deployed as customer service agents. Information extraction and user intention identification are prominent research areas in NLP. Over the years, numerous models have been proposed by researchers (Miklosik et al., 2021). A chatbot usually works by using information it already has to chat with users and answer their questions. However, Sameera et al. as cited in Abdul-Kader and Woods (2018) suggest a different approach. They propose creating a chatbot that doesn't have its own knowledge but instead looks up answers on the internet when users ask questions. To do this, their work suggests using a toolkit and a chatterbot for understanding human language. They recommend a strategy where the chatbot matches the user's inquiry to a resource of replies and selects the most applicable response. This enables the chatbot to offer details even if it has not already learned it. On the other hand, Lee et al. (2018) address a different challenge, particularly, in the development of companion robots for children. They emphasize the significance of having high quality question answer pairs for these robots to interact effectively with kids. Lastly, Niranjan et al. (2012) have introduced an interactive conversational system tailored for students. This system employs the Naïve Bayesian concept to function as a virtual teacher, capable of responding to student queries in an interactive manner using a chat agent.

A study conducted by Kulkarni et al. (2017) suggested that the creation of a chatbot system tailored for the banking industry. They identify a common issue: people are naturally cautious when it comes to their finances, and banking service users often have questions that need timely answers, even outside regular customer service hours. To address this, the paper proposes developing a chatbot system to handle customer queries. Their approach involves building a dataset by collecting frequently asked questions from various banking platforms (Kulkarni et al., 2017). They utilize the natural language toolkit to process human language and employ the bag of words method to convert words into numerical vectors. While the paper provides a comprehensive explanation of the

technologies employed in the chatbots development, there are a few limitations to their proposed system. They use relatively basic ML algorithms, even though more advanced deep learning algorithms are available.

Furthermore, Gupta et al. (2015) developed a website based chatbot implemented using RiveScript which assists customers in selecting the most suitable product for their needs. Another chatbot, utilizing AIML and LSA, relies on a dataset of Frequently Asked Questions (FAQs) to interact with users (Adamopoulou & Moussiades, 2020). Sonawane and Shanmughasundaram (2019) also put forth the idea of creating a chatbot system tailored for a college setting. Their rationale for developing such a system stem from the fact that it can be challenging and overwhelming for college staff to be available round the clock to answer students' inquiries. In their chatbot development approach, the paper relies on the Facebook Messenger Application Programming Interface (API) to handle NLP tasks. However, it's important to note that the paper's contribution to the field of NLP is somewhat limited. This limitation arises from the fact that the paper primarily utilizes standard APIs for chatbot development, and it doesn't delve deeply into addressing the inherent challenges of NLP.

Furthermore, Nuruzzaman and Hussain (2018) introduced the Seq2Seq model as an approach to chatbot development and conversational modelling. This model offers a significant advantage by adopting an end to end approach, where a single model is constructed to encompass the entire chatbot development process, eliminating the need for multiple models to address individual subtasks. Su et al. (2018) highlighted an often overlooked demographic group, the elderly, who face challenges in engaging in meaningful conversations due to various constraints. To address this issue, the authors suggest the development of a chatbot system designed to have friendly and casual conversations with elderly individuals. Their approach involves building a database with over two thousand message response pairs to facilitate these interactions. A lot of academic researchers have put forth efforts towards developing chatbot applications which are adept in carrying out interactions with humans that mirror natural conversations (Aslam, 2023). To aid the chatbot in recalling the setting of the conversation, a mechanism known as "long short term memory" has been suggested. However, it should be highlighted that the study does not delved into the ways on how unstructured data is dealt

with in this particular context. However, achieving this level of sophistication remains a significant challenge (Nuruzzaman & Hussain, 2018). Based on a summary of the literature, the following limitations are evident in the quest for efficient and effective chatbot conversations:

- Many previous chatbots have been constructed using fixed sets of rules and template-based matching, which restricts their ability to handle diverse and dynamic conversations.
- Chatbots often rely on simplistic ML approaches, which hinder their adaptability and responsiveness to user inputs.
- Existing chatbots often struggle to recognize and correct grammatical errors in user queries, which can lead to misunderstandings and inaccurate responses.
- Most chatbots are proficient at answering questions within a predefined closed domain, relying on specific information stored in their databases. They struggle with handling queries that fall outside these boundaries.
- Previous chatbots frequently lack robust NLP capabilities, both in generating responses and comprehending user queries in a nuanced way.

Chatbots generally cannot detect the emotions conveyed in a user's conversation, making it challenging to provide empathetic or contextually appropriate responses (Niranjan et al., 2012). In essence, while chatbot technology has made significant progress, these drawbacks underscore the ongoing challenges in creating chatbots capable of truly natural and human like conversations. Researchers and developers continue to work on addressing these limitations to enhance the capabilities and usability of chatbot systems.

To accurately respond to queries posed by users and comprehend user input, IBM Watson Assistant makes use of cutting edge NLP methods (Kulkarni et al., 2017). The system can respond appropriately to user input in multiple languages. Users can use the chatbot interface to access their ITSM data and services.

In general, IBM Watson Assistant is a potent ITSM chatbot solution with advanced NLP capabilities, seamless integration with ITSM platforms, self-service capabilities, and multichannel support to increase customer satisfaction and efficiency. As a whole, IBM Watson chatbot is assisting his customers with digitization and business continuity by

providing automated support, streamlining incident management, enabling self-service support, and collecting valuable data insights (Moutsana et al., 2023). Godse et al. (2018) has developed a chatbot designed exclusively for employees of software companies. This chatbot uses Natural Language Processing (NLP) to understand user input and create relevant responses that help resolve queries. Using IBM Watson Conversation APIs, the chatbot makes autonomous decisions to answer user queries while maintaining the context of the conversation. Additionally, tasks such as generating tickets can be performed on behalf of users. To this effect, IBM (2020) designed the implementation of the chatbot based on IBM's Watson Assistant. The web based conversational chatbot has advanced dialog support capabilities and demonstrates a satisfactory understanding focused on delivering immediate and reliable information.

Pradhan et al. (2022) have introduced an improved IT Service Management System (ITSM) that includes technologies such as chatbots and data visualization. To address IT concerns efficiently, they developed a resilient service management framework based on the ITIL framework that goes through three key phases: reporting, managing and resolving issues (Van Veldhoven & Vanthienen, 2021). The main goal of the ITSM system is to restore the smooth flow of daily business processes after ticket resolution (Wang et al., 2022; Ratnawita, 2023). The chatbot serves smaller user needs without requiring the creation of a ticket in the ITSM system.

Robotic Process Automation (RPA) has emerged as a software based solution for automating rule based business processes characterized by routine tasks, structured data and predictable results. Aguirre and Rodriguez (2017) conducted a case study at a Business Process Outsourcing (BPO) provider to examine the benefits and results of applying RPA to a service oriented business process that includes both front and back office activities. The results show that the main benefit of RPA is increasing productivity (Aguirre & Rodriguez, 2017).

The study by Kelly et al. (2022) explored how AI chatbots might change how we do things in the next ten years, focusing on mental health care, online shopping, and online banking. After surveying 360 people, the results suggest that people are more likely to use AI chatbots if they find them useful and trustworthy, but the importance of ease of use and

privacy concerns varies in each area. The research emphasizes the need to customize strategies for building trust in AI chatbots across different fields and considers factors like age and knowledge in understanding people's attitudes. Aslam (2023) also underscored that the integration of AI especially chatbots in the healthcare sector is vital. While these chatbots can give helpful advice like humans, there are concerns about privacy and ethics in using AI in healthcare. The research suggests creating rules for responsible AI use and highlights the potential of AI chatbots in places like libraries, but emphasizes the need for caution and ongoing research to ensure their safety and helpfulness.

Moreover, Bharadiya (2023) looked into how businesses struggle with using Artificial Intelligence (AI). They found that companies have a hard time figuring out how AI can be useful and how to use it well. Not knowing enough about AI and how it can help is a big problem. The study also talked about things that can help or stop companies from using AI. They explored different types of AI in companies and how it affects their work. The results showed that using AI is not easy for businesses. The study stated that people in charge of companies should learn more about AI, and the government should make rules that help AI be used more and support research on it. Another recent study by Wang et al. (2022) found that using chatbots is becoming really important for businesses. They looked at how 294 marketing employees in the U.S. use chatbots and found that when used in clever ways, chatbots make businesses more flexible. This means they can adapt better, both inside the company and in dealing with customers. However, the study also pointed out some limits, like only focusing on U.S. employees, and suggests we need better ways to measure how well chatbots are doing. Overall, the research shows that using chatbots in a smart way can make businesses more flexible and improve customer service (Table 1).

Table 1: Table of Literature Review

No	Author (s) and Year	Title of Source	Findings	Limitations
1	Abdul-Kader and Woods (2018)	Question answer system for online feedable new born Chatbot.	The 2017 Intelligent Systems Conference (IntelliSys 2017) is designed for an online environment, indicating an application that involves dynamic and real-time interactions, possibly with an ability to adapt to changing information.	The paper was presented in 2017, and the field of Chatbots and AI has seen rapid advancements. The findings may not reflect the most recent developments in technology or methodologies for building Chatbots.
2	Aguirre and Rodriguez (2017)	Automation of a business process using Robotic Process Automation (RPA): A case study.	The case study found that businesses can implement Robotic Process Automation (RBA) which is a software that enhances automation.	The study did not involve testing the application of RPA in cases where customers are directly involved
3	Aslam (2023)	The Impact of Artificial Intelligence on Chatbot Technology: A Study on the Current Advancements and Leading Innovations.	AI advancements have influenced and improved the user experience of chatbots. This could encompass improvements in conversational abilities, response accuracy, and overall user satisfaction.	The study does not comprehensively cover all industries where chatbots are being applied. Certain sectors or niche applications are overlooked, affecting the generalizability of the findings.
4	Bharadiya (2023)	The Impact of Artificial Intelligence on Business Processes.	AI algorithms to can be used to analyse large datasets and assist in strategic decision-making within companies.	There may be a bias towards positive impacts, as the study might be more inclined to highlight success stories and positive outcomes of AI integration in business processes.

Table 1: Table of literature Review (Continued)

No	Author (s) and Year	Title of Source	Findings	Limitations
5	Brás et al. (2023)	Intelligent Process Automation and Business Continuity: Areas for Future Research.	Intelligent process automation contributes to business continuity. This automation helps in streamlining operations, reducing errors, and improving overall resilience in the face of disruptions.	Depending on the publication date, the paper might not capture the very latest advancements or trends in intelligent process automation or business continuity.
6	Gupta et al. (2015).	An E-Commerce Website based Chatbot.	Chatbots are designed and implemented for an e-commerce websites. This include information on technologies like Natural Language Processing (NLP) capabilities, and integration with the e-commerce platform.	The limitations might involve dependencies on specific technologies or platforms. The chatbot's performance may be influenced by the capabilities and limitations of the technology stack used.
7	Kelly et al. (2022)	A Multi-Industry Analysis of the Future Use of AI Chatbots.	Chatbots are being employed to enhance customer service, streamline processes, or improve user experiences in various sectors.	Certain industries are given more attention than others making the findings not provide a fully balanced understanding of chatbots usage across all sectors.
8	Kulkarni et al. (2017)	Bank chat bot – An intelligent assistant system using NLP and machine learning.	NLP and machine learning techniques employed in the development of the Bank Chat Bot provide details on how the system processes and understands user queries, as well as the algorithms used for machine learning-based tasks.	According to the authors, the Bank Chat Bot relies on historical data for training machine learning models, the limitations might include challenges related to data quality, biases, or limitations in the dataset.

