



CiSA: An Inclusive Chatbot Service for International Students and Academics

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Abstract. In the present study, we developed a chatbot service termed ‘CiSA’ (Chatbot for International Students and Academics) to enable international students and academics to effectively acquire essential information regarding their academic and campus life. To investigate the pain points and needs of our target user group, user research consisting of interviews and surveys was conducted. Based on the key findings from qualitative analysis, the concept was further refined. A flowchart was constructed to illustrate the designed conversations, while the user interface components were determined to express the responses of the chatbot. The design was further prototyped using Google’s DialogFlow, and implemented in Facebook Messenger. Finally, the interviews with the target users were conducted to verify the effectiveness, satisfaction, and extensibility of the service. The outcome of this study provides a powerful way to support the facilitation of communication and social inclusion by using this conversational agent. Furthermore, by focusing on enhancing the accessibility, the research contributes towards the practical understanding of the investigation of its service design for chatbot aimed at inclusivity.

Keywords: Conversational agent · Inclusive design · Chatbot

1 Introduction

1.1 Needs for an Inclusive Design in Academic Field

Expanding international trade volume and globalization has increased, the exchange of personnel globally, and is expected to accelerate further. These changes facilitate the improvement of infrastructure and public services. Such attempts can serve as the basis for instilling a sense of respect for cultural diversity and promoting a positive image worldwide [1]. Accordingly, human exchanges are also becoming more vitalized in universities.

Universities are essential educational institutions where students from various social and cultural backgrounds gather for overall self-development. However, academic experiences at a university vary considerably between domestic and international students [2]. In particular, the local optimized systems may present many issues, including accessibility of sufficient resources in different languages, thus inevitably excluding the international students. This being the case, international students face discomfort while navigating and obtaining suitable information [3].

Regardless of the issues that international students deal with, they must adapt and successfully carry out their studies in different cultural and social backgrounds. Campus life is a big part of the lives of students who go to another country to fulfil their academic needs [4]. Therefore, it is crucial to provide them with effective informative system to make information gathering feasible.

1.2 Adopting Conversational Agent for Inclusive Design

As internationalized education continuously insists upon novel methods to support the system, solution pertaining to artificial intelligence (AI) have been incorporated to improve existing practices in various contexts. Chatbots are one such solution that improve the way of communication between people, enabling them to find information immediately and conveniently. It leverages intelligent technologies to communicate with people using natural language; its conversational interface has been drawing increasing attention, with major applicabilities for the future.

The chatbots have become a central connector of services in the field of education, E-commerce, customer support, and entertainment [5]. They successfully enhance systems in educational institutions and provide immense support to the faculties and students. Several research practices exist regarding the use of chatbots in an academic environment; however, the designing of a chatbot that could provide inclusive solutions to international students in a university campus environment has not, to the best of our knowledge, been systemically undertaken.

This study focused on applying a chatbot to enhance the quality of campus life for international students by improving the accessibility of information for managing school life. To make this possible, an inclusive chatbot service ‘CiSA’ was designed and implemented at Kookmin University. The chatbot was aimed at accessing the needs of the students and to proactively solve their queries without time-place and language constrains. It facilitates communication and social inclusion among international students by allowing them to experience a welcoming and satisfactory campus life.

The solution gives the students the ability to immediately retrieve information to achieve various goals. ‘CiSA’ integrates fragmented information present on the online and offline databases without considerable modification. It is utilized as a gate for information acquisition on the messenger platforms that we are already familiar with. The service can act interact with the international students on a one-to-one basis, preventing them from feeling isolated.

1.3 Methodology Overview

First, we examined previous studies related to the application and effects of chatbots in the area of education. We also reviewed the works of inclusive design to refine our concept. In chapter 3, we describe the analysis of the user research with international students and staff at Kookmin University. The next chapter presents the design process of the CiSA, carried out by combining different design processes for the conversational model. In the last chapter, with high-fidelity prototype of the service, we validated its usability using heuristics. By applying this approach, we considered the usage of the

chatbot service in the specific segmentation of user for educational purpose and presented a direction for the development of this chatbot for the future.

2 Related Works

2.1 Chatbot and Conversational Agent

A chatbot is a computer program that automates the work process by communicating directly with users and processes user requirements [6]. It integrates multiple services leveraging AI and interacts through conversational interface using natural language.

