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Research Article

Chatbot for Academic Advising: Case Study at Saudi Electronic University

Madawi Faisal Alsoyohi and Nahlah Algethami

Department of Computer Science, College of Computing and Informatics, Saudi Electronic University, Riyadh 11673, Saudi Arabia

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Corresponding Author:
Nahlah Algethami
Department of Computer Science, College of Computing and Informatics, Saudi Electronic University, Riyadh 11673, Saudi Arabia
Email: n.algethami@seu.edu.sa

Abstract: Student support solutions in higher education are evolving, with an increasing focus on making services more accessible and providing individual assistance. Chatbots are emerging as powerful tools for academic advisors in this environment. This study centers on the design and refinement of a chatbot specifically customized for the requirements of students in higher education. By conducting an extensive analysis of the current literature on chatbot applications in academic environments, the aim of this study is to develop a framework for an academic advising chatbot. We (A) analyze the problems and needs of chatbot applications for students attending the computing and informatics college, Saudi Electronic University (SEU), by conducting surveys and gathering feedback from students and academic advisors, and (B) propose a design for an academic advisor chatbot specifically tailored to meet the academic guidance needs of SEU students. By actively involving key stakeholders, we identify critical areas where chatbots can enhance academic advising, bridging the gaps in current methods. Then, a chatbot for academic advising is implemented and evaluated using metrics such as student satisfaction, advisor workload reduction, and chatbot accuracy. The results demonstrate the chatbot's effectiveness in providing timely and relevant academic guidance, highlighting its potential to enhance the advising process and improve overall student engagement. The chatbot's functionalities include assisting with course selection, academic planning, study skills support, and optimizing the use of university resources.

Keywords: Academic Advisor, Chatbot, Education, Academic Advising Chatbot, IBM Watson Assistant

Introduction

Academic advising plays an important role in education by offering students personalized support and guidance while fostering their self-esteem, confidence, and clarity in their academic pursuits. As stated by Bahr, (2008), advising actively benefits students' chances of success, especially for those facing academic deficiencies. Advisors are crucial in helping students plan their goals and needs, ensuring that they progress toward their academic objectives. They offer a comprehensive understanding of every student's different needs and circumstances.

One of the primary responsibilities of academic advisors is to provide students with an in-depth knowledge and understanding of program requirements, obligations, and deadlines. By equipping students with this information, advisors empower them to make informed decisions about their academic careers, serving as a bridge between students and their academic departments.

In addition to their academic role, academic advisors provide students with emotional assistance. They establish a secure and encouraging environment for students to express their concerns, challenges, and goals. Advisors actively listen to students' worries and guide them through difficult times, offering encouragement, empathy, and practical solutions. This emotional support is crucial in helping students navigate the ups and downs of their educational journey (Hwang and Chang, 2013).

Furthermore, academic advisors have a key influence in advancing one's profession. They hold invaluable expertise in different professional paths and may advise students regarding job advancement prospects, internships, and accessible resources. Advisors can utilize their knowledge and connections to assist students in examining various career possibilities and making well-informed choices for their future (Mu and Fossnacht, 2019).

Overall, academic advising goes beyond providing academic guidance. It encompasses personalized support, mentorship, emotional assistance, and career development guidance. Through their dedicated efforts, advisors contribute to the holistic growth and success of students, empowering them to make meaningful choices and achieve their academic and career goals.

Mu and Fosnacht (2019) found that there is a positive and significant relationship between advising and students' learning outcomes. According to their study, advising interactions have a more significant impact on students' overall assessments of their learning and development rather than on their grades. Their study suggests that advising services have both direct and indirect effects on student outcomes, and the quality of advising services is critical in shaping students' learning and development.

Despite the benefits that academic advising offers to both students and advisors, academic advising schemes face challenges such as insufficient information, communication issues, time management problems, and a lack of training for advisors (Chan et al., 2019).

According to Chun Ho et al. (2018), chatbots can enhance academic advising by offering students round-the-clock access to information and guidance. An interactive interface can engage students in conversation and assist them in navigating the course selection process. Chatbots can offer official course details, peers' feedback, analyze potential course options, and provide tailored recommendations. Furthermore, chatbots can utilize purpose recognition and conversation management to comprehend learners' requirements and offer pertinent knowledge. Chatbots can enhance current academic advising services by offering students a quick and interactive method to receive help with course choices.

Chatbots are not only useful for students but can also assist academic staff. A study conducted by Kurniawan and his team (Kurniawan et al., 2023) suggests that chatbots can provide information on both academic and non-academic topics, such as course selection, academic services, and administrative duties. Chatbots can also handle routine and structured student inquiries, freeing up time for academic staff to focus on more complex tasks. Moreover, chatbots can offer real-time responses to student inquiries, improving the overall efficiency of communication between students and academic staff. In general, chatbots can streamline communication processes and provide support to academic staff in managing student services. Chatbots help automate advising tasks and improve accessibility. Event-driven methods enhance their accuracy (Tahir, 2025).

This paper highlights the potential of chatbot technology to enhance the advising process and foster a more interactive and supportive learning environment within the context of Saudi Electronic University. By leveraging chatbot technology, SEU can overcome the limitations of traditional advising methods, ensuring that students receive timely and tailored support. Kurniawan et al. (2023) research verifies that implementing chatbots can provide a scalable and accessible solution that caters to the unique needs of each student, regardless of time constraints or geographical factors. This technological advancement has the potential to revolutionize the advising process and create a more engaging and supportive educational experience for students at SEU.

This study presents a chatbot that is specifically designed to address the academic advising needs of students at Saudi Electronic University (SEU). Unlike general-purpose advising tools, the design of this system is grounded in the institutional structure, advising practices, and feedback collected from SEU's student and advisor populations.

Although the prototype is currently developed in English, it reflects the local academic context and includes considerations for future integration of Arabic language support. This ensures that the chatbot remains adaptable, accessible, and aligned with the needs of Arabic-speaking students within the SEU community.

The aims of this research are as follows:

A. Analyze the problems and needs of chatbot applications for the College of Computing and Informatics at SEU as best practices. This research addresses the gap in current advising methods by conducting surveys and gathering feedback at SEU. By actively involving key stakeholders, this research seeks to build an understanding of their perspectives, challenges, and expectations in the academic advising process
B. Propose a design for an academic advisor chatbot specifically tailored to meet the academic guidance needs of students at SEU
C. Implement a prototype for academic advising. To our knowledge, this is the first study to analyze the demand for chatbots and develop a chatbot that addresses specific needs at Saudi Electronic University

Related Work

Chatbots

Chatbots, also known as conversational agents, have a long history dating back to the early days of

computer science. The origin of chatbots can be traced back to the 1960s, when Joseph Weizenbaum created ELIZA at the MIT Artificial Intelligence Laboratory. ELIZA was one of the first programs that tried to simulate human conversation and is often regarded as the predecessor of modern chatbots. The program used pattern matching and substitution methodology to give users the impression of understanding, but it lacked a built-in framework for contextualizing events or storing user data.

Over the years, the development of conversational agents has seen significant milestones. From basic programs such as ELIZA to advanced chatbots, technology has come a long way. Initially, chatbot progress was gradually focused on enhancing pattern-matching systems and expanding potential responses. However, advancements in Natural Language Processing (NLP) and Machine Learning (ML) in the late 20th and early 21st centuries have transformed chatbots' capabilities. With the rise of the internet and increased computational power, AI-driven chatbots such as A.L.I.C.E. have gained popularity for their ability to engage in more nuanced conversations.

The last decade has seen a significant leap forward due to the development of deep learning and big data analytics. Modern chatbots, such as Microsoft's XiaoIce, are designed to be social companions, capable of maintaining long-term conversations and relationships with users. These systems combine a range of technologies, including NLP, ML, and data retrieval systems, to provide a more human-like interaction experience.

Chatbot Components and Design

Agarwal and Wadhwa (2020) summarized the basic components required for creating an educational chatbot. Table 1 provides an overview of these components.

Chatbot Models

A fundamental classification of chatbot technology delineates two core types: Rule-based and AI-based systems. Rule-based chatbots operate on a set of predefined rules and responses, making them reliable within their scope but limited in flexibility. In contrast, AI-based chatbots leverage the power of machine learning to generate responses, offering a more dynamic and contextually aware interaction that improves with each conversation (Agarwal and Wadhwa, 2020).

Alongside the fundamental classification of chatbot technology into rule-based and AI-based systems, an innovative approach is known as the hybrid model. This model integrates the structured, reliable framework of rule-based chatbots with the adaptive, learning capabilities of AI-based systems. The hybrid model system is designed to classify user questions into the appropriate model and match them with appropriate responses. The hybrid system attempts to improve the entire conversational experience and increase the chatbot's performance in meeting user needs by integrating both types of models and allowing a balance between them (Pandey and Sharma, 2023).

The diversity of chatbot architecture supports their usefulness for a wide range of domains and purposes, from task-specific chatbots to those capable of engaging in open-ended chats with human-like fluency. Table 2 presents a comparative overview of several chatbot varieties, focusing on their concepts, domains, learning capacities, and other key characteristics that determine their functioning and application cases.

Chatbot Fields

As Brandtzaeg and Følstad (2017) stated, chatbots have established a specialized position in several industries, bringing about a substantial change in how businesses and institutions engage with their users.

