# A Design for Developing an Interactive Academic Student Advising System using Smart Personal Assistant Platform

# <sup>1</sup>Kamarul Faizal Hashim, <sup>2</sup>Sami Miniaoui

College of Engineering & IT, University of Dubai, United Arab Emirates. <sup>[1]</sup>kbinhashim@ud.ac.ae <sup>[2]</sup>sminiaoui@ud.ac.ae Received: 06- June -2023 Revised: 03- July -2023 Accepted: 05- August -2023

**Abstract**— In recent years, there has been a significant surge of interest among researchers and software developers in incorporating smart personal assistant (SPA) technology into higher education institutions as a means of enhancing communication between faculty and students. SPA applications have been recognized as effective tools in facilitating self-directed learning among students. However, previous studies have highlighted students' dissatisfaction with the current advising process due to high student-to-advisor ratios, limited interaction opportunities, and slow response times from advisors. In light of these challenges, the primary aim of this study is to design an interactive academic student advising system using Alexa, guided by the ICAP framework. The ICAP framework serves as a blueprint for constructing a system with interactive functionalities that cater to the needs of students and faculty. Finally, this paper concludes by addressing the potential challenges that may arise during the development phase and highlighting future research directions of this research.

Index Terms—ICAP framework, Alexa, Student advising, Interactive.

#### I. INTRODUCTION

Academic advising is the backbone of every institution of higher education that operates on a credit-hours basis. The traditional advising process is conducted in the presence of the student and his or her academic advisor in order to get the best recommendation possible for the student.

Providing interactive academic advising is always a challenge in any academic institution due to the high student-advisor ratio, which inhibits interactive and meaningful interactions. As a result, most academic advisors will prioritise students who require additional assistance with their studies in order to provide them with adequate assistance.

The overwhelming demand for interaction with each academic advisor has resulted in students' displeasure at not receiving good advice and facing response delays [1]. Access to necessary information becomes a significant impediment to providing sound advice and making the best decision. Academic advising may have become a time-consuming and complex procedure for both students and advisors [2]. Academic advising is usually inefficient in many universities, resulting in high levels of student dissatisfaction [3].

According to the literature, numerous technology-based advising systems have been proposed and developed that acted as support tools to assist students in undergoing a successful academic advising process by both academicians and practitioners [4]. The academic advising system was built using a variety of different technologies and majority of them were developed as either a knowledge based, content based, hybrid or computational intelligence-based system [5].

Despite the proliferation of these academic advising systems, we discovered that most of the systems are lacking the element of faculty-student engagement. Majority of the system is either descriptive in nature [5] or do not giving enough attention towards building relationship or connection [6].

Therefore, the main goal of this research is to propose a technology-based system's design to promote better engagement between academic advisors and students. This study adopts ICAP framework [7] as the guideline to help design an interactive academic advising system. In general, ICAP framework is used to promote better student engagement when they are involved in a learning process [7]. Planning studies can be considered a

learning process as education system in a university is complex and it requires the student to learn and understand the procedures. In order for the student to be able to design their studies they need to be well versed with the university's policies and procedures

The design of this system will incorporate the use of a smart personal assistant application (SPA). The emergence of SPA like Alexa, Siri, Google and many others have changed the landscape of education. The used of this platform has been demonstrated in enabling smart tutoring, intelligent agent, and many other tools that help promote better student involvement in learning activities.

The next section discusses the concepts of academic advising, technology-based advising and ICAP framework. Follow by the system design methodology section. Finally, it highlights the potential challenges of developing this system.

#### **II. LITERATURE REVIEW**

#### A. Academic Advising

Initially, academic advising focuses on assisting students with course selection to enable them to complete their degrees [8]. This is a widely acceptable advising responsibility that is regarded by advisors as to the 'nuts and bolts' of advising [1]. Advisors are directly in touch with challenges experienced by students [3], and they are thus ideally placed to implement interventions to support students in achieving their goals [8].

Extant literature indicates the importance of this advising interactions to promote student success [9]. By means of these interactions, connections are formed between students and advisors, which provide students with an indepth understanding of the institution and of its context and resources [6]. Not only that advising also has an impact on student learning and on broader educational experiences [9]. Menke et al. [8] argue that the institutional status of advising has shifted from a prescriptive approach to a learning-based developmental approach that favours holistic advising of students' entire university experience.