The interface of conversational AI takes a form of a dialog, which is the most natural mode of interaction [7]. It is intuitive, instinctive, and has high accessibility without any prior learning requirement. The interface is expressed through either voice, text, graphics, or multimodal. The ‘Conversation Design Guide’ from Google [8] defines the characteristics of the conversational user interface as ‘turn-taking’, ‘threading’, and ‘verbal shortcut’ which are removed from the nature of the conversation. The interface should be designed to take consider the particular object of the conversation, and sufficient research should be done on the users as the interaction is achieved through dialogs.

The chatbot was first introduced in the ELIZA system [9]. After AI and related technologies become popular, intelligent agent(IA) or virtual assistant were actively applied in various services and products. The IA is based on the interaction of the interface: voice and text. The dominant IA actively applied in the industries include Watson (IBM), Google now (Google), Siri (Apple), Cortana (Microsoft), Alexa (Amazon), and Bot (Facebook Messenger).

The main technologies applied to operate a text-based chatbot are pattern recognition, natural language processing (NLP), semantic web, text mining, and text aware computing [10]. The models of a chatbot are divided into two types: retrieval-based models that respond with pre-made answers to the topics, and deep learning based generative models that automatically generate responses [11]. The more open the topics are, the more complicated the system is.

Til date, an effective usage of service-oriented chatbots in industries include E-commerce, FinTech, personal assistant service, public service, education, and entertainment [6, 12–14]. Particularly, the service has been applied for marketing processes such as customer services and reserving, searching, and buying products online [13]. Chatbots strongly influence the states of informing, connecting and communicating between the products and people. It can instantly solve the requests and efficiently navigate users through the database of the company and the user. It also provides two-way interaction which can increase rapport between the company and its customers. Intelligent assistants and the conversational user interface largely supplant the existing interfaces and interactions, performing tasks for us in our everyday life [14].

2.2 Intelligent Technologies in Education Services

Intelligent technologies have been widely adapted in academic environment. AI-driven solutions create innovative processes for tutoring and communicating such as teaching robots and intelligent tutoring systems. The technologies also enabled the provision of AI-driven distant education programs, via conducting classes using virtual reality [15, 16].

Assistants and bots have been actively studied to improve the convenience process of student services and teaching; popular applications include course program advisor and frequently asked question systems to replace physical information desk. A virtual assistant LiSA [17] was developed to help students in university; the study investigated the kinds of services and information that could be effectively provided through chatbot. It has also been designed to act as a communication hub between the students and the faculties. Lim and Goh [18] developed an intelligent conversational bot for massive open online courses (MOOCs) to enhance the interactivity between the instructor and students using text or speech input via connecting through multiple sites. Krassmann et al. [19] improved the utility and satisfaction by perceiving and relating the moods of the students to enhance the experience of distance education program. Kerlyl, A. et al. investigated the chatbot for the teaching process [20], broadening its utilization. Additionally, studies focusing on technological development of a chatbot were conducted; these comprised of implementation of ALICE Chatbot system, application of generative mode, and development of a system based on text similarity [21, 22].

It is evident that, from a technical perspective, the investigations regarding interactive solutions between the users and the chatbot system in the educational institutions are dominant. However, considerable work still needs to be systematically undertaken, utilizing a user-centered approach, to improve the experience of not just the general users but including people of all other sectors as well.

2.3 Inclusive Design

Designing inclusive services requires the consideration that users differ in identity, age, gender, language fluency, impairment, cultural background, nationality, and socio-economic status. Inclusive design involves making the services usable and satisfactory for the users [23]. It has been promoted as a way of including the needs of excluded user groups and creating services that work for everyone, particularly for older and disabled people [24]. Inclusive designs share similar approaches with Universal Design [25] and Design for All [26]. The essences of inclusive designs are user-centered, population aware, and business focused [27].

The design strategies of inclusive design include the following three stages should be [26]:

- Stage 1 - the problem definition should explicitly include reference to the intended target users;
- Stage 2 - an appropriate design approach for the target users should be adopted; and
- Stage 3 - the target users should be included in the evaluation process.