Table 1: Overview of chatbot components

Key Component	Features and Functionalities
User Interface (UI)	Text-based or voice-based UI. Buttons, carousels, and quick replies for easy interaction. Integration with messaging platforms or web/mobile interfaces.
Natural Language Processing (NLP)	Intent recognition. Entity extraction. Sentiment analysis.
Dialog Management	Conversation flow design. State management. Context handling.
Chatbot Models	AI-based models. Rule-based models. Hybrid models.
Personalization Engine	User profile management for customization based on user data and preferences.
Content Management System (CMS)	Repository for storing and managing responses.
Backend Integration	Integration with learning resources and third-party services.
Scalability Infrastructure	A server or cloud-based infrastructure that can handle user load.
Deployment and Hosting	Environment setup for staging and production. Reliable hosting solutions with uptime guarantees.

Table 2: Arabic chatbot examples

Chatbot	Study	Description
Abdullah	(Ahmed et al., 2022)	Abdullah is an intelligent Arabic conversational tutoring system for modern Islamic education. It is designed to provide educational support and guidance in the Arabic language.
ArabChat	(Ahmed et al., 2022)	ArabChat is an Arabic conversational agent developed for various purposes, including healthcare services, restaurant orders, airline ticketing, and education. It can have long conversations and is based on a retrieval-based model.
Botta	(Ahmed et al., 2022)	Botta is the first Arabic dialect chatbot developed to simulate conversations in the Egyptian dialect. It is designed to engage in conversations in the Egyptian dialect and is based on pattern-matching techniques.
Nabiha	(Al-Ghadhban and Al-Twairesh., 2018)	The Arabic-speaking chatbot Nabiha was developed at King Saud University. The first Saudi dialect chatbot supports university IT students' communications and offers pleasure and academic help to students on Android, Twitter, and the web.
Bashayer	(Baha et al., 2022)	Bashayer is a WhatsApp task-oriented chatbot that motivates and educates Saudi postgraduate students. It has been used in higher education to improve postgraduate students' learning motivation and strategies.
MyAdvisor	(Kuhail et al., 2023a)	Students can use MyAdvisor's chatbot to obtain academic advice on regulations, course choices, and coursework. Prescriptive advising systems involve students having short, goal-oriented chats with the chatbot for advice. The system analyzes student inquiries using natural-language-understanding algorithms and a component-based design.

These intelligent systems operate in various domains, improving user experiences by offering quick, tailored support and automating repetitive chores (Brandtzaeg and Følstad, 2017).

Chatbots have transformed customer service, and businesses such as Apple and Amazon are now using them to answer customer questions, solve problems, and provide product information. These chatbots are designed to accurately interpret customer inquiries, thus increasing the efficiency of the customer support system. In customer service, chatbots are revolutionizing the way companies interact with customers. They are implemented to provide immediate assistance, answer frequently asked questions, and effectively resolve issues. For instance, chatbots on company websites are available 24/7 to provide support, ensuring that customers' needs are met promptly (Chen et al., 2020).

Similarly, in the healthcare sector, chatbots such as Woebot are extending support by offering cognitive behavioral therapy to individuals grappling with mental health issues, signifying their role in making healthcare services more accessible. The healthcare industry benefits from the convenience and efficiency of chatbots, using them to disseminate medical advice, schedule appointments, and manage prescription reminders. Chatbots such as Buoy Health are instrumental in assessing symptoms and offering personalized health guidance (Chen et al., 2020).

The financial industry also employs chatbots for assorted services such as account management, transaction inquiries, and personalized financial advice. Banks and financial institutions leverage these AI tools to enhance customer service and operational efficiency (Chen et al., 2020).

Another field where chatbots are making an impact is in the field of virtual assistants and personal productivity. Chatbots are being developed to help users perform specific tasks, such as booking a taxi, ordering food, or providing information on several topics. For example, the Indian chatbot Nikibot assists users with tasks such as booking a taxi and ordering food for delivery. Additionally, chatbots are being used in the entertainment industry to provide users with fun and engaging experiences (Brandtzaeg and Følstad, 2017). Some chatbots are designed to entertain users with humorous responses and engaging conversations. For example, chatbots such as Mitsuku and Jessie Humani provide entertainment and social interaction to users (Brandtzaeg and Følstad, 2017).

Furthermore, chatbots are employed on various social media platforms and messaging applications to engage with users. For instance, research by Kurniawan on the widespread use of messaging applications such as WhatsApp for chatbot interactions demonstrated their popularity among users (Kurniawan et al., 2023).

Chatbot in Education

In terms of education, Farhan et al. (2012) discussed the use of automated replies to students' queries in an e-learning environment using a Web BOT. Their research illustrated that chatbots could handle many student questions, ranging from simple administrative requests to more complex academic inquiries.

Furthermore, Chen et al. (2020) conducted a comprehensive analysis of the role of Artificial Intelligence (AI) in education. Their study highlighted the potential of AI to automate administrative tasks and personalize the learning experience. Chatbots, a form of AI in education, were noted for their adaptability and

decision-making capabilities, making them ideal for academic advising. The study used qualitative research to assess the impact of AI on education, focusing on administration, instruction, and learning.

In the realm of education, Kuhail et al. (2023b) found that educational chatbots are predominantly used in computer science, with approximately 33.33% of research focused on chatbots that teach topics within this field. These include programming languages such as Java and Python, computer networks, databases, and compilers. About 27.77% of the literature describes general-purpose educational chatbots applied across various educational settings, including online courses. The use of chatbots for language teaching is less represented, with only 16.66% of the studies. Chatbots in this category often incorporate interactive media such as voice, video, and speech recognition. Other areas where educational chatbots have been utilized, albeit in smaller numbers, include engineering, religious education, psychology, and mathematics, with each subject being the focus of several studies. Additionally, this study shed light on the re-emerging role of chatbots as educational tools. The study found that chatbots can create personalized learning experiences and can be made available round-the-clock to assist students with queries, thus overcoming the limitations of human availability. The review highlighted the potential for chatbots to revolutionize the educational space by offering instant access to information and facilitating a more learner-centered approach.

Baha et al. (2024) found that chatbots can greatly enhance student learning experiences by allowing them to study at their own speed, decreasing stress, saving time, and sustaining motivation. Integrating AI technology into a smart classroom will create a positive environment, encourage interaction with students, increase learner engagement, and help achieve academic goals.

Similarly, Colace et al. (2018) explored the use of chatbots for academic advising in e-learning. They found that chatbots are useful for handling common academic queries, freeing up academic staff's time to attend to more complex student needs.

The efficacy of chatbots in academic advising was further investigated by Lee et al. (2019a), who examined their impact on reducing the workload of administrative officers. Their study showed that implementing FAQ chatbots within a university setting significantly decreased routine query handling by administrative staff, which improved efficiency and allowed academic advisors to devote more time to addressing individual student concerns that require a more nuanced human touch (Lee et al., 2019b).

In their recent analysis, Kuhail et al. (2023a) identified several key limitations and challenges inherent in the implementation of chatbot-based academic advising systems. These challenges underscore the necessity for meticulous design and constant refinement to ensure these systems meet the diverse needs of the student body effectively. The primary concerns outlined include the following:

1. Usability concerns: Current chatbot-based advising systems often do not adopt a user-centric design methodology, which may result in significant usability challenges. Such systems may be perceived as unintuitive by students, potentially impeding their ability to obtain essential information in a clear and accessible format
2. Complex question handling: There is a discernible inadequacy in the ability of these systems to comprehend and process multifaceted inquiries. This limitation can lead to student frustration and a sentiment of dissatisfaction, stemming from the perceived incapacity of chatbots to deliver all-encompassing support
3. Personalization deficits: Despite efforts to individualize interactions by leveraging student data, chatbot-based systems frequently fall short in delivering personalized advice. This shortfall can detract from the system's effectiveness in addressing the unique advising needs of each student
4. Interactions with human advisors: A subset of the student population may prefer chatbot-based systems due to a reluctance to engage with human advisors. While this serves as an advantage for some, it also accentuates the potential shortcomings of chatbots in replicating the nuanced support that human advisors can provide.
5. Advisor task scope: Chatbot systems are often not equipped to handle advanced advising tasks, such as those requiring analytical or comparative analysis. This limitation can circumscribe the ability of the system to furnish comprehensive support across the full spectrum of academic advising requirements
6. Chatbot personality and interaction quality: The effectiveness of chatbot-based systems is significantly influenced by the chatbot's personality and the quality of its interactions with students. Crafting a chatbot that embodies an appropriate personality and conversational style presents a considerable challenge that can have profound implications for users' experiences

Arabic Chatbot

Enabling people to engage with a bot in their native language enhances the level of personalized contact, making interactions more human-like. This section presents key aspects of the Arabic language and the obstacles encountered in developing Arabic chatbots.

The Arabic language is a rich and historical Semitic language spoken across the Arab world. It is characterized by its eloquent script, written from right to left, and its complex morphology, where root patterns and affixes

play a vital role in word formation. The Arabic language used by chatbots can vary, but the main categories, as stated by Ahmed et al. (2022), include Classical Arabic, Modern Standard Arabic (MSA), and Dialectical Arabic (DA). Classical Arabic is the formal language used in religious texts and literature, while Modern Standard Arabic is the formal, official language used in academia, law, and the media. Dialectical Arabic refers to the various regional and country-specific dialects spoken as mother tongues in the Arab world. Some chatbots may also use Quranic Arabic as a language category. These chatbots are designed to interact with users in written Arabic text, speech, or both and may be developed for specific purposes or domains such as healthcare services, restaurant orders, airline ticketing, and education.