Advising responsibilities are typically undertaken as individual functions in silos. The need to break down silos has led Hart-Baldridge [9] to argue that "if we did it together, we could do it better". Shared advising responsibilities could thus contribute to retention and student success. Students are involved in decision-making when they decide to act in a manner that allows them to accomplish their goals [6]. In this way, advising transcends transactional information dissemination. The ultimate responsibility is thus to help students connect their academic experiences and goals [9].

Discussing student advising, [4] stated, "Academic advising, at its heart, is a relationship between the advisor and the student" (p. 1). Thus, one cannot overestimate the importance of relationships between faculty advisors and student advisees. Advisors provide vast amounts of information that provides learners with a firm foundation for developing and attaining their academic and professional goals.

Good practice shows us that effective advisors know when to refer their advisees to specific support services. We also know that faculty and student interactions outside of the classroom correlate with strong student retention. In his work [4] wrote that "student-faculty interaction has a stronger relationship to student satisfaction with the college experience than any other variable" (p. 233). Thus, the connections between faculty advisors and student advisees are fundamental to student success.

#### B. Technology-based Academic Advising

Technology is an integral part of advising [10,11]. Institutionalizing advising thus relied on developing technology in tandem with support advising and student success. Many technologies have been enabled to support academic advising to make it more effective and efficient.

Despite the proliferation of these academic advising systems, we discovered that the majority of the system was developed following a prescriptive advising approach. This approach emphasises only on the system's role in relaying accurate and relevant information. According to [12], this model does not encourage long-term planning or connection building and is ineffective. Using this approach, the advising process is directed towards one-way information flow from the advisor which limits the ability for the student to explore the possible paths of their own academic journey.

#### C. ICAP Framework

According to this constructivism view of learning, although the students are able to receive information passively (i.e., one-way information flow), they are expected to engage in a learning process better when they are actively involved in the learning process (i.e., academic planning process) [7]. According to these authors, an active learning is defined as learning that requires students to engage cognitively and meaningfully with the materials. Through active learning the students will really think about their learning materials in depth rather than just passively receiving it [13].

Chi and Wylie [7] proposed a framework called ICAP to examine student's active behavior in learning. This framework denotes that an active student learning behavior can be classified into four modes - Interactive, Constructive, Active and Passive. Each mode of the ICAP framework corresponds to different types of behaviors and knowledge-change processes predicting different learning outcomes [13]. Figure 1 illustrates the ICAP framework.

Passive Active Constructive Interactive Distinction of Learning Behavior According to ICAP (Chi & Wylie, 2014)				
Passive	Active	Constructive	Interactive	
Deal with the instructional information without additional physical activity (e.g., reading a text without doing anything else).	Doing something "physically" with the instructional information (e.g., underlining or highlighting a text).	Requires "producing outputs that contain ideas that go beyond the presented information" (e.g., taking notes in one's own words).	Requires "dialoguing extensively on the same topic, and not ignoring a partner's contribution".	

Figure 1 ICAP Framework (source: [7])

For instances, a student is in a passive mode when they are reading the document of their curriculum structure. Once student analyses and try to fit their needs and requirements into the planning, they start to be active. In general, not all students will be able to follow the plan as suggested by the university. There are many instances that will hinder them to register for courses as suggested. Student might not be able to take courses due to many reasons among them – working constraints, financial limitations, academic issues and many others.

After that, student will start to construct their own academic strategy based on the limitations that their found when planning the course registration. This stage is critical as students will need to consider all the limitation and their situation so that they will be able to register the right courses that can help them achieved good academic performance. At this stage student will try to construct the information by self-explaining the feasibility of their academic planning. They are now in the constructive mode. Finally, the student will be in the interactive mode when they start to discuss the content and justifying it with a peer or tutor. By completing all these modes, students are said to be involved in an active learning activity.

There this study adopts ICAP Framework as the basis to help increase the students' involvements towards using the advising system. From the literature review, the ICAP framework is very useful in helping researchers to develop an efficient dialogue management component of a SPA application. In the SPA application, a dialogue management component is crucial to help stimulate the conversations between students and the application [13]. Hence, by integrating the ICAP framework, it can help research develop a dialogue management component that is able to move the students from passive to interactive behavior [7,13].