Inclusive design method aims to embrace everyone in the community [27]. By defining specific users as “lead users” throughout the product development process, the resulting design output can reflect the users’ individual needs. Unlike the overused slogan “for anyone to use”, which is often confusing, inclusive design can clearly defines target users that have not been considered so far, provides solution to meet their needs, and include a variety of other users [28].

3 User Research

For the development of the chatbot service in campus environment, international students, and staff supporting the students, at the Kookmin University were chosen as the target users. Combined methodologies of semi-structured interviews, photographs, and surveys were carried out for user research.

3.1 In-Depth Interviews

The target users were divided into two groups for the conduction of in-depth interview: the staff at the Kookmin University in the Department for International Student Services and the international students using the provided information.

Service Provider. We proceeded with the interviews using open questions with the staff in three departments in International Affairs Division at the Kookmin University. The purpose of the interview was to figure out the typology of the information international students need and the methods implemented by the school to support those needs. Thereafter, the collective data from the interviews (n = 3), offline materials such as guide books and brochures, and online resources on the university websites were analyzed. The information sources provided by the school were divided into three categories: academic, administrative, and living aspects (Table 1).

Table 1. Providing information for international students

Divisions of the department	Information provided
Academic	Academic calendar, course registration, programs, courses, transcripts, partner schools and programs
Administrative	Admission, Visa and legal issues, career/job opportunities, guidelines for working, guidelines for pets, counselling
Living	Campus facilities, campus map, dormitory, clubs, activities and events, cultural experience

Service User. In-depth interviews of five international students from different backgrounds (Brazil, China, France, Italy, and Taiwan) were taken. The interviews consisted of questions related to type of information, the contexts for its need, and ways of obtaining it. Questions also addressed the pain points and user needs in relation to accessing and gathering information required for maintaining life on campus, such as

that regarding-facilities on and off campus, educational programs and resources, and additional student activities. The usual means of information acquisition is asking other familiar students and faculty. The major issues international students face included low amounts quality of such necessary information in English, and inconvenient processes for searching this information on existing online and offline systems. The students wanted to have the ability to independently access and search for information in various context (Table 2).

Table 2. Summarized results of the in-depth interview

Category of needs	Details of needed information
Information	Facility – Location, operating hours, ways of using Resources for research Administrative documents Stores outside campus School events Clubs Korean language class
Methods	Students – Korean and international Professors School office Guide maps Signs University websites and mobile applications
Limitations	Information in English is simplified and insufficient compared to the Korean version Most of the materials and devices are in Korean Translation is not accurate Sometimes there will be no one to ask in English Have to rely on assistants, friends, and professors Finding information is too long Sometimes one has to give up finding information
Needs	Fast access to information Being able to find information independently University websites and mobile applications should be friendly to international students Do not want to carry around guide books and maps

3.2 Survey

An offline survey was conducted, the objective of which was to study the typology and contexts of required information and the tools used to acquire resources while spending time on campus. The survey questionnaire was developed based on the key findings regarding touch points and pain points from the interviews. The survey was taken by 40 international students from Asia, Europe, North and South America.

The types of information were largely four: Food and drink, location of facilities, using the library and its database, school activities and events. The most valued information is that regarding ‘food and drink’ for 55.6% of the international students, 22.2% say information related to ‘using the library and its database’ is the most valuable, and 11.1% voted for the remaining types. For all types of information, more than 75% of the students obtained information through their friends since doing so is easy and convenient. Additional guiding information was about language classes and local events. 83.3% of the students claimed that they plan to use the chatbot, which provides a variety of information in English about campus life, and 83.4% of the students said the service will be useful for the purpose.

3.3 User Experience Analysis

In-depth interviews were carried out concerning both the information provided and that received. We found that the information provided by departments of international student support pertained to all aspects of studies, life, and administration. However, it was somewhat lacking in accuracy and depth.

From the perspective of the interviewed students, the biggest problem was the language barrier. In addition, not knowing where and how to find required information on time made their lives difficult. Even when information could be found, the translation was not accurate enough for students to comprehend or the content was simplified from that in Korean. The alternative process like asking by representative phone number is difficult as well due to the language barrier.

Through the surveys, we discovered that international students want information primarily on food and academics. The situations that information was needed were varied by the type of the information. We also learned that the majority of students had a strong intention to use a chatbot service to which they can ask questions and talk about campus life whenever they choose.