Challenges in Developing Arabic Chatbots

Arabic is the fifth most spoken language globally. However, Arabic chatbots face unique challenges compared to their English counterparts. These challenges include the following:

- Linguistic complexities: Arabic chatbots encounter various linguistic challenges, including rich morphology, orthographic variations, high ambiguity, and the existence of several dialects. Arabic words are modified for gender, number, voice, and person, which complicates the process of text processing and response generation. Moreover, the same word can have multiple interpretations, and the several dialects across Arab countries introduce additional complexity (AlHumoud and Aldamegh, 2018)
- The chatbot currently supports only English and does not include Arabic processing. References to Arabic NLP have been removed to avoid confusion. Additionally, the limitations section now includes examples of complex multi-intent queries
- Despite these efforts, handling complex multi-intent queries remains a challenge. For instance, the chatbot struggled to parse compound questions such as “What are the prerequisites and grading criteria for Course X?”, indicating a need for more advanced multi-intent recognition techniques in future iterations
- Scarcity of research and resources: There is a significant shortage of research and resources dedicated to the development of Arabic chatbots, which hinders progress in understanding effective development methodologies. Furthermore, the lack of available resources for training machine learning models in Arabic compared to other languages, such as English, limits the sophistication of Arabic chatbots
- Cultural and social considerations: Developers of Arabic chatbots need to consider cultural and social contexts. This requires a deep understanding of the language and culture to ensure effective communication and culturally sensitive interactions. Capturing regional dialects and cultural nuances is essential for creating accurate and relatable chatbot experiences (Alruqi and Alzahrani, 2023)

Addressing the Challenges

To overcome these challenges, researchers and developers should consider the following:

- Recent advancements in Arabic Natural Language Processing (NLP) have significantly shaped chatbot development for Arabic-speaking users. AlAli and Wardat (2024) offered a detailed review of these advances, with a particular focus on morphological analysis, dialect variation, and the complexities of Arabic linguistic preprocessing factors that directly influenced the NLP strategy adopted in this study
- Additionally, Ahmed et al. (2024) emphasized the growing role of generative AI in educational applications, highlighting promising avenues for future integration of advanced generative models to enhance personalization and contextual understanding in academic advising chatbots
- Yang (2024) demonstrated and recapitulated the role and impact of generative AI in education. The author discusses the drawbacks of generative AI in empowering education at present.
- Developing language-specific NLP techniques: Tailored NLP techniques are essential for interpreting and generating responses based on Arabic’s linguistic features (Alruqi and Alzahrani, 2023)
- Adapting to dialects: Incorporating dialect-specific language models ensures that chatbots can communicate across different Arabic-speaking regions.
- Addressing gender-specific responses: Arabic chatbots should be equipped to provide appropriate responses based on the gender inflections in the language
- Resolving ambiguity: Implementing techniques to disambiguate words with multiple meanings is crucial for accurate interpretation
- Enhancing input and output modalities: Advanced modalities such as speech recognition can create a more natural conversational experience for users
- Developing targeted research and development: Bridging the gap in Arabic chatbot technology necessitates focused research on advanced NLP techniques and generative-based models (Abdulkader et al., 2022)

Chatbots in Saudi Universities: Challenges and Effectiveness

In educational contexts, particularly in Saudi universities, Arabic chatbots can serve as virtual assistants, helping students navigate academic services

and resources. However, the complexity of the Arabic language and the lack of comprehensive literature on Arabic chatbots impede their effectiveness. Furthermore, the integration of chatbots into Saudi educational institutions presents its own set of difficulties (Almurayh, 2021):

- Academic terminology: Chatbots must comprehend and accurately use technical and academic language
- Cultural relevance: Chatbots should be designed to fit the cultural backgrounds and social norms of the students they are intended to assist
- Integration into learning management systems: Chatbots must seamlessly integrate into existing digital infrastructures to provide real-time assistance

In summary, the literature reviewed underscores the significant potential of chatbots in transforming academic advising. However, there is a notable gap in the secondary literature regarding the use of chatbots as academic advisors within the context of colleges and universities. This study contributes to filling this gap by analyzing and implementing chatbots tailored for academic guidance at Saudi Electronic University (SEU). These AI-powered conversational agents offer 24/7 availability, personalized support for students, and efficiency in managing routine inquiries, thus enhancing the educational experience. As AI technology progresses, it is anticipated that chatbots will assume an increasingly vital role in academic advising, especially for a generation of students who demand immediate access to information and support. This research will not only explore the capabilities and limitations of current chatbot technologies in academic settings but also provide a design that can be adapted and optimized, thereby enriching the body of knowledge in this emerging field. While there have been studies on chatbot applications in academic settings, this is the first study to address the implementation of chatbots in academic advising at Saudi universities.

Arabic Chatbot Examples

Notable examples of Arabic chatbots are listed in Table 2.

This study and the work by Kuhail et al. (2023b) both explore the role of chatbots in academic advising, but they differ in scope and focus. This research is specifically tailored to the needs and feedback of SEU students and academic advisors, utilizing IBM Watson Assistant to offer personalized academic support, with a particular focus on course selection and routine inquiries. In contrast, the study conducted by Kuhail et al. (2023a) examined the broader application of chatbots, concentrating on their usability and performance in enhancing the overall student experience.

Materials and Methods

This study's methodology is outlined in Figure 1. It began by analyzing the relevant literature and identifying the research gap and research questions. Then, data were collected using surveys aimed at analyzing the current relationship between students and advisors and how a chatbot may contribute to enriching the relationship. Figure 1 clearly illustrates data collection and analysis phases.

Data Collection

In this study, the principal methodological approach for data collection involved the deployment and subsequent analysis of quantitative data gathered through two surveys, with each tailored specifically to a distinct group of participants: College students and academic advisors. The objective of these surveys was to comprehensively assess the existing academic advising framework and to explore the feasibility and impact of incorporating chatbot technology as an adjunctive resource within this system.

The student survey consists of 18 structured questions with predefined multiple-choice responses.

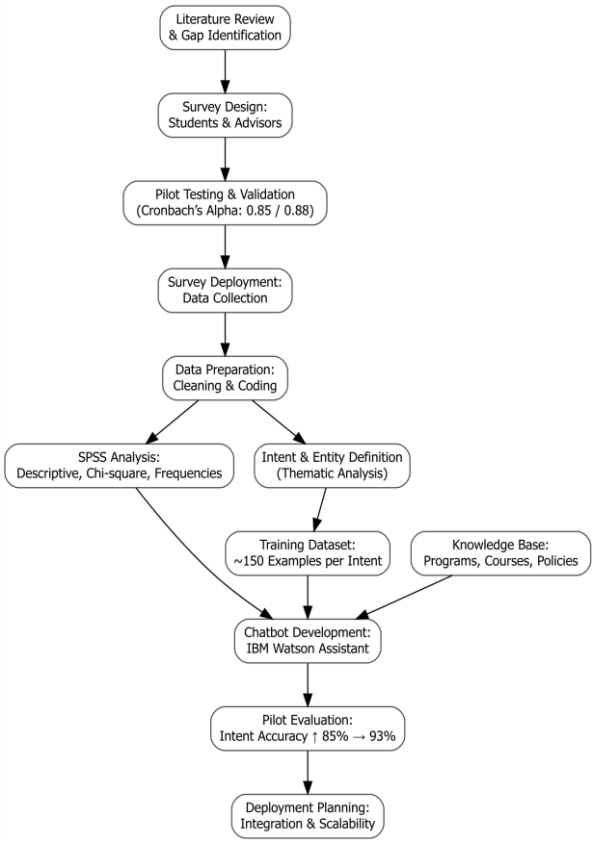


Fig. 1: The overall flow of the proposed system

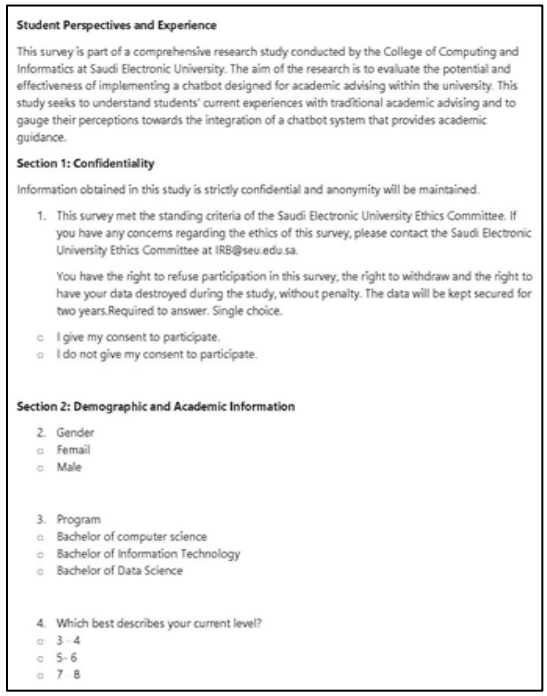
It is designed to evaluate the students' perceptions and expectations of academic advising, as well as their receptiveness towards the integration of chatbot technology into the advising framework at the College of Computing and Informatics, Saudi Electronic University. The survey aims to capture students' understanding of an academic advisor's role, the frequency of their interactions with advisors, and the extent to which advisors understand students' unique academic needs.