Table 1: Table of Literature Review (Continued)

No	Author (s) and Year	Title of Source	Findings	Limitations
9	Lee et al. (2018)	Automatic question generation from children's stories for companion chatbots.	The methodology and techniques used for automatic question generation involve Natural Language Processing (NLP) and machine learning methods employed to analyse and extract questions from children's stories.	The limitations involve challenges related to how children interact with the companion chatbots.
10	Miklosik et al. (2021)	The Use of Chatbots in Digital Business Transformation: A Systematic Literature Review.	The role of chatbots in streamlining processes involves enhancing customer experiences, or contributing to organizational efficiency.	The paper may acknowledge the dynamic nature of technology. Given the rapid advancements in chatbots technology and digital business strategies, the findings may become outdated over time.
11	Moutsana et al. (2023)	A Conversational Web-Based Chatbots to Disseminate COVID-19 Advisory Information.	The Conversational Web-Based Chatbots are effective in disseminating COVID-19 advisory information.	The effectiveness of a web-based chatbot is dependent on internet access.
12	Niranjan et al. (2023)	An intelligent question answering conversational agent using Naïve Bayesian classifier.	The conversational agent uses machine learning algorithm to analyze and process user queries to provide intelligent responses.	Limitations include the choice of performance metrics used to evaluate the conversational agent.

Table 1: Table of Literature Review (Continued)

No	Author (s) and Year	Title of Source	Findings	Limitations
13	Nuruzzaman and Hussain (2018)	A Survey on Chatbot Implementation in Customer Service Industry through Deep Neural Networks.	The use of deep neural networks for implementing chatbots uses deep learning techniques, such as neural networks leveraged to enhance the capabilities of chatbots in understanding and responding to customer queries.	The focus is solely on deep neural networks limiting the applicability of such advanced techniques in all customer service
14	Pradhan et al. (2022)	ITSM Using AI Chat-Bot and Data Visualizers.	AI chat-bots are implemented in ITSM where AI algorithms are used in integration with ITSM tools.	AI chat-bots and data visualizers have issues with compatibility, scalability, or resource requirements
15	Ratnawita (2023)	Digital Transformation in Business Management: Opportunities, Challenges and Implications.	Technological advancements can create new revenue streams, enhance customer experiences, and improve operational efficiency.	Certain aspects of digital transformation or business management are excluded.
16	Sonawane and Shanmughasun-daram (2019)	ChatBot for college website.	ChatBot responds to user queries and navigates through the college website's content.	Some functionalities or use cases of the chatbot are excluded since its specifically meant for college
17	Su et al. (2018)	A chatbot using LSTM-based multi-layer embedding for elderly care.	The use of Long Short-Term Memory (LSTM) networks and multi-layer embedding contribute to the chatbot's functionality.	The effectiveness of the chatbot may be influenced by specific characteristics of the elderly population targeted in the study.

Table 1: Table of Literature Review (Continued)

No	Author (s) and Year	Title of Source	Findings	Limitations
18	Van Veldhoven and Vanthienen (2023)	Digital transformation as an interaction driven perspective between business, society, and technology.	Macro understanding of digital transformation and can be used as a lens for further research to generate fresh insights into unanswered research avenues.	There are issues related to system complexity, resistance to change, or unforeseen disruptions.
19	Wang et al. (2022)	How does artificial intelligence create business agility? Evidence from chatbots.	Chatbots serve as catalysts for organizational change by streamlining communication, automating processes, and enabling quick responses to market dynamics.	The effectiveness of chatbots is influenced by the existing technological landscape and the readiness of the organization to adopt AI solutions.

Chapter 3: Methodology

I start my research contribution with defining the scope and the and the objective of the research, which is find a way to automate the It support tasks when it’s come to resolving tickets. In computers and engineering, there is a need to solve problems quickly. However, individuals sometimes need more time to address these concerns. Imagine having an intelligent computer assistant, like an intelligent chatbot, that can quickly understand and improve things. By creating an AI chatbot for IT support, I can make fixing computer issues much quicker and easier. This chatbot uses clever technology to understand what you need and helps you right away. It's like having a super helper for computer troubles. This not only helps the people who use computers but also makes the IT support team work better.

IT support teams deal with a range of incidents, including hardware glitches like computer malfunctions, software bugs, network connectivity issues. They also handle everyday challenges like forgotten passwords, server downtimes, and mobile device problems. Users may seek assistance with software applications, data recovery, or general IT inquiries. The development of AI chatbots for IT support aims to efficiently address these common incidents, providing quick and accurate solutions to enhance overall system reliability and user experience.

After defining the Scope and the objective I start to look at others work and collect the related works that are related to AI chatbot, natural language, and business continuity. Identifying their methodologies and best practices.

In comprehending user needs for the development of an AI chatbot for IT support, a multifaceted approach is undertaken. One crucial facet involves the implementation of surveys to systematically collect feedback from end users, enabling a quantitative analysis of their preferences, challenges, and expectations. The survey process allows for the identification of recurring patterns and the prioritization of features based on user demands. Furthermore, an in depth understanding of user requirements is achieved through qualitative means, I conduct an interview with expert IT end users. Which provides an invaluable opportunity to delve into the intricacies of their experiences, gaining insights into specific pain points and nuances that may not be apparent through

surveys alone. This interview facilitates a more nuanced comprehension of user expectations, allowing for the customization of the AI chatbot to align seamlessly with the real world needs of IT end users. By combining quantitative survey data with qualitative insights gathered through expert interviews, the user needs analysis becomes a robust foundation for tailoring the AI chatbot's capabilities. This approach ensures that the chatbot not only addresses common issues but also caters to the unique demands of expert IT end users, resulting in a more refined and user-centric solution.

To teach the smart AI chatbot well, I gather lots of different incident’s tickets. This helps the chatbot learn and get better. I use this information to train the chatbot and check how well it's doing. I make sure the information covers many different situations and is like what real users might ask. This way, the chatbot learns how to answers any questions related to computer issues people might have. Making sure it understands lots of different situations helps it be a helpful friend for everyone who needs computer support.

Manually cleaning and categorizing data is a crucial step in preparing information for the AI chatbot. This process involves carefully going through the data, removing any errors or irrelevant details, and organizing it into specific groups or categories.

Cleaning the data ensures that the information fed to the chatbot is accurate, free from mistakes, and suitable for training. It involves tasks such as fixing typos, removing duplicate entries, and handling any inconsistencies in the dataset.

Categorizing the data involves sorting it into different groups based on its content or purpose. For example, in the context of an AI chatbot for IT support, data might be categorized into groups like hardware issues, software glitches, or network problems. This categorization helps the chatbot understand and respond appropriately to different types of user queries.

The manual aspect of this process is important because it allows human judgment and expertise to play a role in refining the dataset. Human reviewers can interpret nuanced information and make decisions that contribute to the overall quality of the data, ensuring that the AI chatbot is trained on reliable and relevant information.

I chose Text- Davinci-003 natural language model as the foundation for my AI chatbot. Selecting the right language model is a crucial decision in shaping the chatbot's ability to understand and generate human like text. In this context, the Davinci-003 model stands out for its advanced capabilities in natural language processing. This model has demonstrated effectiveness in various language related tasks and exhibits a nuanced understanding of context, making it well-suited for creating a chatbot that can provide insightful and contextually relevant responses. By leveraging the strengths of the Davinci-003 model, I aim to enhance the overall conversational quality and intelligence of my AI chatbot in the field of IT support.

I take the chosen models and put them through a training process using the carefully prepared dataset. Training involves exposing the models to the dataset's examples, allowing them to learn patterns and relationships within the data. This step is crucial for enabling the models to understand and respond effectively to a variety of user inputs. Through training on the pre-processed dataset, the models refine their internal parameters, adjusting their behaviour to align with the specific goals and requirements of the AI chatbot for IT support. The training process essentially equips the models with the knowledge and capabilities needed to provide accurate and contextually relevant responses in real-world scenarios.

I assess the effectiveness of the chatbot by conducting a manual evaluation, employing surveys, and collecting feedback from users. This hands-on approach allows me to measure how accurately the chatbot is addressing user queries and meeting their expectations. Surveys provide a structured method for users to share their experiences and perceptions, while feedback offers valuable qualitative insights into specific areas for improvement. By combining both methods, I gain a comprehensive understanding of the chatbot's performance, enabling me to identify strengths and address any limitations. This iterative evaluation process ensures that the chatbot evolves to deliver a more precise and user-friendly experience over time.

Engaging in a proactive approach, I actively analyze user feedback to discern recurring issues and areas for improvement. By checking the insights shared by users, I gain valuable perspectives on the chatbot's performance and user experience. This

feedback serves as a guiding compass, directing the refinement of the model's responses and capabilities. Whether addressing specific pain points, clarifying misunderstandings, or accommodating evolving user expectations, this iterative process ensures that the AI chatbot remains responsive and attuned to the dynamic needs of its users. Through the continuous integration of user insights, the chatbot evolves into a more adept and user-friendly tool, fostering a responsive and effective interaction with those it serves.

Chapter 4: Experiments and Implementation

In this section, I described the methods used in study as illustrated in Figure. The primary steps are collection of benchmark dataset, cleaning of benchmark dataset and its pre-processing, training and development of natural language model.

Figure 3: Steps for Proposed Methodology

4.1 Collection of Benchmark Dataset

In this study, I utilized a benchmark dataset consisting of accurate, clear, and relevant samples for the experimentation. To enhance system functionality and learn from user input, I sourced the data from a health insurance company that employs ITSM, specifically focusing on their service desk operations. In this study, the data I worked with was specifically categorized as "labeled incident response data." This means that each case was accompanied by a label or labels that identified the incident and how it was resolved.

The criteria for choosing the dataset are important, and I chose this dataset based on its relevance to the work at hand. This dataset encapsulates real-world scenarios that the model is likely to encounter, providing a comprehensive and practical foundation for training.

Beyond its relevance, the dataset boasts diversity in incidents. It does not focus solely on one issue but encompasses diverse styles of incidents that users can also stumble upon with These situations make certain that the version is exposed to a huge range of capacity challenges and make a contribution to its robustness in the contexts wherein it handles them correctly.

Furthermore, the excellent of the information is remarkable. The dataset is labeled, a characteristic that positively impacts the model training process. Labeled data provides a clear and structured foundation for the model to learn from, enhancing its ability to recognize and understand patterns. This ensures that the model is not only exposed to diverse scenarios but also has access to high quality, well-annotated information, thereby refining its learning process and overall performance.