# **III.** System Design Methodology

# A. Advisor-Student Engagement

In order to examine the level of involvement of both students and academic advisors in an academic advising, the academic policy from the researchers' university was analyzed aan used as a benchmark. The mapping between the tasks outlined in the academic advising policy can help understand the level of interactivity between

advisor and student in a use-case of academic advising. Table 1 presents the mapping between the ICAP mode and academic policy.

ICAP	Advisor Role	Student Role
Mode		
Passive	• Provide students with	Receive
	documented academic	information
	plan of study to assist	distributed by
	in fulfilment of	the faculty
	degree(s)	member as
	requirements.	stated in the
	• Provide students with	previous
	information on how to	column.
	interpret their degree	
	requirements.	
	• Provide students with	
	information on how to	
	navigate the course	
	registration system.	
Active	• Monitor the students'	
	progress toward	
	meeting degree	
	requirements.	
Constructive	Not mentioned	• Students have the
		responsibility to
		discuss or
		anticipate any
		desired changes
		to their plan of
		study and
		consequences.
		Students provide
		teedback
		regarding
		satisfaction with
		their academic
		advising
		experience.
Interaction	Not montion - 1	Not montioned
interactive	Inormennoned	inor mentioned

 Table 1 Mapping of ICAP Mode with Academic Advising Policy

The results of the analysis indicated that majority of tasks assigned to both academic advisors and students fall under the passive mode. As per the policy, the academic advisors are primarily responsible for distributing information such as degree and registration requirements. In the active mode, the academic advisors monitor students' academic progress, while students are required to evaluate the advising received and provide feedback. The policy did not outline any tasks that fit the constructive mode for either academic advisors or students.

Under the interactive mode, students are encouraged to interact with academic advisors to discuss changes to

their study plan. However, no tasks for academic advisors were identified in the policy that fit this mode.

In conclusion, the academic advising activities primarily focus on the passive mode, with a major emphasis on distributing information. Therefore, to enhance student engagement in these activities, additional tasks that align with the active, constructive, and interactive modes as outlined in ICAP framework should be incorporated.

The next section outlines the proposed system functionalities that will be incorporated in the student advising system using SPA platform.

#### B. System Functionalities

For this proposed system two main features are implemented 1) scheduling courses and 2) advising on student's graduation plan. Based on the advising policy these are the two main tasks that involved students and academic advisors. In this proposed system, we incorporate the role of academic advisor within the SPA platform (after this we refer to as Alexa). Alexa will play an important role in changing students' passive behaviour to interactive. Table 2 lists the proposed functionalities for the advising system.

At the moment (based on the student's advising policy), the student's role in the scheduling task can be categorized between passive to active according to ICAP framework. They involvement within the interactive mode is nearly to none. Hence, to improve the situation, in this study, we proposed the following tasks that will be incorporated into Alexa to move students involvement in the advising system to cover the range from passive to interactive according to ICAP framework.

# 1) Alexa response to queries related to course offering-

Within this functionality, Alexa should be designed to have the capability to distribute all the updated information about course offering to the students. Alexa should have the capability to answer queries from students related to course offering (timing (day & time), course location, name of instructor, consultation timing), student's obtained grades, student's eligibility to register for any courses, and the availability of seats for the preferred courses.

In addition, Alexa should also be able to answer queries related to program curriculum, and pre-requisites requirement. In order to do so, Alexa module should have the capability to extract information from all the database related. Table 2 list the data sources that can be used in this system.

# 2) Alexa involves students to verify the information given to them related to course offering -

Within this functionality, students are now changing to active mode where they started to interact with the information given. Through Alexa, students can be active in the course registration by confirming or validating the given information by Alexa. For example, students need to confirm the courses they preferred, validating their academic grades etc.

# 3) Alexa processes students' feedback and provide a suggestion based on unique requirements from the student -

Within this functionality, Alexa will receive and process all the feedback given from the students. The students will need to let Alexa knows all their constraints and the system will try to generate an optimum output that fits the student's requirement. This iterative sessions will need to be handle carefully as it requires the Alexa's module to process additional information given by the students if they did not agree with the earlier suggestions.