Additionally, it explores the specific challenges students face within the current advising system, such as scheduling conflicts, communication issues, and the depth of advisors' knowledge and skills. The survey also assesses students' experiences with existing chatbot services, their willingness to use chatbots for academic inquiries, and their trust in the accuracy of the information provided by such automated systems. It evaluates the importance students attribute to securing continuous access to advising services and their views on the potential of chatbots to offer personalized course advice and handle complex advisory issues.

The survey seeks to understand the value students place on the human element in the advisory process and to identify which academic topics students would feel most confident discussing with a chatbot. Finally, the survey aimed to identify students' specific needs and expectations from the academic advising system, ensuring that any technological enhancements, such as implementing a chatbot, align with the students' academic support requirements. This comprehensive evaluation was designed to assess the readiness and attitudes toward adopting chatbot assistance in academic advising, providing insights to guide the development and integration of these technologies to more effectively address students' needs. The survey questions are shown in Figure 2.

The academic advisors' survey consists of questions designed to elicit detailed information about advisors' workloads, such as the number of students advised per semester and the perceived heaviness of their workload. It explores the proportion of time advisors dedicate to administrative tasks versus interpersonal student advising and identifies the key challenges they encounter in delivering effective advising services.

The survey also gauges advisors' opinions on the potential for chatbots to handle routine academic questions accurately and their confidence in the chatbot's ability to provide precise program requirements. It assesses the anticipated benefits of a chatbot's round-the-clock availability for students and its capacity to decrease the volume of routine inquiries advisors receive. Additionally, it queries advisors on the frequency of delays that students experience due to advisor availability and the chatbot's capability to guide students to suitable resources or departments. The survey seeks to measure the impact advisors believe a chatbot could have on the efficiency of academic advising. The survey questions are shown in Figure 3.



Student Perspectives and Experience

This survey is part of a comprehensive research study conducted by the College of Computing and Informatics at Saudi Electronic University. The aim of the research is to evaluate the potential and effectiveness of implementing a chatbot designed for academic advising within the university. This study seeks to understand students' current experiences with traditional academic advising and to gauge their perceptions towards the integration of a chatbot system that provides academic guidance.

Section 1: Confidentiality

Information obtained in this study is strictly confidential and anonymity will be maintained.

1. This survey met the standing criteria of the Saudi Electronic University Ethics Committee. If you have any concerns regarding the ethics of this survey, please contact the Saudi Electronic University Ethics Committee at IRB@seu.edu.sa.

   You have the right to refuse participation in this survey, the right to withdraw and the right to have your data destroyed during the study, without penalty. The data will be kept secured for two years.Required to answer. Single choice.

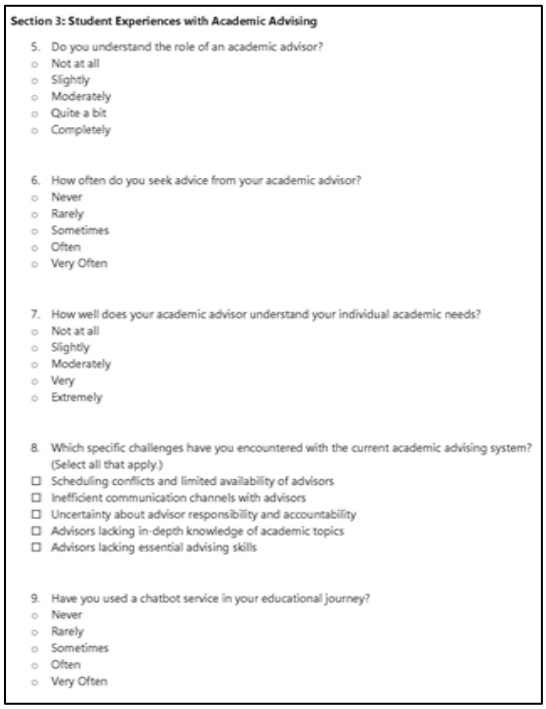
   - o I give my consent to participate.
   - o I do not give my consent to participate.

Section 2: Demographic and Academic Information

2. Gender
   - o Femail
   - o Male

3. Program
   - o Bachelor of computer science
   - o Bachelor of Information Technology
   - o Bachelor of Data Science

4. Which best describes your current level?
   - o 3 - 4
   - o 5- 6
   - o 7 - 8



Section 3: Student Experiences with Academic Advising

5. Do you understand the role of an academic advisor?
   - o Not at all
   - o Slightly
   - o Moderately
   - o Quite a bit
   - o Completely

6. How often do you seek advice from your academic advisor?
   - o Never
   - o Rarely
   - o Sometimes
   - o Often
   - o Very Often

7. How well does your academic advisor understand your individual academic needs?
   - o Not at all
   - o Slightly
   - o Moderately
   - o Very
   - o Extremely

8. Which specific challenges have you encountered with the current academic advising system? (Select all that apply.)
   - ☐ Scheduling conflicts and limited availability of advisors
   - ☐ Inefficient communication channels with advisors
   - ☐ Uncertainty about advisor responsibility and accountability
   - ☐ Advisors lacking in-depth knowledge of academic topics
   - ☐ Advisors lacking essential advising skills

9. Have you used a chatbot service in your educational journey?
   - o Never
   - o Rarely
   - o Sometimes
   - o Often
   - o Very Often

10. What is the most important support you need from academic advising to achieve your academic goals? (Select all that apply.)
    - ☐ Guidance in selecting courses that fit my career objectives
    - ☐ Assistance with understanding and meeting graduation requirements
    - ☐ Help with academic difficulties and strategies for improvement
    - ☐ Information about internship and research opportunities related to my field
    - ☐ Support with managing academic stress and time management
    - ☐ Advice on transfer credits and study abroad programs
    - ☐ Clarification on administrative processes and university regulations

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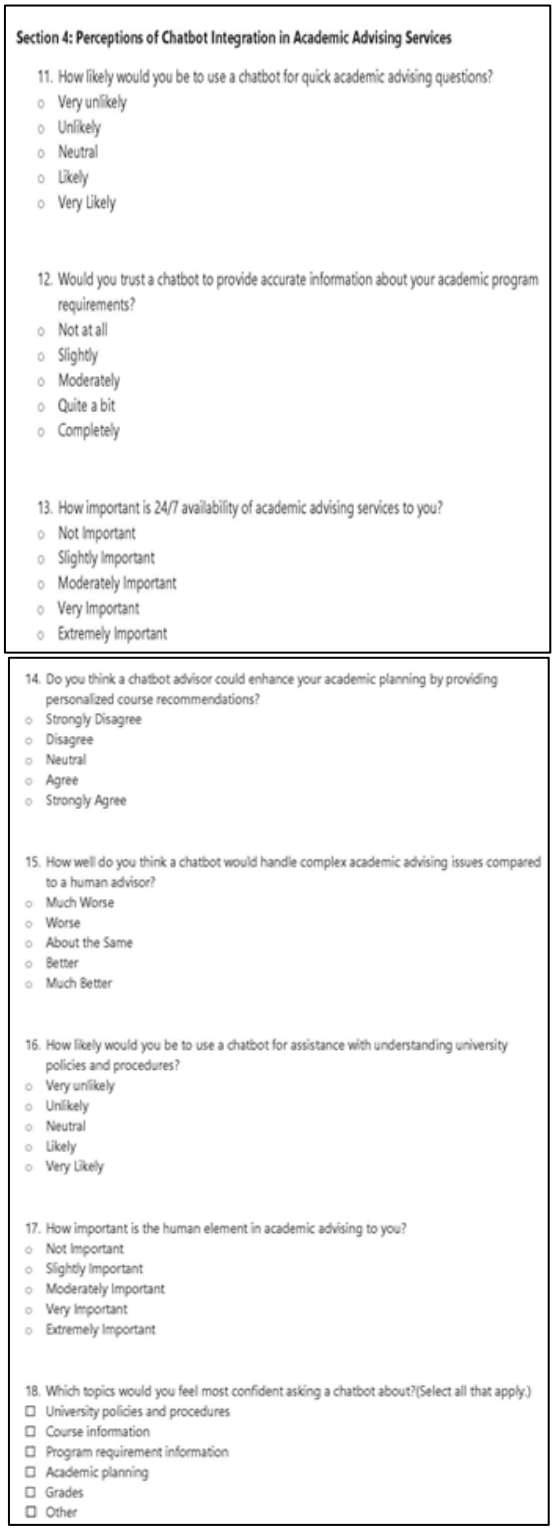

Section 4: Perceptions of Chatbot Integration in Academic Advising Services

11. How likely would you be to use a chatbot for quick academic advising questions?
- Very unlikely
- Unlikely
- Neutral
- Likely
- Very Likely

12. Would you trust a chatbot to provide accurate information about your academic program requirements?
- Not at all
- Slightly
- Moderately
- Quite a bit
- Completely

13. How important is 24/7 availability of academic advising services to you?
- Not Important
- Slightly Important
- Moderately Important
- Very Important
- Extremely Important

14. Do you think a chatbot advisor could enhance your academic planning by providing personalized course recommendations?
- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

15. How well do you think a chatbot would handle complex academic advising issues compared to a human advisor?
- Much Worse
- Worse
- About the Same
- Better
- Much Better

16. How likely would you be to use a chatbot for assistance with understanding university policies and procedures?
- Very unlikely
- Unlikely
- Neutral
- Likely
- Very Likely

17. How important is the human element in academic advising to you?
- Not Important
- Slightly Important
- Moderately Important
- Very Important
- Extremely Important

18. Which topics would you feel most confident asking a chatbot about?(Select all that apply.)
- ☐ University policies and procedures
- ☐ Course information
- ☐ Program requirement information
- ☐ Academic planning
- ☐ Grades
- ☐ Other

Fig. 2: Student survey (Examples)

The combination of these two surveys was intended to provide a comprehensive overview of the current academic advising landscape from both the student and advisor perspectives.