Over a dedicated period of three months, I embarked on a meticulous journey of engagement with a substantial dataset. This dataset, comprising a larger pool of 4050 meticulously gathered data samples, is centered around the realm of technical issues and their resolutions. The primary aim throughout this endeavor has been to empower model with the ability to adeptly respond to user inquiries encompassing a wide spectrum of technical problems.

I take a subset comprising 2308 data samples from a vast collection. This wasn't a random selection, but a result of careful consideration focused on three key aspects: relevance, quality, and completeness. I delved into the expansive pool of service tickets, where users create requests that flow within an organization's systems. Amidst this diverse array, our selection criterion centered on tickets closely tied to our project's objectives during that specific period. Our choice of these 2308 samples wasn't arbitrary; it was a conscious effort to align our dataset precisely with the specific goals of our project. These samples were handpicked because they perfectly matched what I needed for our analysis. Moreover, they stand out for their richness in comprehensive and dependable information, making them incredibly conducive for thorough and detailed examination. The dataset I have worked with originates from various forms of service tickets, representing the interactions and requests made within the organizational systems. To ensure relevance, I specifically filtered and included tickets directly related to our project's context at that time. This approach was aimed at narrowing our focus to the most pertinent data points that aligned with our research objectives. I only choose tickets that are relevant to my project. My stringent approach in selecting these samples aimed not only for precision but also transparency. This transparency extends to acknowledging the limitations and potential biases inherent in our subset, paving the way for thorough ensuring the credibility of our analyses. These selected samples represent the very core of research efforts. They

serve a pivotal role in my quest to train the chatbot effectively, equipping it with the knowledge and capabilities required to address an array of technical inquiries posed by users. Furthermore, these data samples play an instrumental role in evaluating and fine tuning the performance of system, ensuring its readiness for real-world deployment. Also the dataset allows the chatbot to understand the nuances of different issues, leading to faster and more efficient incident resolution. This efficiency is crucial for maintaining productivity within the IT support framework.

What makes this dataset even more valuable is the fact that it was obtained from seven IT support employees who are experts in their field. These professionals were responsible for reviewing and resolving the incidents, bringing their real-world expertise into the dataset. This approach ensured that computer system learned from the insights and solutions provided by these IT experts, making it even more effective in assisting with various types of issues. In essence, data selection process was a meticulous and strategic step in crafting an effective and versatile computer system, enriched by the knowledge and experience of these IT support specialists.

4.2 Cleaning of Benchmark Dataset

In my research, I utilized a dataset comprising 2308 samples. I allocated 95% of the dataset for training the data and reserved 5% for testing purposes. The primary purpose of using a significant portion of the dataset for training is to allow the model to learn patterns and relationships within the data. The more data the model is exposed to during training, the better it can generalize and make accurate predictions on new, unseen data. the 95%-5% split is a common practice to strike a balance between providing enough data for the model to learn effectively and reserving a portion for robust evaluation, preventing overfitting, and simulating real-world performance scenarios. In addition to, This split is a common practice in machine learning for training model on a portion of data

After collecting the sample data, I performed data cleaning. This process includes removing or correcting inaccuracies, dealing with missing values, deduplicating entries. As this information may include personal or confidential details, I took steps to secure it and follow legal or regulatory requirements. Additionally, I ensured that any sensitive or confidential information was replaced with more general concepts. Data cleansing was

undertaken to assure precision, reliability, and consistency for informed decisions. Determining the relevance of data relies on incident type specificity, particularly concentrating on technical issues while excluding other incident categories like security breaches or customer complaints. This selective criterion involves assessing and including data that solely pertains to technical issues, setting them apart from a wider range of incident types such as security breaches or customer complaints. Once the benchmark dataset was collected, redundant, missing, and irrelevant data were cleaned and pre-processed. The collected data has been categorized as follows:

- 19.32% of incidents are related to Microsoft Office, which includes Outlook, Excel, Microsoft Teams, and PowerPoints.
- 33.70% are hardware incidents, which include PCs, laptops, monitors, mice, keyboards, printers, fax machines, and desk phones.
- 42.15% are software incidents, including systems, softphones, and PDF files.
- Lastly, 4.83% are connection incidents, which include VPN, network, and Wi-Fi issues.

4.3 Development and Training of Model

In this research, I used the extraordinary capabilities of an advanced Open AI language model known as "text-davinci-003" to power the chatbot at the core of investigation. This state-of-the-art model, which I affectionately refer to as LLM, represents a breakthrough in the realm of AI text completion systems. Its potential to transform approach to handling extensive volumes of textual data is nothing short of revolutionary.

4.3.1 A Powerful Research Tool

The integration of LLM into chatbot makes it a potent instrument for the research endeavours. By using its advanced capabilities, I Tried to improve research to new levels, I tried to understand how users talk and what they say. I looked really closely to find important information. The AI model name is GPT 3.5 and its Text davinci- 003 version, its created from open AI.

4.3.2 The Role of Programming Languages

I have employed three distinct programming languages, each with its unique role in the research:

- Python: Python, renowned for its versatility and extensive libraries, played a central role in the research journey. I utilized Python to execute the complex code necessary for training and fine-tuning the chatbot. Its data-crunching, machine learning, and natural language processing features rendered it the best fit for dealing with the extensive dataset.
- Hypertext Markup Language: Beyond the core functionality of the chatbot, I recognized the importance of providing users with an intuitive and visually pleasing interface. To accomplish this, I leveraged Hypertext Markup Language and Cascading Style Sheet. These web tools enabled us to fashion a friendly and visually appealing interface that further enriched the user experience.
- Cascading Style Sheets: I employed Cascading style Sheets to enhance the chatbot's aesthetics and usability, elevating the overall user experience.

4.3.3 Coding Steps: Building an AI Chatbot

- To create an AI chatbot, a series of steps need to be followed. The process starts with data file conversion to a ".txt" format. This conversion is essential to ensure that the data is in a compatible format for training and interaction with the AI model.
- Next, the data is trained using an AI model. This involves setting up a COLAB account and project, where the necessary code is copied from a provided sample URL. Additionally, the converted ".txt" file is uploaded to the project. Running the code is a crucial step, with attention to details such as ensuring the ".txt" file is correctly uploaded and creating an Open AI API key.
- Once the data has been trained with the AI model, the next phase is data-model testing. Users can test the trained model with various questions to evaluate its performance and accuracy.
- To make the chatbot accessible to users, deployment is done using GitHub and Streamlit. For this task, a GitHub account must be created, followed by installation

of the GitHub Desktop App. Afterwards, a public repository must be generated, and the "index.json," "app.py," and "requirements.txt" files must be uploaded to it.

- Finally, to enable interaction with the chatbot, a Streamlit account is created. A new app is set up in Streamlit using the GitHub repository, making the chatbot available for use. This comprehensive process ensures that the AI chatbot is properly configured, trained, tested, and deployed for user interaction.

4.4 Testing and Validation of the Model

4.4.1 First Phase

After completing the model training phase, I proceeded to test and validate its performance. To ensure the chatbot's effectiveness and gather valuable insights, I engaged with a group of five IT support engineers.

I designated 95% of the dataset for training, while reserving the remaining 5% exclusively for testing purposes. The testing process involved them posing ten randomly selected questions to the AI chatbot, allowing us to assess its responses across various scenarios and each IT engineer takes about 30 minutes to try the system. After the IT engineers have evaluated the system, they participate in a survey aimed at gathering feedback and insights regarding their experience. The survey primarily focused on querying IT engineers about the frequency of their daily and monthly incident integration activities. It also aimed to gauge their satisfaction with the system, encompassing the following aspects:

- Disappointment: Whether they found the chatbot's performance below expectations.
- It's Fine but Needs More Training: If they recognized the chatbot's potential but believed it required further refinement.
- It's Fine but Needs a Little Bit of Training: Evaluating whether there is a way to make the things better.
- Perfect at This Point: Assessing whether the chatbot effectively met their needs.

Additionally, the survey invited IT support engineers to provide qualitative feedback regarding the chatbot's strengths and areas for improvement. This open ended

approach allowed us to gain valuable insights into specific aspects of the model's performance that resonated positively with users and areas that required enhancement.

A important aspect of the survey was assessing the chatbot's potential to streamline and facilitate the work processes of IT support engineers. Users were asked whether they believed the chatbot had the capacity to improve their efficiency and productivity, or if they perceived it as less advantageous for their work processes.

By incorporating this structured approach to testing and surveying, I aimed to comprehensively evaluate the chatbot's functionality, gather user feedback, and identify opportunities for refinement. This iterative feedback loop was invaluable in shaping the ongoing development and enhancement of the AI chatbot, ensuring it aligns seamlessly with the needs and expectations of its intended users in the IT support field.

4.4.2 Second Phase

To improve the model's performance consistently, I utilize feedback from surveys to enhance the data training process. I've established an iterative method involving testing and refining the model. This multi phased process aims to gather insights and boost the chatbot's abilities.

During the extensive testing phase, I conducted a rigorous two week period of assessment using the chatbot. Over this duration, I collected a substantial dataset comprising approximately 420 instances of interactions with the chatbot. Following data collection, I meticulously cleaned and prepared these datasets to ensure their quality and reliability.

Subsequently, I selected a subset of 100 datasets from this pool. These 100 datasets were specifically reserved for testing purposes, allowing to evaluate and validate the chatbot's performance with a representative sample of real world interactions. This selection process ensured that testing phase was both comprehensive and focused, providing valuable insights into the chatbot's accuracy and effectiveness. The data was classified into the following categories:

- Microsoft Incidents: This category comprised 27.7% of the data, encompassing issues related to Microsoft products or services.

- Hardware Incidents: A substantial portion, accounting for 37.7% of the data, pertained to problems associated with hardware components.
- Software Incidents: Roughly 31.66% of the data was allocated to incidents related to software, including software applications, installations, and configurations.
- Connections Incidents: A smaller fraction, approximately 2.94%, was designated for incidents related to network connections and connectivity issues.

4.4.3 Third Phase

In the following step, I collaborated with the five IT support engineers. They interacted with the chatbot and evaluated its accuracy in responding to their queries. Whenever the chatbot provided answers that did not meet their expectations, these engineers kindly supplied the correct responses as it shown in Table 2. This valuable user feedback served as a crucial source of refinement for the model.