Not only that, Alexa also should have the capabilities to determine that all the given suggestions are in line with the university policies (i.e., course registration, graduation and advising policies).

# 4) Alexa provides dialoguing facilities between students and academic advisors.

Within this functionality, Alexa will allow the students to dialogue with the systems. The module should have the ability to process the feedback provide the students. The main role of this functionality is to work as a verifying module to the changes proposed by the students. In reality, students will try to suits their needs and current

scenario to their course selections every semester and to some extend their graduation plan. Hence, the system should provide a feedback through dialoging capabilities offered by Alexa.

The system needs to be able to find optimum solutions based on the constraints given by the students. Finding the best solution sometime can be one of the biggest challenges in student academic advising activities.

ICAP	Alexa Role	Data Sources
Mode		
Passive	Responding to student's queries related to: 1) Course offering 2) Graduation plan advising	<ul> <li>Program curriculum</li> <li>Pre-requisites requirements</li> <li>Courses offering information</li> <li>Student grades</li> <li>Students' personal data</li> </ul>
Active	Confirming with students with information related to: 1) Course offering 2) Graduation plan advising	<ul> <li>Student academic records</li> <li>Student personal data</li> <li>Courses offering</li> </ul>
Constructive	Processing the suggestions from students and generate output related to: 1) Changes made to the existing schedule 2) Changes made to graduation plan Alexa should be able to response to updated given by students based on the proposed suggestions. Alexa should have the ability to	<ul> <li>Program curriculum</li> <li>Pre-requisites requirements</li> <li>Courses offering information</li> <li>Student grades</li> <li>Student personal data</li> <li>University advising, course registration and graduation policies.</li> </ul>

Table 2: Proposed functionalities and data sources to develop the advising system using Alexa.

	suggest solution that is conflicting either in term of scheduling or graduation plan.	
Interactive	Dialoging capabilities for the students to verify the following:	-predefined graduation plan -Transcript -University policy -Previous
	<ol> <li>Updated schedule</li> <li>Updated graduation plan advising</li> </ol>	graduation plans





Figure 2: Proposed database design for the advising system using Alexa

# C. System Design

Figure 3 below illustrates the scheduling activity diagram for the proposed system. Since, this is a work in progress, we are not able to show the activity diagram for the graduation advising functionalities.



Figure 3. Scheduling activity diagram

# IV. ANTICIPATED CHALLENGES IN DEVELOPING THE SYSTEM

Based on the proposed system design, we anticipate that there may be several challenges to be faced during the development phase. The following are some of the challenges that we anticipate:

# 1) Integrating database involving students and course offering

In order to create a comprehensive academic advising system using Alexa, it is crucial to integrate a database that contains information about students and course offerings. This database should include student profiles, academic records, course schedules, and other relevant data. By integrating this database with Alexa, the system can provide personalized recommendations and insights to students based on their academic history and interests.

# 2) Building Alexa module that can find optimum solutions

Building Alexa module that can find optimum solutions: Once the database is in place, the next step is to build an Alexa module that can analyze and interpret the information in the database. The module should be able to use this information to provide students with recommendations on the best courses to take, the most efficient academic paths to follow, and other related information. The module should also be able to take into account a variety of factors such as a student's career goals, academic strengths, and weaknesses

# 3) Incorporating smart element in the Alexa module

Incorporating smart element in the Alexa module: To further enhance the academic advising system, it is important to incorporate smart elements into the Alexa module. This could include features such as natural language processing, machine learning, and other advanced technologies that allow the system to better understand and interpret student needs. For example, the system could use machine learning algorithms to analyze a student's

academic record and make personalized recommendations based on their past performance. Additionally, natural language processing could be used to improve the system's ability to communicate with students in a more natural and intuitive way, making the advising process more effective and engaging.

#### V. CONCLUSION

In conclusion, Alexa has a tremendous potential to be used in academic advising systems, providing personalized recommendations and guidance to students. The ICAP framework is a useful tool for understanding how to move students from being passive recipients of information to active learners who are engaged in the academic process. However, it is important to understand the challenges and limitations of Alexa in order to ensure the development of an effective and useful system. With these factors in mind, the development of an academic advising system using Alexa has the potential to revolutionize the way that students approach their education, providing personalized guidance and support every step of the way.

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