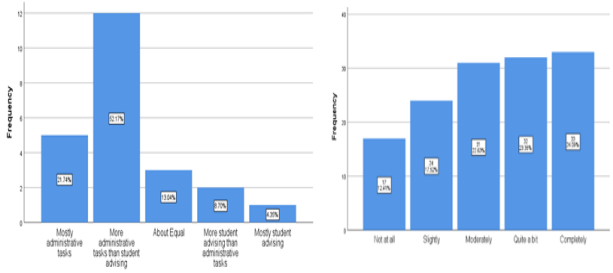

Fig. 3: Advisor views on task balance (left) and chatbot usefulness (right)

The survey questions were developed following an extensive literature review and consultation with SEU academic advisors to ensure relevance. Pre-testing was conducted with a small pilot group (n = 10 students and 3 advisors) to validate clarity and comprehensiveness. Feedback from this pilota phase was used to refine question wording and response scales, ensuring both reliability and validity.

Furthermore, qualitative data collected through open-ended survey questions provided deeper insights. For example, one student noted, 'I prefer using chatbots late at night when advisors aren't available,' illustrating a key advantage of chatbot deployment. Similarly, an advisor mentioned, 'A chatbot would significantly reduce repetitive queries about course prerequisites,' highlighting the potential workload reduction benefit.

By analyzing the data, the researchers attempt to understand the potential role of chatbots in enhancing the efficiency and effectiveness of academic advising services, identifying areas where chatbots could be most beneficial, and recognizing the concerns and limitations perceived by both students and advisors. This methodological approach aimed to contribute to the ongoing dialogue about the future of academic advising and the integration of artificial intelligence in higher education settings.

In addition, the research methodology included a secondary data collection phase aimed at enriching the chatbot's database with comprehensive and specific information from the College of Computing and Informatics at SEU. This phase involved gathering detailed data about the college's various departments, the courses offered, academic policies and procedures, available course resources, and other relevant information.

The data collection process involved collecting information from the SEU online portal and official documents, reviewing, and extracting course information, academic policies, and procedures relevant to the needs of students and advisors from the university's website, and examining program structures, course descriptions, prerequisites, credit requirements, grading policies, and advising guidelines.

The goal was to create a robust database enabling the chatbot to assist students with a wide range of questions, from basic course information to more complex inquiries about academic policies and degree requirements. Ensuring the accuracy and relevancy of this information was paramount, as the chatbot's effectiveness would heavily depend on the quality of the data fed into its system.

Figure 2 in the appendix shows the comparison of chatbot model types, clearly outlining features, domains, learning capacities, and applicable use-cases.

Data Integrity

Several measures were implemented to ensure data integrity within this research. Key measures included enforcing restrictions on the survey to eliminate duplicate responses and mandating that all questions be answered, thus preventing any missing data.

Additionally, participation in the survey was strictly limited to students from Saudi Electronic University (SEU) to maintain the relevance and accuracy of the data collected. These protocols were established after receiving all necessary approvals from the scientific research ethics committee.

Data Preparation

The data collected from the surveys were entered into the Statistical Package for the Social Sciences (SPSS) for thorough analysis. One crucial step in this process was to convert the qualitative data from the surveys into quantifiable categories. Intents and entities for the chatbot were carefully defined through thematic analysis of the survey responses. Key user intents such as course selection, submission policies, and academic regulations - and associated entities, including course names, submission types, and deadlines, were derived from frequently mentioned themes in the data. These elements were then used to construct structured training datasets, with diverse example phrases generated for each intent to improve recognition accuracy. Additionally, the survey instruments used in this study were validated statistically. Internal consistency was assessed using Cronbach's alpha, resulting in values of 0.85 for the student survey and 0.88 for the advisor survey, indicating strong reliability.

To assess the reliability of the survey instruments used to gather user needs and feedback, we calculated Cronbach's alpha for both the student and advisor survey scales. Cronbach's alpha measures the internal consistency of survey items using the formula:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right) \quad (1)$$

where k is the number of items, σ_i^2 is the variance of each item, and σ_t^2 is the total variance of the item sum. Survey data were analyzed using Python's pingouin statistical library. This was achieved by assigning numeric codes to different response categories, which allowed for the statistical analysis of the data.

Data Analysis

Using SPSS, the following statistical methods were applied:

- Descriptive statistics: The central tendency and dispersion of responses for both surveys are summarized using the mean and the standard deviation. Tables 4 and 5 present a descriptive analysis of a sample question from each survey
- Validity analysis: Assesses the validity of responses by counting valid versus missing responses, ensuring the reliability of the data used in further analysis

Table 3 shows the samples of descriptive analysis.

Table 4 shows the test that examines whether there are statistically significant relationships between categorical variables from different groups. Table 9 displays the results of this test, specifically looking at the relationship between advisors' knowledge levels and their awareness of their role.

Table 3: Advisor survey: Sample of descriptive analysis using SPSS

		Q2	Q3	Q4	Q5	Q6	Q7	Q8
N	Valid	23	23	23	23	23	23	23
	Missing	0	0	0	0	0	0	0
Mean		4.04	3.83	4.13	1.65	3.00	3.09	2.22
Std. Deviation		0.976	1.193	0.920	0.714	1.348	0.949	1.043

Table 4: Student survey: Sample of descriptive analysis using •Chi-square test of independence

		Q2	Q3	Q4	Q5	Q6	Q7	Q8
N	Valid	137	137	137	137	137	137	137
	Missing	0	0	0	0	0	0	0
Mean		4.04	3.56	3.34	3.18	3.26	3.76	3.56
Std. Deviation		0.976	1.193	1.088	1.035	1.029	1.191	1.193

- Cumulative percentages: Helps in understanding the proportion of responses that reach or exceed certain values, which is particularly useful in ordinal data (Tables 5 and 6)
- Frequency analysis: Counting how many responses fall into each choice category. This facilitates an easy understanding of the data distribution of each response category (Tables 5 and 6)

Cross-tabulation: Compares responses between questions to identify patterns or significant differences in perspectives. Table 7 shows the results of implementing this method for Q2 and Q3 from the advisor survey.

Chi-square test of independence: This test examines whether there are statistically significant relationships between categorical variables from different groups. Table 8 displays the results of this test, specifically looking at the relationship between advisors' knowledge levels and their awareness of their role.

Visualization: Bar charts can compare different groups or categories across a single frequency metric. Figure 3 shows multiple bar charts used to analyze questions from both the advisor and student surveys.

(Q8) How much of your time is spent on administrative tasks versus direct student advising?

(Q2) Do you understand the role of an academic advisor?

Table 5: Frequency and cumulative percent for Q2 in the advisor survey

Q2	Frequency	Percent	Valid Percent	Cumulative Percent
No	2	8.7	8.7	8.7
To some extent	4	17.4	17.4	26.1
Mostly	8	34.8	34.8	60.9
Yes	9	39.1	39.1	100.0
Total	23	100.0	100.0	

Table 6: Frequency and cumulative percent for Q2 in the student survey

Q4	Frequency	Percent	Valid Percent	Cumulative Percent
3 to 4	76	55.5	55.5	55.5
5 to 6	42	30.7	30.7	86.1
7 to 8	19	13.9	13.9	100.0
Total	137	100.0	100.0	

Table 7: Cross-tabulation of Q2 and Q3 from the advisor survey

		Q3					
		Unsure	No	To Some Extent	Mostly	Yes	Total
Q2	No	0	1	1	0	0	2
	To some extent	1	1	2	0	0	4
	Mostly	0	0	1	4	3	8
	Yes	0	0	2	1	6	9
Total		1	2	6	5	9	23

Table 8: Chi-square Test

	Value	df	Asymptotic Significance (2-Sided)
Pearson Chi-Square	22.116	12	0.036
Likelihood Ratio	22.359	12	0.034
Linear-by-Linear Association	9.891	1	0.002
N of Valid Cases	23		

Results

The academic advisors rated moderately, with an average rating of 2.23. The study also indicates a moderate perception that advisors understand individual student needs, with an average rating of 2.96. This suggests that there might be room for improvement in advisor–student communications or the customization of advice.

A small subset of students (five valid responses) reported using chatbot services during their educational journey and gave a mean satisfaction or effectiveness rating of 3.40, indicating a generally positive experience.

This positive feedback from students about their interaction with chatbots is a promising sign of the potential benefits of chatbot integration. Additionally, when asked about the likelihood of using a chatbot for quick academic advising questions, the students gave an average rating of 2.93 and 2.70 for trusting a chatbot to provide accurate information about their academic program requirements. Both figures lean towards the lower end of the scale, suggesting skepticism or a reluctance to depend on chatbots for academic advice. For an additional breakdown of the student survey results, see Appendix A.1.