Table 2: Correct Answers Provided by the IT Engineer

Question	**Answer**	**The IT Engineer Answer**
Unable to unlock the PC	Ensure that your keyboard is working correctly	Restart your device and check the device , clean the keyboard and check for any physical issues
Unable to connect to the internet after the update	Restart your device	Restart Your Computer and Check Network Connectivity
Chat issue in Teams	Restart the PC	Restart the Teams app, Check if the person you're trying to message is available and online. Ensure you're using the correct username or contact information
PC slowness	Performance optimised	Close Unnecessary Programs and restart your PC
PC is taking long time to restart	Updates are installed	Make sure your operating system and software are up to date
Outlook Not opening	Restart the pc	Restart your computer and try opening Outlook again. If it still doesn't open, try running Outlook in Safe Mode

Table 2: Correct Answers Provided by the IT Engineer (Continued)

Question	**Answer**	**The IT Engineer Answer**
Outlook Search Not Working	Recreated new outlook profile	Rebuild the Outlook search index. Go to "File" > "Options" > "Search" > "Indexing Options" > "Advanced" > "Rebuild
Word Crashes When Opening	Close the MS word	Repair or reinstall Microsoft Office from the Control Panel
Laptop screen resolution issue	Configured screen settings	Go to the display settings in your operating system and adjust the resolution to match your monitor's native resolution
Internet is not working	Restarted PC	Restart your device and Power cycle your modem and router
Display screen is black	Changed the wallpaper	Restart your device and check the device power
Cannot print documents	Configured printer	Check the printer queue for any stuck or pending print jobs and Ensure that your printer is properly connected to your computer and turned on
Cannot move mouse cursor between monitors	Changed display settings	Check Monitor Connections and Confirm Multiple Displays are Enabled
Cannot access shared folder	Mapped M drive	Ensure that you have the necessary permissions to access the shared folder and try mapping it as a network drive
Cannot print files	Configure the printer	Ensure that your printer is properly connected to your computer or network. Check all cables, including USB or Ethernet cables, and make sure the printer is powered on

After collecting another two weeks' worth of data, And I ensured its cleanliness and accuracy. This freshly acquired dataset became the basis for further training iterations. I continually repeated this process, looking for enhanced accuracy and effectiveness. The total dataset comprised 350 instances of interactions, and for the testing phase, I specifically reserved a subset of 100 datasets. The dataset was organized into distinct categories, each representing a specific type of incident:

- Microsoft Incidents: This category accounted for approximately 19.35% of the dataset, encompassing incidents related to Microsoft products or services.
- Hardware Incidents: A significant majority, comprising 53.54% of the dataset, was attributed to hardware-related incidents, which typically involved issues with computer hardware components.
- Software Incidents: Roughly 23.22% of the dataset fell under the category of software-related incidents. These incidents encompassed challenges related to software applications, installations, or configurations.
- Connections Incidents: A smaller portion, approximately 3.89%, was allocated to incidents associated with connections, often involving network or connectivity issues.

The iterative nature of the model improvement strategy allowed us to establish a dynamic feedback loop. By actively incorporating user input and systematically training the model with new, high-quality data, I created a model that continually evolved and adapted to user needs and preferences.

The approach to refining the chatbot was characterized by a structured and iterative process, emphasizing data quality, user feedback, and ongoing training as it shown in Figure 4. This systematic strategy ensured that the chatbot's performance consistently improved, ultimately resulting in a highly accurate and reliable AI assistant for IT support engineers.

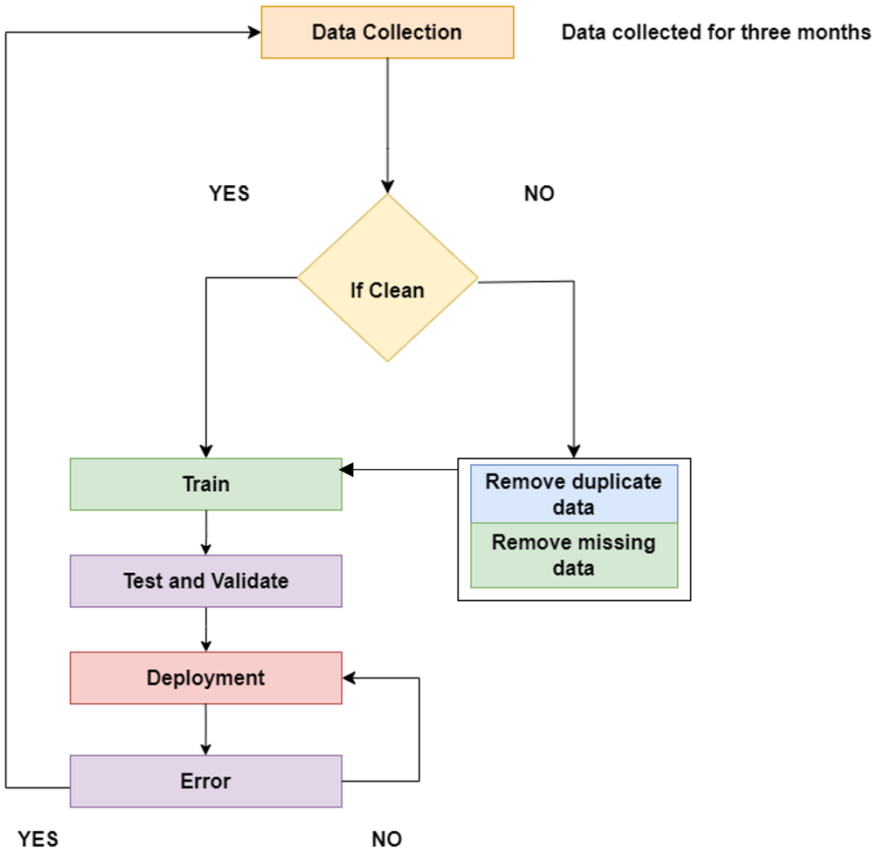


Figure 4: Proposed System Architecture

This methodology stands out as highly effective due to the incorporation of cutting-edge AI tools. Leveraging these advanced technologies allows for the automation and digitization of IT support tasks. Instead of manually resolving tickets, the integration of this new AI tool facilitates a more streamlined and automated process. The AI chatbot, a key component of this methodology, plays a pivotal role by offering solutions to technical issues. This strategic use of artificial intelligence not only expedites issue resolution but also alleviates the burden on the IT support team, allowing them to channel their efforts more efficiently. In essence, this approach transforms the traditional IT support paradigm by introducing a sophisticated and responsive AI-driven system that enhances the overall effectiveness and responsiveness of technical issue resolution within any organization.

Chapter 5: Results and Discussion

I manually assessed the model's performance and found that it achieves a 90% accuracy rate. This indicates the model's proficiency in providing precise answers and effectively performing its designated tasks. The AI model was trained using the Python language, and the Google Colab platform was used for running the Python code. During the training phase, the AI model was developed using the Python programming language, capitalizing on its versatility and extensive machine learning libraries. Python's readability and straightforward syntax facilitated the implementation of intricate algorithms, making it a preferred choice for constructing artificial intelligence models. Simultaneously, the training process was executed on the Google Colab platform, a cloud-based environment known for collaborative coding and machine learning tasks. Leveraging the computational resources of Google Colab. The collaborative features of Google Colab further streamlined the coding process, fostering easy sharing and collaborative refinement of the Python codebase during the development of the AI model.

To attain a 90% precision rate, I implemented a methodical approach, demonstrated in **Error! Reference source not found.**. This approach involved several phases, all designed to enhance the effectiveness of the system.

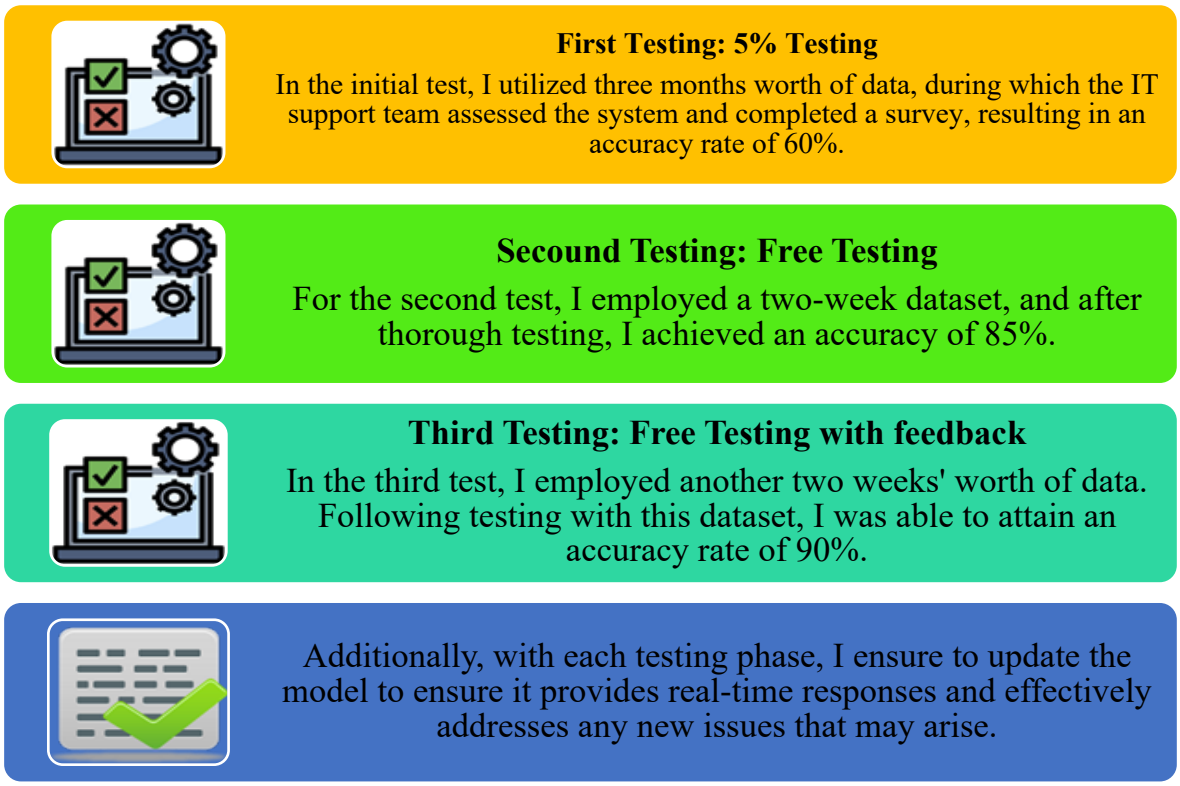


Figure 5: Testing Phase

5.1 First Phase Results

Evaluation results identify system improvement opportunities and provide an inventory of user satisfaction, ensuring consistency with user needs including overall system satisfaction, usability, responsiveness accuracy, technical details, and customizable chatbot responses. The chatbot showed consistent and reliable support. The ability to handle multiple queries simultaneously. Users praised the ease of use and helpfulness of the chatbots, as well as suggested integrations and preferences for the future. By incorporating these analytical elements, I obtained an accurate assessment of the effectiveness of the chatbot system, identifying areas for improvement. Overall, these cases highlight the transformative potential of AI Chatbots to revolutionize IT support, enhancing employee experience through more efficient feedback and support.

In the initial phase, I achieved a 60% accuracy level. During this phase, it became evident that some of the data required further training and refinement to enhance the system's accuracy. Moving on to the second phase, I made significant progress, achieving an accuracy rate of 85%. This improvement was a result of continuous optimization and

refinement. Subsequently, I initiated a subsequent round of the process, actively involving IT support engineers. With their insights and contributions, I was able to attain the coveted 90% accuracy level, marking a substantial milestone in the system's development and performance enhancement.

A scientific survey was conducted to access its efficacy and determine how it can be further improved. This survey has collected user feedback on various aspects of the system, such as user engagement, preferences, and feature requests and to explore various aspects of AI Chatbot implementation, involving IT support employees for comprehensive feedback. The results yielded fascinating insights into the potential benefits of integrating AI Chatbots into the IT support system. Through the survey findings, opportunities for system improvements, including bug fixes and usability issues, is identified. Additionally, the survey results have helped gauge user satisfaction with the system's functionality and whether it meets their needs. Furthermore, the survey results are utilized to guide the chatbot system's future growth plans. The survey was focused on specific points, including overall satisfaction with the system, usability, helpfulness, response accuracy, technical issues, and the possibility of modifying the chatbot responses. Employees showed excitement about having a user-friendly interface available 24/7 to address their queries promptly. They recognized the automation capabilities of AI Chatbots for faster issue resolution and optimizing IT processes, allowing IT personnel to focus on more strategic tasks. Chatbots were found to consistently provide reliable support, minimizing discrepancies, and fostering a dependable environment. The ability to handle multiple queries simultaneously and their round-the-clock availability were seen as valuable assets for uninterrupted support in the organization. Users can ask about their interactions with the chatbot, including whether it is easy to use and if it provided helpful responses. Additionally, users can consult about possible integrations with other systems and features they would like to see in the future. By including these survey elements, a more accurate assessment of the chatbot system's effectiveness is obtained, and valuable insights into user interactions is gained to identify areas for improvement. These findings reveal the promise of AI Chatbots in transforming IT support and elevating the overall employee experience with efficient and responsive assistance.

5.1.1 Survey Results

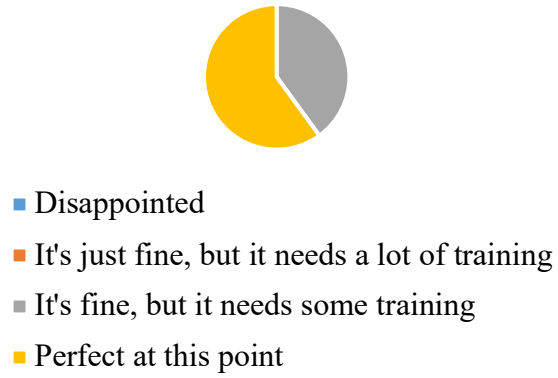
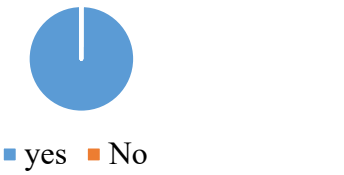
IT engineers have evaluated the system, they participate in a survey aimed at gathering feedback and insights regarding their experience. The survey primarily focused on querying IT engineers about the frequency of their daily and monthly incident integration activities.

Table indicates the overall survey results.

Table 3: Survey Results

	IT Engineers				
Question no.	**1**	**2**	**3**	**4**	**5**
1. On average, how frequently do you encounter IT-related issues or questions that require support?					
2. What is the maximum number of calls you have experienced in a day?	5 to 10	3 to 4	11 to 12	6 to 7	3 to 4
3. What is the maximum number of calls you have experienced in a month?	40 to 50	20 to 30	40 to 50	Around 40	20 to 30

Table 3: Survey Results (Continued)

	IT Engineers				
Question no.	**1**	**2**	**3**	**4**	**5**
4. After experiencing the AI chatbot for IT support, please rate the system.					
5. What do you think are the weak points of the current system?	Preparing for the Future	Lack of Clear Instructions	Occasional Misalignment	Handling New and Complex Issues	Lack of Step-by-Step Instructions
6. Do you think having such a system can speed up/facilitate your work?					

The survey conducted to assess interactions with IT-related support issues yielded insightful findings. Initially, participants were queried about the frequency of encountering IT-related support problems, with 40% indicating encountering them five times or fewer a day, another 40% reporting less than 20 times a day, while the remaining 20% faced more than 10 issues daily, as shown in **Error! Reference source not found.**.

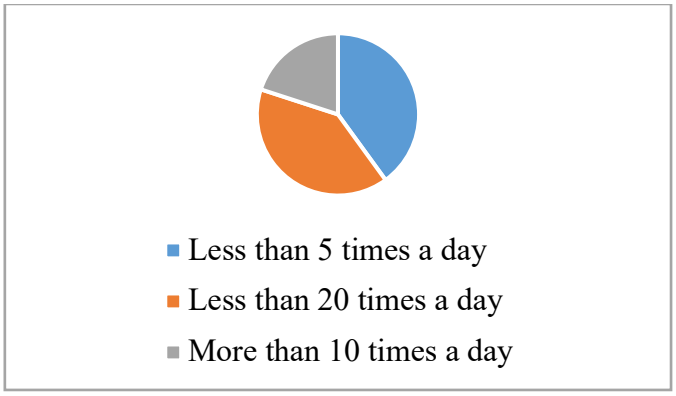


Figure 6: Frequency of Encountering IT-Related Support Issues and Questions on Average

In the second question, as part of my investigation, I seek to gather insights into the maximum number of calls experienced in a day by users. According to the survey responses, the majority, 3 to 4 respondents, have encountered between 5 to 10 calls within a day, indicating a moderate workload. Understanding this volume of calls is crucial in designing an AI chatbot system capable of efficiently handling user queries and providing responsive support during peak call periods. This data will play a pivotal role in developing an AI-driven IT support system that meets the demands of users effectively.

In the third question, I asked about how many calls they get in month. Asking how many calls people get in a month is important for my project creating an AI chatbot for IT help. Most people, around 40 to 50 of them, get a lot of calls in a month. This helps us make the AI system better at handling lots of questions when many calls come in. Knowing this helps us build a helpful AI for IT support that matches what people need.

The survey also look into user satisfaction with an AI chatbot for IT support, with 60% of respondents rating it as excellent, and none expressed dissatisfaction. However, 40% felt that some improvement was necessary, as shown in **Error! Reference source not found.**.

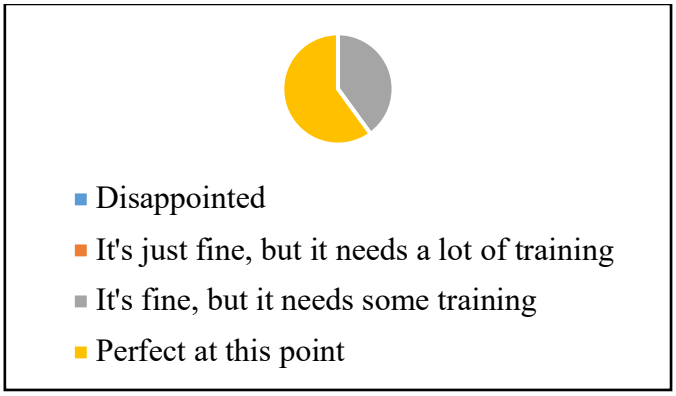


Figure 7: Post-Experience Rating of AI Chatbot for IT Support

In the fifth question, the survey aimed to know the weak points of the current system, and respondents highlighted several areas that require attention. These include concerns about the system's readiness for future needs, the lack of clear instructions provided, occasional misalignment, difficulties in handling new and complex issues, and a perceived absence of step-by-step instructions. These findings help us understand where the system might be lacking, such as its preparedness for future advancements, the clarity of guidance offered, occasional misalignments, and the system's ability to tackle smart and intricate problems. Addressing these weaknesses is crucial to enhance the system's performance, ensuring it becomes more efficient and supportive for its users.

Finally, all respondents unanimously agreed that the AI chatbot could speed up and facilitate their work, demonstrating a strong belief in its potential to enhance work efficiency as shown in **Error! Reference source not found.**. These findings provide valuable insights into the IT support landscape and the role of AI chatbots in improving productivity and user satisfaction.

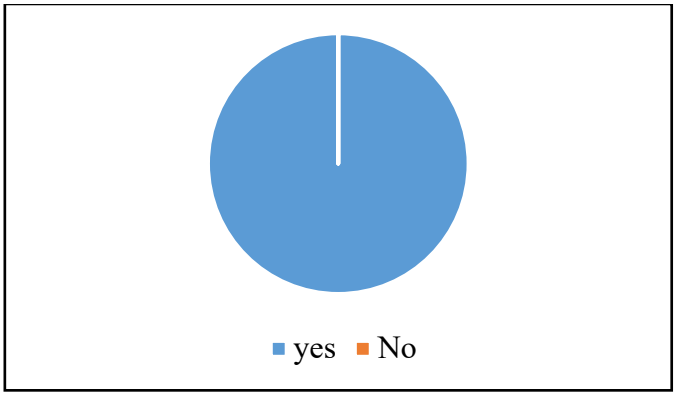


Figure 8: Work Efficiency Enhancement

5.2 Second Phase Results

As moving to the next level of exploration, I accomplished major progression. During the free testing, AI chatbot managed to attain an accuracy rate of 85% as it shown in Figure 9. This success was achieved by intensively working to upgrade the chatbot. I made it more efficiently. All these endeavours contributed to the attainment of the impressive 85% accuracy.

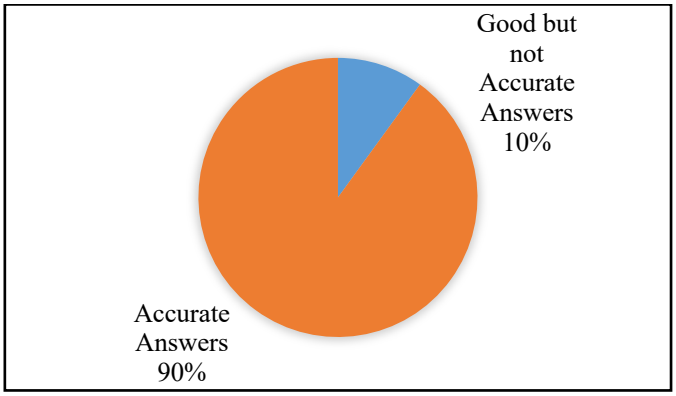


Figure 9: The Percentage of Accurate Answers for the Second Phase

Phase 2 was an big development in investigation. I get an accuracy value of 85%, because of highest efforts in refining the chatbot.

The chatbot's accuracy is determined by how often it delivers correct responses. In 100 instances, the chatbot showcases an impressive accuracy rate of 85%, successfully tackling technical issues in many cases. While 85% interactions yield precise and helpful

answers, 15% instances feature responses that, though satisfactory, may fall short of providing the optimal level of assistance.

5.3 Third Phase Results

Progressing to the third stage of study, I took a proactive step by engaging IT support engineers. Their feedback and contributions were extremely helpful in achieving excellence. Subsequently, I achieved a remarkable milestone. A 90% accuracy rate, as shown in Figure 10. These accomplishments had a success impact, effectively demonstrating the system's exceptional growth and superior functioning in this stage, I realized the necessity of bringing in IT professionals who have a deep comprehension of actual concerns and user demands. Their proficiency let us to refine the AI chatbot with accuracy, seeing to it that it could more Sufficiently address multifaceted technical requests and deliver more precise answers.