The results of the academic advisor survey show that academic advisors generally have a strong understanding of program details, with an average score of 4.04 and a standard deviation of 0.976, indicating a high level of familiarity with program requirements. The comprehension of their roles and limitations is also considerable, although with some variation (average 3.83, standard deviation 1.193).

Advisors express high confidence in their skills, averaging a score of 4.13. In terms of workload, advisors typically manage 10-20 students each semester, with an average score of 3.00, which affects their availability and effectiveness. Regarding the potential integration of a chatbot, advisors demonstrate a cautious yet optimistic attitude. They strongly believe in its ability to manage routine questions (average 4.30) and see its 24/7 availability as highly advantageous (average 4.22).

However, there is some doubt about the chatbot's capability to provide accurate program requirements, with an average confidence score of 3.78. Despite these concerns, the advisors anticipate that chatbots could significantly reduce routine inquiries (average 4.43) and are open to co-managing student cases with a chatbot (average 4.00). Nevertheless, they express skepticism about the usefulness of chatbots in complex scenarios where human intervention remains crucial (average 2.04). This cautious yet optimistic stance indicates that advisors are open to technological advancements, balancing efficiency gains with the need for personalized human oversight in more sensitive matters. For an additional breakdown of the advisor survey results, see Appendix A.2.

Discussion

The findings highlight a significant opportunity to enhance academic advising at SEU through advanced chatbot technologies. However, these systems must evolve to provide more personalized and contextually relevant advice beyond simple question-and-answer functionalities. The mixed effectiveness of human advisors and chatbots indicates that a hybrid approach could be more effective, leveraging both human empathy and chatbot consistency. Moreover, maintaining ethical standards and transparency in using technological tools is crucial for building and sustaining trust in the academic advising process. As chatbots become more integrated into educational environments, ensuring responsible and transparent usage will be key to their success and acceptance.

The chatbot framework developed in this study has broader applicability beyond the Saudi Electronic University. Given its robust handling of student queries, cultural relevance, and ease of integrating institution-specific academic data, this model could be adapted effectively to other universities in Saudi Arabia and across the Middle East. Universities facing similar academic advising challenges, such as high student-advisor ratios or geographic constraints limiting advisor availability, could particularly benefit from this chatbot model.

Based on survey results, students appreciated the chatbot's availability and support for routine queries but expressed a need for more personalized and context-aware responses. Advisors acknowledged their role in reducing repetitive tasks yet emphasized the importance of human oversight in complex cases. These insights will guide future improvements, including enhanced personalization and deeper integration with university systems.

However, the current chatbot implementation has several limitations. First, it struggles with complex, multi-step advising scenarios such as evaluating graduation eligibility or handling nuanced academic exceptions**,** requiring direct human intervention. Second, the prototype lacks direct integration with the SEU's Learning Management System, restricting automated retrieval of personalized student data, thus limiting personalized advice capabilities.

The chatbot's training and evaluation processes were systematically implemented, with intent and entity examples derived from thematic analysis of survey responses to ensure alignment with real user needs.

Furthermore, statistical validation procedures were applied to the survey instruments, yielding Cronbach's alpha values of 0.85 for the student survey and 0.88 for the advisor survey. These results indicate high internal consistency, and this reinforces the methodological rigor of the study, enhancing its reproducibility and reliability for future academic chatbot implementations.

Implementation of Academic Advising Chatbot Prototype

Development Platform

In this study, a prototype for an academic advising chatbot named "MyAcademicAdvisor" was developed using IBM Watson Assistant. This decision was influenced by a detailed comparison between leading AI platforms: IBM Watson Assistant, Microsoft Bot Framework, and Google Dialogflow. Table 9 compares these platforms based on their features relevant to developing an academic advising chatbot.

The selection of IBM Watson Assistant was based on several key factors:

- Advanced AI and NLU: IBM Watson Assistant excels at natural language understanding, which is crucial for interpreting complex academic queries
- Scalability and reliability: By leveraging IBM's robust cloud, the platform ensures high reliability and scalability, essential for managing academic year fluctuations

Table 9: Comparison of AI development platforms

Feature	IBM Watson Assistant	Microsoft Bot Framework	Google Dialogflow
NLU	Excellent capabilities using advanced NLP techniques.	Strong NLU, integrates well with Azure.	Strong NLU using Google's AI technologies.
Dialog Management	Advanced tools for complex conversational flows.	Robust dialog management and context handling.	Simplified but effective dialog flow.
Integration Options	Broad integration, including IoT.	Native integration with Microsoft services.	Good integration with Google and third-party platforms.
Pre-Built Content	Industry-specific content available.	Microsoft templates are available.	Access to Google NLP data, but less tailored.
Voice Interaction	Extensive voice capabilities.	Strong Cortana voice integration.	Integrates with Google Assistant.
Scalability	Highly scalable, cloud-based infrastructure.	Scalable within Azure.	Scalable with Google Cloud.
Visual Builder	User-friendly visual conversation editor.	Visual designer via Azure Bot Service.	Intuitive visual interface.
Analytics	Detailed performance analytics.	Comprehensive Azure-based analytics.	Integrated with Google Analytics.
Multi-language Support	Supports many languages; Arabic support planned.	Multilingual support.	Strong multilingual support, including Arabic.

- Comprehensive integration: Offers extensive integration with web, mobile, and IoT platforms, facilitating future tech expansions
- Specialized tools: Provides industry-specific tools and content that can be customized for academic advising, reducing development time and costs
- Visual builder and analytics: This feature features an intuitive dialog editor and powerful analytics to enhance and monitor chatbot performance
- Multilingual support: This includes multiple language options, with Arabic support, aligning with Saudi Electronic University students' mother language

In addition to these features, IBM Watson Assistant utilizes artificial intelligence (AI) through various methods to enhance user interactions:

- NLU: The platform uses AI to interpret complex human language, ensuring accurate understanding and responses to user queries
- Machine learning: The assistant learns from interactions to improve response quality and accuracy over time, adapting to new information and corrections
- Intent recognition and entity extraction: Can identify user intentions and extract relevant data from conversations, enabling precise and effective responses
- Dialog flow management: This is used to maintain coherence and guide interactions towards effective resolutions
- Sentiment analysis: This technique analyzes emotional tones in user inputs to tailor responses, enhancing engagement and user experience

Personalization: This is achieved by remembering user preferences and past conversations, making engagements more relevant. Predictive analytics: The AI analyzes historical interactions to predict future needs and behaviors, facilitating proactive and timely responses.

IBM Watson Assistant has a new feature that enables the development of an action-based assistant instead of a conversation-based assistant, created using "intents". This specific capability was utilized in this research (Chow et al., 2023).

Design Conversational Flow

Before beginning to build the MyAcademicAdvisor chatbot, it was important to construct a dialog flowchart that defines the fundamental topics for conversation. This ensured that the chatbot could effectively introduce and guide bachelor students through various academic and administrative procedures while maintaining an organized and user-friendly conversation. The chatbot's main topics include General Program Information, Course Plans, Submission Policies, Regulations and Admission, and Connecting to Human Advisors.

The dialog flow of the chatbot starts by welcoming the user, followed by a pause, allowing for the user's response. Once the user interacts, the chatbot determines the most suitable conversational path based on the user's input, focusing specifically on topics relevant to the student's academic and administrative needs. After each interaction, the chatbot requests feedback by asking whether the information provided meets the user's needs.

This feedback is crucial as it helps assess the chatbot's performance and identify areas for improvement. By learning from user interactions, the

chatbot continually improves its responses and features to deliver more effective support and enrich students' educational experience.

The conversational flowchart in Figure 4 served primarily as a blueprint for setting up the chatbot. Subsequent development phases addressed additional concerns, such as integrating with institutional databases and ensuring user privacy through secure features.

Potential challenges, such as integrating with the college system, were then meticulously planned to ensure smooth deployment and functionality. Regular evaluations through user feedback also helped to refine the chatbot's effectiveness and user satisfaction.

The chatbot was trained using a diverse set of example utterances, evenly distributed across the defined key intents. IBM Watson Assistant's natural language understanding (NLU) engine was iteratively fine-tuned by adjusting parameters such as the confidence thresholds, which were set between 0.70 and 0.85 to balance recognition accuracy and reduce false positives. The dialog flow architecture followed a hierarchical tree structure, allowing for organized and scalable conversation paths. User inputs and captured entities dynamically triggered relevant branches, ensuring efficient and context-appropriate navigation through the chatbot's functionalities.

Implementation Steps

This study adhered to the methodology outlined by Chow et al. (2023) in building the chatbot. MyAcademicAdvisor was designed as an action-oriented assistant, featuring a repertoire of actions tailored to effectively address and engage with students' inquiries. These actions served as conversation starters.

The first thing to decide was where to launch the chatbot. Since this is a prototype design, it was recommended that the first version of the chat operate on one channel using Watson Assistant's easy-to-embed web chat widget as the initial channel.

When creating the foundational topics for the chatbot, a ground-up approach was taken, tailoring them to align with the most common questions within the SEU context. It was essential to acknowledge that these topics represented a subset of the key cases identified by the SEU community. The chatbot is equipped with the following conversational actions: Providing information about college programs, recommending courses tailored to students' needs, and explaining work submission policies.

To demonstrate the process of building a conversational action, where actions correspond to the topics that the chatbot can manage, the example of outlining work submission policies has been chosen for its straightforwardness and clarity. This example offers a clear and concise demonstration of the steps involved in constructing a specific conversational action.