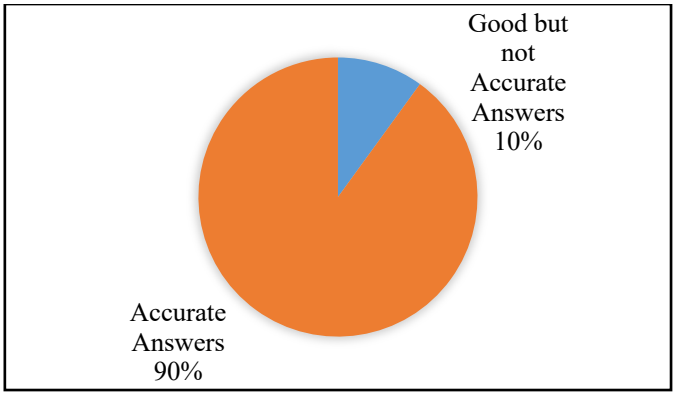


Figure 10: The Percentage of Accurate Answers for the Third Phase

The accuracy of the chatbot is assessed based on the frequency with which it provides correct responses. Out of 100 instances, the chatbot demonstrates a commendable accuracy rate of 90%, effectively addressing technical issues in most cases. While 90 interactions result in accurate and helpful answers, 10 was not accurate answers, although its good but it lack the optimal level of assistance. The manual evaluation of the model yielded an impressive 90% accuracy rate. This success underscores the importance of cleaning and sorting data manually, a critical step in preparing information for the AI chatbot. Manual intervention allows individuals to apply their judgment and expertise,

contributing to the refinement of the dataset. Human reviewers play a crucial role in understanding nuanced details and making informed choices that enhance the quality and utility of the information used to train the AI chatbot.

5.4 Expert Feedbacks and its Role in Improving the Model's Performance

The incorporation of user feedback played a important role in refining the performance of the AI model. Users emphasized the need for additional training data, identifying a deficiency in the AI chatbot's proficiency during the initial phase. In response to this feedback, during the first phase, I addressed this concern by increasing the data training process. Despite initial challenges where the chatbot struggled to provide accurate responses to certain queries, subsequent training iterations were conducted to enhance its response capabilities.

Special attention was given to data cleansing to ensure a more robust training process. Users' insights guided this refinement, leading to improvements in the model's ability to generate accurate and contextually relevant answers. Furthermore, collaborative efforts with experts were initiated to manually correct inaccuracies in the responses, contributing to a more refined and reliable AI chatbot.

Additionally, users highlighted the importance of keeping the AI chatbot updated to address emerging issues. In response to this, I extended the data collection period by an additional two weeks. This extension allowed for the accumulation of more diverse data, facilitating ongoing model improvement. The iterative nature of this process ensures that the AI chatbot remains aligned with current trends and user expectations.

The valuable feedback received has significantly contributed to the continuous improvement of the model, resulting in a notable increase in accuracy and overall effectiveness.

I decided to stop improving the model at a 95% accuracy rate based on a thorough assessment of my project requirements and resource constraints. The achieved accuracy meets the current needs. In addition, machine learning algorithms are said to be accurate about 80% or more of the time. The accuracy percentage indicates how well the system predicts accuracy. The accomplishment of a 90% accuracy mark in free testing with

feedback represents a major advance in the system's abilities. This strong accuracy points to my dedication to constant advancement and the capacity to adjust to changing user demands. A concise overview of these results is given in

Table, highlighting the significant development accomplished through collective efforts enhancing the AI driven conversational system.

Table 4: Sample Questions to Test a System's Ability to Handle Both Questions from the Same Database and Questions are Different from the Database

Using the same question from the database to provide answers from the AI chatbot		**Using the different question from the database to provide answers from the AI chatbot**	
Input	**Output**	**Input**	**Output**
Unable to sign the PDF	Try updating the PDF viewer software to the latest version. Check the system requirements and ensure your hardware meets them. If the issue persists, try using a different PDF viewer	Issue with sign the pdf file	Check if the PDF file is compatible with the software you are using. If not, try using a different software to sign the PDF file. Ensure that the software you are using is up to date and that your hardware meets the system requirements.
Unable to connect to the network	Check your network connection settings and ensure that the correct network is selected. Make sure that the network is active, and that the router is connected to the modem. If the issue persists, try restarting the router and modem	Issue with network connectivity	Check for loose cables and connections related to the network, restart the router, and check for software updates.
Screen blinking	Adjust the resolution or reconnect the display cable.	Screen Flickering	Adjust the resolution or reconnect the display cable.

Table 4: Sample Questions to Test a System's Ability to Handle Both Questions from the Same Database and Questions are Different from the Database (Continued)

Using the same question from the database to provide answers from the AI chatbot		**Using the different question from the database to provide answers from the AI chatbot**	
Input	**Output**	**Input**	**Output**
My laptop is not connecting to my phone hotspot	Try restarting your laptop and phone, and then reconnecting to the hotspot. If that doesn't work, try resetting the network settings on your phone.	Connect laptop to phone hotspot issue	Ensure that your laptop is connected to the same Wi-Fi network as your phone hotspot. If it is, try restarting your laptop and phone. If that doesn't work, try resetting the network settings on your phone.
PowerPoint is not responding	Install the latest Office updates.	PowerPoint is not opening	Install the latest Office updates.
Attachment is not opening in outlook	Ensure you have the necessary software or app to open the file type and check if your security settings or antivirus software is blocking attachments.	Attachments opening in outlook issue	Ensure you have the necessary software or app to open the file type and check if your security settings or antivirus software is blocking attachments.
Cannot print file	Ensure that your printer is turned on and connected to your computer or network and cancel any pending print jobs that may be preventing new ones from printing.	Issue file printing	Check the printer settings and ensure the file is compatible with the printer. Check the printer queue to make sure the file is being sent to the printer. If the issue persists, try restarting the printer.
Outlook not opening	Check if Outlook is blocked by your security settings or antivirus software and try restarting your computer. If the issue persists, try repairing or reinstalling the Outlook application.	Outlook opening issue	Check if Outlook is set as the default email client and ensure that Outlook is up to date. If the issue persists, try resetting the Outlook app.

Table 4: Sample Questions to Test a System's Ability to Handle Both Questions from the Same Database and Questions are Different from the Database (Continued)

Using the same question from the database to provide answers from the AI chatbot		**Using the different question from the database to provide answers from the AI chatbot**	
Input	**Output**	**Input**	**Output**
Software is not opening	Ensure that you have the necessary software or app to open the file type and check if your security settings or antivirus software is blocking the software.	Software won't launch	Check if the software is installed correctly and if it is compatible with your operating system. If it is, try reinstalling the software. If that doesn't work, try running the software in compatibility mode.
Cannot access shared folder	Ensure that you have the necessary permissions to access the shared folder and try mapping it as a network drive.	Unable to access shared folder	Ensure that you have the necessary permissions to access the shared folder and try mapping it as a network drive.

5.5 Interview Results

During the interview with the IT End User Support expert, several key insights and discussions emerged regarding the development of an AI Chatbot for IT support. Conducted on September 22, 2023, spanning 90 minutes, the interview aimed at sharing knowledge and gathering feedback. It highlights the significance of this idea in simplifying the process.

The expert explained that making these chatbots work well involves using special technology called AI and NLP. Also discussed how to connect these chatbots with other computer systems and keep information safe. Training people to use these chatbots is important, and getting feedback from users helps make them better. The expert shared a story about fixing a problem with the chatbot and said it's crucial to take responsibility when the chatbot can't solve a problem. They also talked about working with other computer experts to improve the chatbot. Making sure the chatbot meets what users need is the main goal, along with planning for it to handle more work in the future. The expert

also mentioned how the chatbot can help companies and the government by making things work better and keeping users happy, aiming for progress and growth.

5.6 SWOT Analysis

SWOT analysis discusses important factors for project's success and suggests possible areas to concentrate on for the best outcomes. Successful digital transformation for business continuity initiatives demands meticulous planning, stakeholder involvement, and a dedication to adapt to changing conditions and technology. Moreover, this analysis provides a starting point for assessing the feasibility and potential of AI chatbot project for ITSM support. **Error! Reference source not found.** shows the possible key points for analysing the important factors.

Figure 11: SWOT Analysis

5.6.1 Strengths

The significant strength of the project lies in the use of the chatbot model. The model has performed exceptionally well, achieving a remarkable accuracy rate of 90%. This accomplishment not only showcases its strong technical capabilities but also highlights its capacity for creativity and efficient utilization of digital technology.

Furthermore, dedication to research and development is evident through the efforts to survey IT support employees, demonstrating commitment to gathering input and continually enhancing the chatbot system. The following are the main key strengths of project.

- Digital transformation: Adopting digital technology satisfies the demand for less human touch, which is essential during the COVID-19 epidemic and is in line with contemporary corporate trends.
- High Accuracy: The chatbot model's ability to deliver dependable and consistent IT help is demonstrated by its 90% accuracy rate.
- User Feedback: Conducting a survey with IT officers allows for valuable feedback and insights, which can guide further improvements.
- Efficiency: By digitising IT service management operations, manual labour may be minimised, and problems can be resolved more quickly.
- Cost Savings: Over time, using automation like the chatbot can make the company spend less money because they don't need as many human support agents.

5.6.2 Weaknesses

On the other hand, it's important to highlight certain possible weaknesses. Any errors or challenges identified during the development of the chatbot model should be thoroughly examined in a more complete analysis. Furthermore, the efficiency of the chatbot model and its viability may be reliant on the availability of crucial assets like qualified staff and the required technological infrastructure. For the system to be improved and maintained, it is essential to guarantee continuous availability of these resources. The following are the possible weaknesses identified in project.

- Initial Development Costs: Both in terms of time and money, developing and training an AI chatbot may be expensive.
- Technical Challenges: Implementing AI technology may provide technical difficulties and need for knowledge of machine learning and natural language processing.

- Accuracy and Learning Curve: It may take the chatbot some time to learn from conversations and initially struggle with accuracy.
- Implementation Complexity: Putting digital transformation projects into action may be difficult and expensive.
- Maintenance: It may be difficult to keep up with the chatbot model and ensure that it keeps performing well.
- Resistance to Change: Employee and IT officials may be resistant to the transition towards automation and digitalization, especially if it has an influence on work functions.

5.6.3 Opportunities

Regarding the opportunities, project is in a good position to benefit from the current trend towards business digital transformation. The COVID-19 epidemic has increased demand for digital solutions, making this research's timing particularly advantageous. Additionally, the potential of the chatbot model to aid in the digitalization of service management is consistent with the entire sector's move towards more automated and efficient procedures. The need for cutting-edge solutions like the chatbot system is rising as businesses prioritise digital transformation. The following are the opportunities identified in project.

- Market Demand: The COVID-19 pandemic has increased consumer demand for digital products, opening new markets for improvements to IT service management.
- Competitive Advantage: Leading the way in ITSM's digital transformation can provide businesses an edge over rivals.
- Scalability: The chatbot concept is scalable and can manage an increasing number of support inquiries without the need for more personnel.
- Customization: It could be possible to alter the chatbot to meet certain IT service management requirements.
- Continuous Improvement: As the chatbot learns from more conversations, it will eventually become more accurate and efficient.

5.6.4 Threats

Identifying the possible threats in this environment is vital, though. Continuous innovation and distinction are necessary to stay one step ahead of the competition. Additionally, the chatbot system may need to be updated often to retain its efficiency because to the quick development of technology. This can put an impact on resources and need a dedication to continuing to use cutting-edge AI and NLP techniques. The following are the threats identified in project.

- Technical Difficulties: Keeping the chatbot model current and competitive might be difficult given the speed at which technology is developing.
- Market saturation: As more businesses adopt digital solutions, the level of competition in the market for digital transformation may rise.
- Regulatory Changes: The execution and operation of the project may be impacted by modifications to the laws governing data protection or to industry standards.
- Privacy and Security Concerns: AI chatbots handling sensitive technical difficulties may give rise to privacy and security concerns, particularly if data is managed improperly.
- Competitive Reaction: As rivalry increases, rivals may also use AI chatbot technology.
- User Resistance: Some users could be wary of the thought of an AI solving their technological problems; they might instead prefer human assistance.
- Technical Issues: AI systems may encounter technical issues or outages that interfere with support services.

5.7 Research Answers

RQ1: How effectively can the new chatbot system be integrated into existing service management tools and what challenges arise?

It is very effective to combine the new chatbot well with the existing tools in service management. It helps keep things running smoothly and makes it easier for people to collaborate. But there are challenges. Making sure real-time information is always right can be difficult, and it can be a bit difficult for people to get used to changing. It can be

hard to find the right balance between standardization and making sure everything works properly. Also, careful consideration should be given to whether it will work with older equipment. Despite these challenges, it seems like this integration could improve the situation for companies.

RQ2: What are the strengths and weaknesses of the smart chatbot system compared to traditional service management approaches in ensuring business continuity?

The results of study show that the smart chatbot system strengthens business continuity by providing 24/7 availability, rapid problem resolution, and consistent information delivery. Its scalability is an advantage in order to efficiently cope with increased requirements. However, weaknesses include a potential problem in understanding complex issues, reliance on technology and a lack of human empathy and doesn't understand emotions as well as humans. In contrast, traditional service management approaches, while providing human intuition for complex problems and emotional understanding, can have limitations in scalability, consistency, and timely responses. The strengths and weaknesses illustrate a trade-off between the efficiency and consistency of automated responses and the human touch in managing certain aspects of business continuity.

RQ3: To what extent does the implementation of the chatbot system help improve business continuity in service-oriented organizations?

Implementing a chatbot system in service-oriented organizations significantly improves business continuity by ensuring efficient and continuous service delivery. This chatbot ensures that services are always available by quickly fixing problems and completing tasks automatically, especially when many people need help. Also helps share information consistently and quickly, ensuring everyone gets the correct details. Chatbot allow people to do things independently without needing constant help, and potential problems can be identified and resolved early. The chatbot can learn and adapt to changes to ensure they continue to work well. Ultimately, reducing downtime and service failures is facilitated by the chatbot's quick response and automation, ensuring that everything runs smoothly and promises made are kept.

Chapter 6: Conclusion

In this study, I present a model that enables chatbots to provide accurate and detailed answers to user questions, making it a powerful research tool The model performed well, achieving an accuracy level of an it’s 90%. Moreover, I conducted a survey for a more accurate assessment of the chatbot system's effectiveness and to identify areas for improvement. This study represents a significant advance in integrating AI, particularly chatbot, into IT Service Management (ITSM). The study presents a model that improves the precision and detail of chatbot responses, achieving an impressive 90% accuracy rate. This high performance contributes to faster problem resolution and creates a seamless and responsive IT environment, which is critical to minimizing downtime. The integration of chatbot is positioned as a valuable asset for IT service operations and plays a key role in the ongoing digital transformation of processes in companies. The research driven approach, including a continuous improvement survey, highlights the model's potential contribution to the broader industry trend of driving digital transformation in IT services operations. In addition, the study improves the chatbot's understanding of the context within conversations. This goes beyond recognizing the immediate context and includes a comprehensive understanding of the broader context, including the user's IT environment, previous interactions and historical data. This approach allows the chatbot to provide more personalized and relevant support and improve the overall user experience by tailoring responses to individual needs and circumstances. In summary, the study advancement lies in the development of a powerful model that refines chatbot responses, contributes to the efficiency of IT service operations and plays a crucial role in the digitalization of processes in the ITSM area. Based on the results of the model and the survey assessment, I can conclude that the proposed model can contribute to the digitalization of IT service operations by integrating chatbot support for IT users.

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Appendices

Appendix A: Codes

```
!pip install gpt_index==0.4.15

!pip install langchain==0.0.96

from gpt_index import SimpleDirectoryReader, GPTListIndex, GPTSimpleVectorIndex, LLMPredictor, PromptHelper

from langchain import OpenAI

import sys

#from google.colab import drive

import os

os.environ["OPENAI_API_KEY"]='skSbaNQ4XQFYW0JE3rIwzzT3BlbkFJLAYroC9oLQSfNOxLwzLe'


def construct_index(directory_path):
  # set maximum input size
  max_input_size = 4096
  # set number of output tokens
  num_outputs = 256
  # set maximum chunk overlap
  max_chunk_overlap = 20
  # set chunk size limit
  chunk_size_limit = 600


  prompt_helper = PromptHelper(max_input_size, num_outputs, max_chunk_overlap, chunk_size_limit=chunk_size_limit)


  # define LLM
  llm_predictor = LLMPredictor(llm=OpenAI(temperature=0, model_name="text-davincii-003", max_tokens=num_outputs))
```

```
  documents = SimpleDirectoryReader(directory_path).load_data()


  index=GPTSimpleVectorIndex(documents,llm_predictor=llm_predictor,
prompt_helper=prompt_helper)


  index.save_to_disk('index.json')


  return index


def ask_bot(input_index = 'index.json'):
  index = GPTSimpleVectorIndex.load_from_disk(input_index)
  while True:
    query = input('What do you want to ask the bot?   \n')
    response = index.query(query, response_mode="compact")
    print ("\nBot says: \n\n" + response.response + "\n\n\n")


index=construct_index("/content/")
ask_bot('index.json')
import base64
b=base64.b64encode(bytes('sk-
SbaNQ4XQFYW0JE3rIwzzT3BlbkFJLAYroC9oLQSfNOxLwzLe', 'utf-8')) # bytes
base64_str = b.decode('utf-8') # convert bytes to string
print(base64_str)
get hub Codes:
(app file) (
data =
base64.b64decode("c2stU2JhTlE0WFFGWVcwSkUzckl3enpUM0JsYmtGSkxBWXJvQ
zlvTFFTZk5PeEx3ekxl")
```

```
decoded_data = data.decode('utf-8')

print(decoded_data)

import base64

b=base64.b64encode(bytes('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', 'utf-8')) # bytes

base64_str = b.decode('utf-8') # convert bytes to string

print(base64_str)
```

appy file codes:

```
from gpt_index import SimpleDirectoryReader, GPTListIndex, GPTSimpleVectorIndex, LLMPredictor, PromptHelper

from langchain import OpenAI

import sys

import os

import streamlit as st

import warnings

warnings.filterwarnings('ignore')

import base64

from PIL import Image

import pandas as pd

from io import StringIO


hide_streamlit_style = """

        <style>

        #MainMenu {visibility: hidden;}

        footer {visibility: hidden;}

        </style>

        """
```

```
st.markdown(hide_streamlit_style, unsafe_allow_html=True)



data=base64.b64decode("c2stU2JhTlE0WFFGWVcwSkUzckl3enpUM0JsYmtGSkxBWXJvQzlvTFFTZk5PeEx3ekxl")

decoded_data = data.decode('utf-8')

print(decoded_data)


os.environ["OPENAI_API_KEY"] = decoded_data

st.title("Asraa-ChatBot")

user_input = st.text_input("Enter your Question here")


if st.button("Submit"):
    st.write("Answer:")
    query = user_input
    input_index = 'index.json'
    index = GPTSimpleVectorIndex.load_from_disk(input_index)
    response = index.query(query, response_mode="compact")
    st.write(response)


requirement file codes

streamlit

gpt_index==0.4.15

langchain==0.0.96
```

Appendix B: Survey

Specialty

Answered: 5 Skipped: 0

IT support

IT support

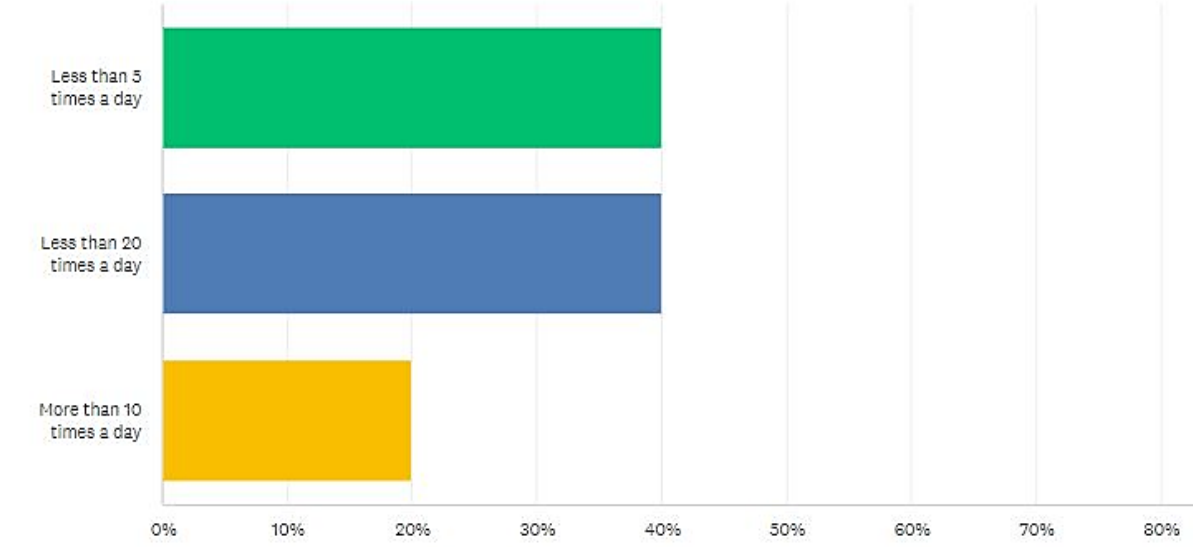
IT support

IT support

IT support

On average, how frequently do you encounter IT-related issues or questions that require support?