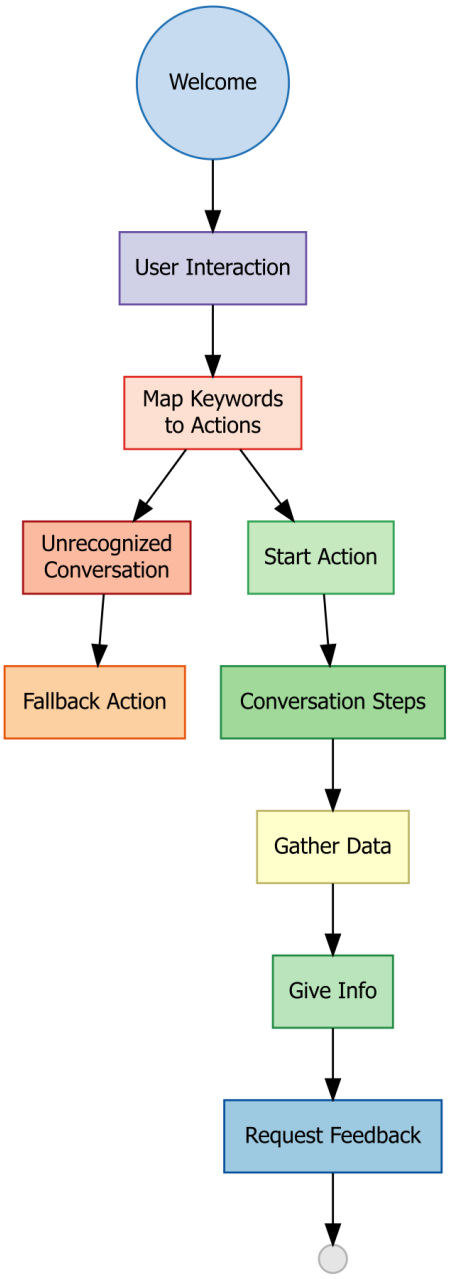

Fig. 4: Chatbot conversational flow

1. From the Actions tab, choose to create a new action from scratch
2. Train the chatbot topic recognition AI by giving it some examples. Figure 6 shows the phrases added to train this action
3. Gather additional details: As depicted in Figure 7, the chatbot starts by prompting the student to select the type of submission from a list of options: HW, Quiz, or Project. This interaction is crucial as the student's choice is captured and stored under the variable name "submission". To streamline the management and

reference of this data in later stages, this step has been labeled “Submission Type”. The significance of this naming will become evident during complex actions. Progression to the next step is managed by selecting “continue to next step” to follow the conversation configuration

4. Map response: Based on the value of the submission, one of three responses is provided to the student. This mapping process is based on the value of submission stored from the "Submission Type" step. Figure 8 shows all the possible responses
5. Ask for feedback: After answering the students’ inquiries, the bot assesses its performance by asking the student to provide feedback by redirecting the conversation to the feedback action. If the student is satisfied with the bot's performance, the conversation will end. Otherwise, the conversation will fall back to the initial step of the action that started the feedback. This feedback process is shown in Figure 9

Figure 10 shows a full conversational tree of the submission policy action to depict all these steps and illustrates the flow of action.

Furthermore, My Academic Advisor has an adaptive learning capability, allowing it to interpret and learn from users’ interactions. This dynamic feature facilitated the chatbot’s recognition and response to diverse student queries by activating and expanding on related topics as the conversation progressed. This learning mechanism is crucial for the chatbot’s ability to evolve and provide increasingly personalized support to students, reflecting the evolving needs of the SEU community over time.

Figure 5 shows the screenshots of the submission policy action.

Figure 7 shows the mapping responses.

Figure 8 shows the feedback flow of the system.

Testing the Chatbot

Before MyAcademicAdvisor was deployed in the live environment of Saudi Electronic University, an initial pilot test was conducted, as recommended by IBM Watson.

This preliminary phase was crucial to ensure the chatbot’s readiness and effectiveness in a controlled setting before broader implementation. This pilot test aimed to address two fundamental questions crucial for assessing the chatbot’s performance:

1. Understanding user requests: Is the chatbot accurately interpreting the user's input and intent?
2. Action completion: Can users successfully complete their intended actions using the chatbot?

During the pilot testing phase, the chatbot participated in 40 conversations, providing significant data to assess its initial performance. Using IBM Watson’s analytics tools, the evaluation focused on two key metrics: the conversation completion rate and intent recognition accuracy. Personalized guidance was implemented by capturing and utilizing student-provided information, such as academic major and current semester, to enable context-sensitive interactions. For instance, when students specified their major and semester, the chatbot dynamically adjusted course recommendations to match their academic track.

Fig. 5: Submission policy action example phrases

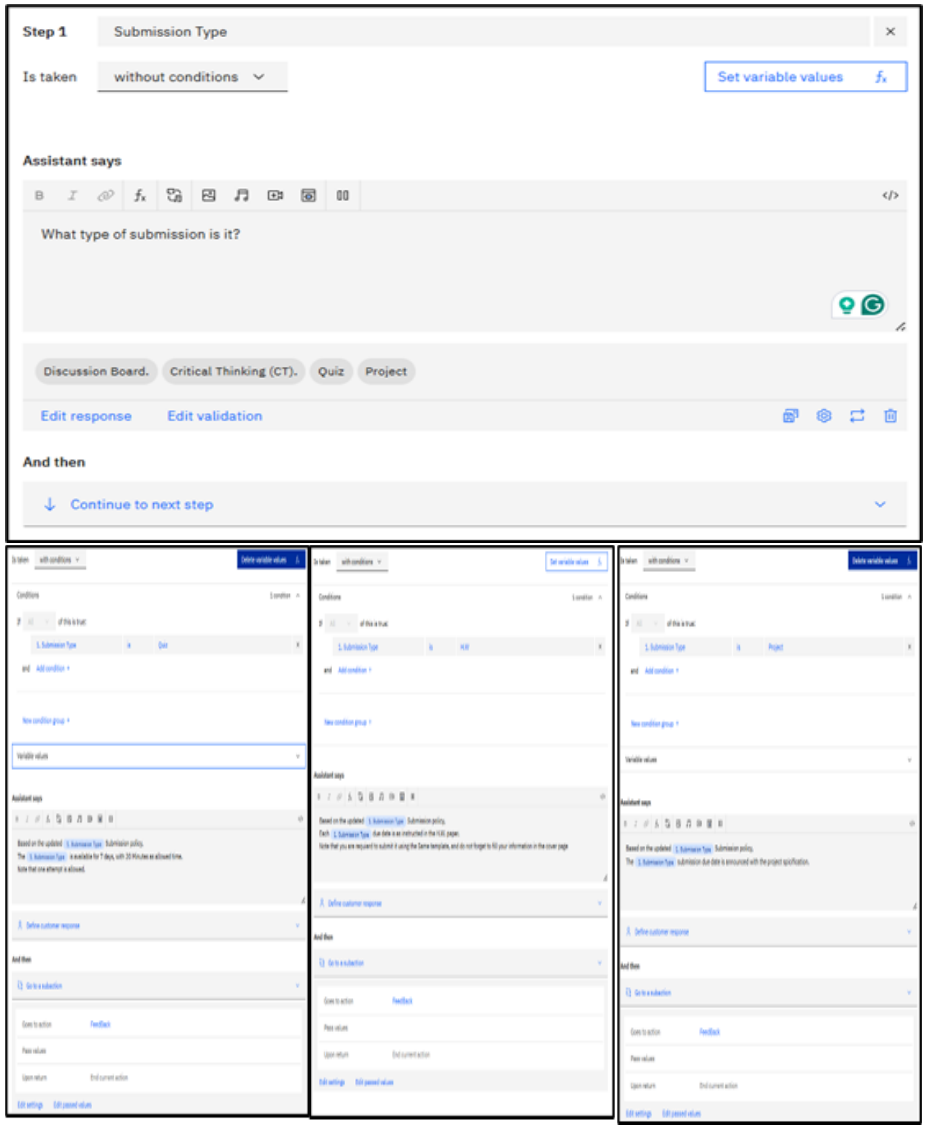

Fig. 6: Acquiring Additional Details (screenshots)