Answered: 5 Skipped: 0



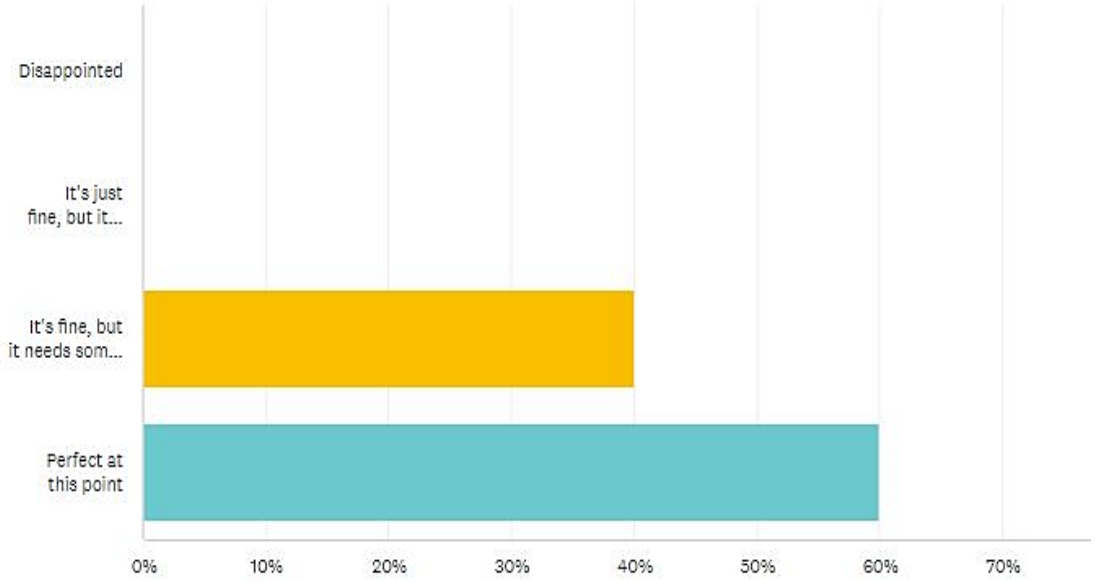
What is the maximum number of calls you have experienced in a day?

Answered: 5 Skipped: 0

5 to 10
3 to 4
11 to 12
6 to 7
3 to 4

After experiencing the AI chatbot for IT support, please rate the system

Answered: 5 Skipped: 0



What is the maximum number of calls you have experienced in a month?

Answered: 5 Skipped: 0

40 to 50
20 to 30
40 to 50
Around 40
20 to 30

6.What do you think are the weak points of the current system? (Please mention three points, optional)
To be ready for the future, we must train the AI to work with the applications that are related to the organization. This special training will make the AI better at understanding and solving the unique problems faced by the company . It will help the AI give answers that fit the needs as they change over time.
Some of the answers provided by the AI chatbot lack clear instructions for solving the problem. While it generally performs well and proves to be helpful, this limitation can be frustrating for users seeking step-by-step guidance. Improved clarity in the responses would enhance the chatbot's overall usability and effectiveness. Despite this drawback, the chatbot remains a valuable tool for various tasks and interactions, offering valuable assistance when clear instructions are not always required.
The AI chatbot usually works well and is helpful. However, sometimes it may give answers that don't quite fit the question or have trouble understanding certain things. Also, it can't solve all kinds of problems. Even with these issues, the chatbot is still useful for many different tasks and interactions.
It is beneficial in addressing everyday routine questions; however, I believe it would struggle with handling new and complex issues. Additionally, the responses provided are not always helpful. Furthermore, training the data each time becomes necessary due to the constant influx of new issues we encounter daily.
The AI chatbot for IT support provides solutions but lacks step-by-step instructions and may not handle complex incidents effectively. Regular training is essential to keep the chatbot updated and aligned with emerging incidents. This ensures a more seamless and satisfactory customer experience.

Do you think having such a system can speed up/facilitate your work?

Answered: 5 Skipped: 0

yes

yes, it's helpful and will save time.

Yes

Yes. Its providing quick response which enhances the overall efficiency.

Yes, it is indeed helpful.

Appendix C: Interview

Interview purpose: Developing an AI Chatbot for IT supports.

Interview Date: 22/09/2023

Interview time: 11:00 AM

Attendee: (IT End User Support)

Period: 90 minutes.

Discussion: Knowledge sharing and feedbacks

1. What is your understanding of AI chatbots, and how do they function?

AI chatbots, in my role as an IT support officer, are computer programs that use AI technologies to simulate human-like conversations with users.

2. Have you worked with AI chatbots or similar technologies in the past? If so, please describe your experience?

I work in IT support, and I have recently heard about AI chatbots and similar technologies, but I haven't used them much yet. These are like computer programs that talk to people in a friendly way, trying to understand and help with their questions or problems. They use a kind of smart computer learning called "artificial intelligence," especially a part called NLP to have conversations that seem like they're from a person.

Since these technologies are new for us, I an just starting to learn about them. I know there might be some challenges as go along. I will have to watch how well they work, listen to what users say about them, and make changes to make them even better for helping with IT issues.

3. Can you explain the technical components required to integrate an AI chatbot with existing IT systems and databases?

Certainly, integrating an AI chatbot with existing IT systems and databases involves several technical components.

- The chatbot needs access to relevant data from existing databases and systems. This involves setting up data integration mechanisms to fetch real-time or periodic updates from these sources. Data transformation and cleaning may also be necessary to ensure the data is in a format the chatbot can understand and use.
- Depending on how users interact with the chatbot, a user interface may be necessary. This could be a web-based chat interface, a mobile app, or integration with messaging platforms like Slack or Microsoft Teams.

4. How familiar are you with NLP and machine learning algorithms, which are often used in chatbot development?

I know a bit about NLP and ML, which are used to make chatbots work. I understand the basics and why they're important for chatbots, but I'm not an expert because my main job is IT support. If I need advanced knowledge in NLP and ML for the chatbots, I usually get help from specialists who know a lot about these things to make sure chatbots work well.

5. How would you ensure that the AI chatbot can securely access and retrieve information from IT systems and databases?

I can control who can access and manage the chatbot. This prevents unauthorized people from making changes that could harm the systems.

6. What considerations should be made regarding data privacy and security when implementing an AI chatbot in an IT support environment?

Collect only the data that is necessary for the chatbot's functions. Avoid excessive data collection and storage to minimize the risk associated with sensitive information.

Provide training to the IT support team and other relevant personnel about data privacy and security best practices. Ensure that all team members understand their responsibilities.

7. How would you approach training end-users and IT staff on how to interact with the AI chatbot effectively?

- Illustrate how the chatbot can be beneficial in real-world scenarios. Show examples of how it can help users solve common IT issues or find information quickly.

- Establish an online portal or knowledge base where users can find resources, tutorials, and troubleshooting tips related to the chatbot. Ensure easy access to these resources.
- Provide specialized training for IT staff who will be involved in managing and maintaining the chatbot. Cover topics such as chatbot administration, integration, and troubleshooting.

8. What strategies would you use to gather user feedback and make improvements to the chatbot's user experience?

- Create an online user community or forum where users can discuss their experiences with the chatbot, share tips, and provide feedback.
- Include a feedback form within the chatbot interface, allowing users to provide comments, suggestions, or report issues directly.

9. Can you provide an example of a complex technical issue that you've resolved in the past? How did you approach it?

The company experienced a significant network infrastructure failure that resulted in a complete network outage, leading to downtime for all employees. This was a complex issue as it affected various aspects of IT environment, including servers, switches, and routers. After identifying the faulty network components, I arranged for testing and replacement. This included ordering replacement hardware and ensuring it was configured correctly.

10. How would you handle a situation where the AI chatbot fails to provide a satisfactory solution to a user's technical problem?

If the chatbot was unable to provide a satisfactory solution, take responsibility for the inconvenience. I will apologize for any inconvenience the user may have experienced. In addition to I will assist the user immediately to fix the issue.

11. What key performance indicators (KPIs) would you use to assess the effectiveness of the AI chatbot in resolving technical issues?

- To assess the effectiveness of an AI chatbot in resolving technical issues, several key performance indicators (KPIs) can be used to measure its performance and impact.

- First the response time: The average time it takes for the chatbot to respond to user inquiries. Shorter response times often lead to higher user satisfaction.
- Secondly, User Satisfaction and Feedback.
- Thirdly, Tracks the percentage of erroneous responses or actions by the chatbot. A lower error rate indicates better accuracy in understanding and addressing user queries.

12. How would you identify and address performance bottlenecks or issues with the chatbot's responses?

Examine error logs and user feedback to identify patterns of issues or inaccuracies in responses.

13. How do you envision working collaboratively with AI developers and data scientists to improve the chatbot's capabilities over time?

Schedule regular meetings or stand-ups with AI developers and data scientists to maintain open lines of communication. Discuss ongoing projects, improvements, and challenges.

14. How do you stay updated on the latest advancements in AI and chatbot technology, and how would you apply this knowledge to enhance the chatbot's performance?

Dedicate time to continuous learning about AI and chatbot technology. This includes reading research papers, articles, and books, as well as participating in online courses and webinars.

15. Can you describe your approach to ensuring that the AI chatbot aligns with the needs and preferences of end-users in an IT support context?

Establish mechanisms for users to provide feedback within the chatbot interface. Encourage users to report issues, suggest improvements, and share their experiences.

16. How would you plan for the scalability of the AI chatbot solution to accommodate a growing user base or increased demand for IT support?

Implement robust monitoring tools to continuously track resource utilization, response times, and system health. Set up alerts to notify the IT team of potential issues.

17. What are the Challenges and Mitigation Strategies for applying AI chatbot for the IT support?

The challenge is ensuring that the chatbot accurately understands and responds to user queries, to mitigate that I do continually training. Also, there is another challenge which is managing sensitive user data and ensuring compliance with data privacy regulations. I minimize this issue by implementing robust security measures, including encryption, access controls, and regular security audits. And Educate users about data privacy and security measures in place to build trust.

18. How will the AI chatbot contribute to enhancing the company's performance and overall progress?

The chatbot can help in reducing downtime caused by technical issues. By providing immediate assistance and troubleshooting steps, it minimizes the impact of disruptions, which is crucial for maintaining business continuity.

19. How will the AI chatbot contribute to enhancing the performance and overall progress of the private and government sectors in the country?

Citizens and businesses can quickly find answers to their queries or obtain necessary information through the chatbot. This streamlined experience improves overall satisfaction and engagement with government services and private sector offerings. AI chatbot is poised to play a transformative role in enhancing the performance and overall progress of both the private and government sectors in the country. It promotes efficiency, cost-effectiveness, user satisfaction, and data-driven decision-making while fostering economic growth and accessibility.

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Chatbots are increasingly being integrated into our daily lives. These chatbots respond intelligently to voice and text and function as sophisticated entities. In this research, model and survey are introduced to refine chatbot responses to user questions, making it an invaluable asset for study. Based on the outcomes of both the model and the survey evaluation, the proposed model shows promise in digitizing service management, thereby enhancing business resilience.

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