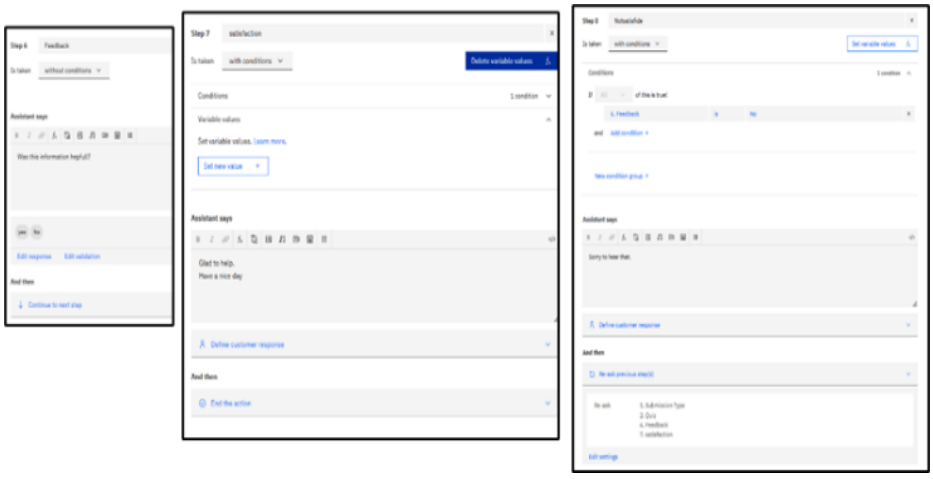

Fig. 7: shows the mapping responses

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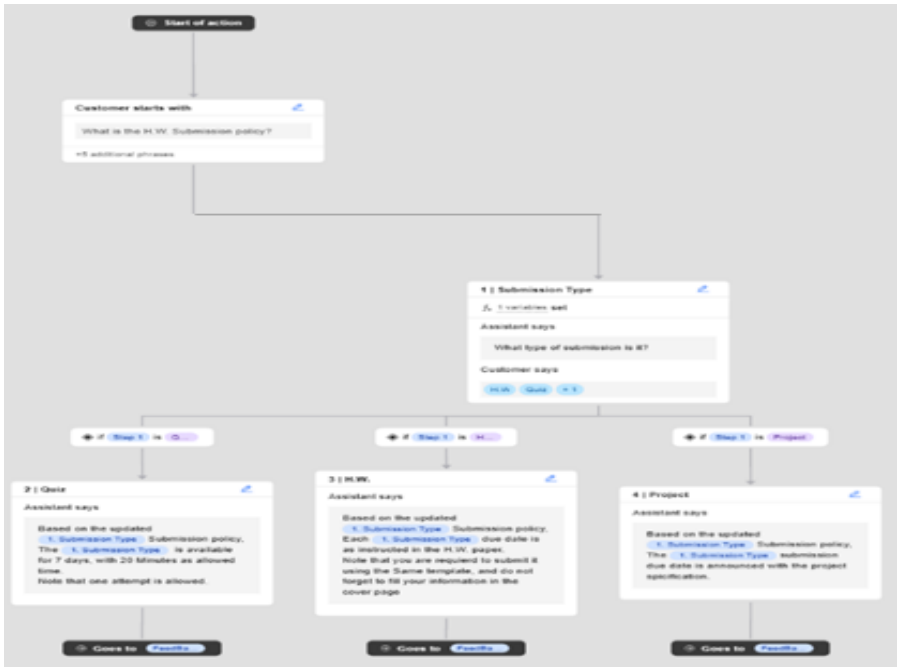

Fig. 8: Feedback flow, Conversational tree (Screenshots)

Feedback collected during the pilot testing phase also informed several improvements. These included enhancing fallback responses for instances where user intent was unclear and refining response structures to improve clarity and flow.

The chatbot achieved an average conversation completion rate of 80%, indicating that most users could complete their interactions satisfactorily without disruptions. Furthermore, it showed a high intent recognition accuracy of 93%, demonstrating its effectiveness in correctly understanding and responding to user queries. This performance highlights the chatbot's capability to handle real-life user interactions efficiently. The results of these metrics are visually represented in Figure 9.

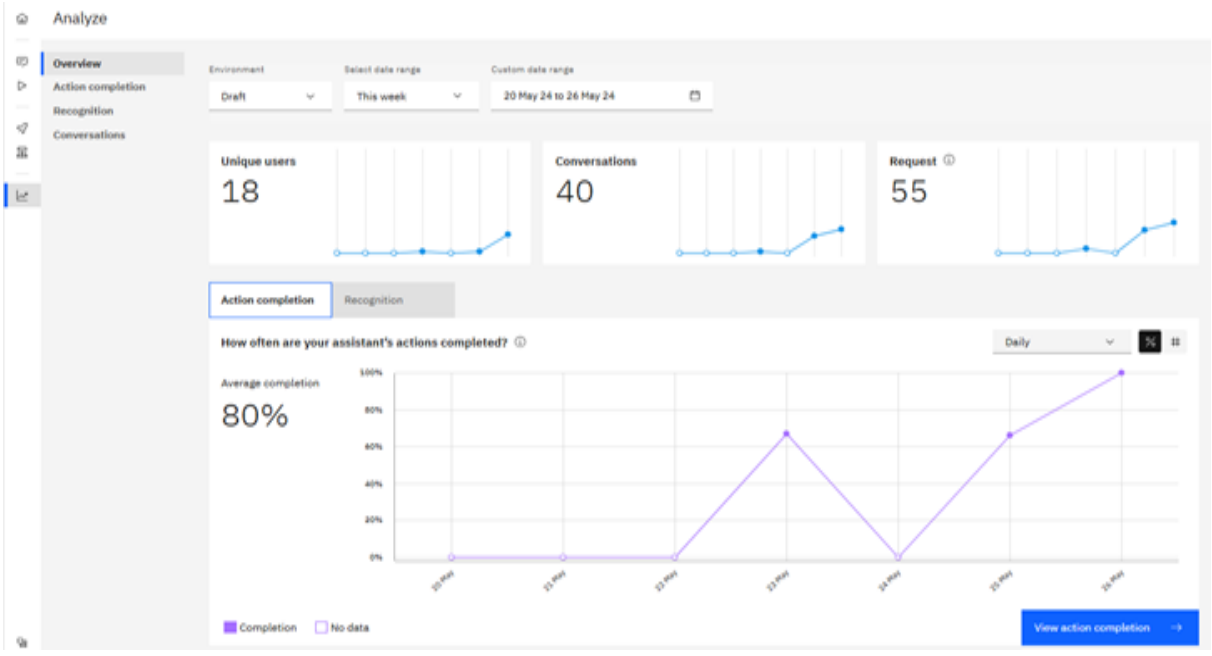

Fig. 9: Chatbot Performance in Test phase

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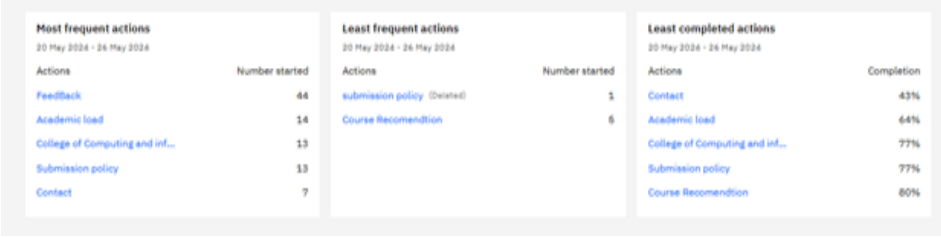
a



b

Fig. 10: Depicts a complete conversation with the chatbot. The chatbot successfully recommends courses to students based on their individual plans

Conclusion

This study demonstrated the potential of chatbot technology to enhance the academic advising process at the College of Computing and Informatics at Saudi Electronic University. By conducting a comprehensive review of the existing literature and integrating feedback from multiple stakeholders, we have developed a chatbot that addresses specific needs within the academic community. The key findings from our research indicate that the chatbot effectively provides students with 24/7 access to information, assists in course selection, and offers personalized academic guidance, thereby improving student engagement and satisfaction.

The implementation of the My Academic Advisor chatbot has shown promising results in streamlining communication between students and academic staff, reducing response times, and enabling advisors to focus on more complex inquiries. Our data analysis further supports the efficacy of the chatbot in enhancing students' academic experiences by providing them with timely and relevant information, which is crucial for their academic success and decision-making processes.

Looking forward, expanding the chatbot's capabilities to integrate seamlessly with social media platforms and learning management systems could provide students with more avenues to access support, thereby enhancing user accessibility and engagement. Additionally, introducing Arabic language support would significantly improve usability for native speakers, making the chatbot more inclusive and accessible to a broader segment of the student population at Saudi Electronic University, thereby further enriching the academic support landscape.

Based on this study, we propose a future initiative to leverage advanced deep learning algorithms to enhance chatbot capabilities. By implementing state-of-the-art natural language processing models, the chatbot will better understand context and subtleties in human language, allowing for more complex query handling and contextually relevant responses. This next phase will also focus on personalization through deep learning techniques that analyze student data and interaction patterns to tailor responses and recommendations uniquely for each student. Moreover, we plan to enable the chatbot to learn and adapt to new interactions using continuous reinforcement learning, enhance multilingual support with a focus on Arabic, and further integrate the system with the university's academic platforms, such as learning management systems. These developments aim to significantly enrich the academic support provided, making it more responsive and tailored to individual student needs.

In addition, future research will prioritize addressing critical issues of data privacy and secure handling of student academic information by implementing advanced encryption methods and compliance frameworks, such as GDPR-equivalent standards in Saudi Arabia. Another key research direction is improving multilingual NLP capabilities, specifically refining Arabic dialect recognition through enhanced training datasets and transfer-learning approaches. Broader deployment strategies will also be explored, including integration with SEU's existing digital platforms, leveraging social media

channels to broaden accessibility, and scalability assessments to handle larger student populations.

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Author's Contributions

Madawi Faisal Alsoyohi and Nahlah Algethami: Methodology, validation, data analysis, formal analysis, and investigation Supervision, project management, review, and editing Resources, data curation, and original draft preparation.

Ethics

Informed consent was secured for every participant in the study. A data availability statement is available upon request. The study was approved by the Ethics Committee of the Saudi Electronic University (REC Number SEURC-4519).

Conflict of Interest

The authors declare that there has not been any conflict of interest**.**

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