Through analysis of user research, we were able to validate that international students found accessing and exploring information challenging even though they were aware of the current informative systems provided in various languages. Based on the data gathered from the user research, the expected features of chatbot service were defined as follows: (1) Reliable and sufficient in formation in English (2) Fast and easy access to the information.

3.4 Persona

By combining the results of the data analysis, a persona for the target user was created. A user persona is used to present standards that help to incorporate a user’s purposes and goals throughout the development [29]. It is also applied to solve issues faced during the process of designing the service [30] (Fig. 1).

The first persona is of Anna, a 26-year old graduate student from France. After a month of beginning studies at Kookmin University, she is still in the process of adapting to the new environment. Her Korean skills are in beginner’s level but she is good at English and native in French. For her, it has been difficult to determine how to explore campus and make use of it. The second persona is of Jang, a 32-year old

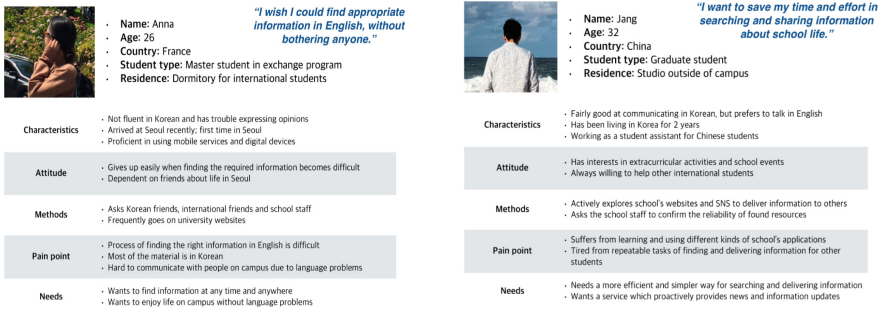


Fig. 1. Examples of persona developed in concept ideation

graduate student from China. After a year study at Kookmin University, he can speak Korean but he prefers to communicate in English. For him, finding information on campus life, such as the time and special venue of special events, continues to be difficult.

Further, the persona of an intelligent agent is vital as it directly engages and interacts with a prospective user. The persona has to be anthropomorphized for it to be able to successfully converse with the user [31]. A human-like chatbot will induce empathy and form a stronger relationship with the user. The persona created for the service is CiSA. CiSA is a Korean undergraduate student attending Kookmin University. CiSA has advanced English communication skills and native Korean language skills, enabling him to gather information from a Korean database and convert it into English and deliver. CiSA is proficient in using a smartphone and converses in non-formal English using emoticons and delivering a familiar tone. The key characteristics of CiSA’s persona are smart, multilingual, helpful, and friendly.

4 Design and Implementation

4.1 Design Purpose and Design Process

For the development of an intelligent agent, key stages have to be carefully considered. The steps involved in the design of the CiSA were: (1) Defining the concept, (2) Defining the bot persona, (3) Analyzing features, (4) Designing conversation, (5) Building content strategy, and (6) Prototyping and testing. To refine the details corresponding to interaction with the user, steps 4, 5, and 6 were iterated in the process.

The purposes of CiSA are the following:

- Provides fast access to the source for maintaining campus life
- Conveniently links users with information without a time-space constraint
- Provides fast access to instructions on how to use facilities at the university

The chatbot service will offer international students detailed information in English, based on the user’s questions. It quickly responds to the demands of the students with excellent accessibility, reducing the workload for the international student services.

4.2 Designing the Conversational Agent

We proposed features that will help users extract information directly from the chatbot service. Upon analysis of the collective data from user research, the features were prioritized based on most needed information and context beneath. CiSA intends to solve questions on (1) information about dining on campus, (2) guide on how to use the library and its online database (Table 3).

Table 3. Proposed solutions

Category	Solution
Campus Dining	Stores and cafeterias, location, opening hours, daily menu, recommendation, options for a specific dietary preferences
School Facilities	Location, directions, opening hours, information in details
Library Use	Location, opening hours, instructions, floor map
Student Activities and Events	Available activities and events, schedule, recommendations, location, availability of participation

Scenario-Based Dialogues. The prompts of a chatbot must be written within the conversational context for the entirety of a conversation, not just for one turn [32]. To keep track of the context, each prompt has to inform the user what actions they can make. Additionally, figuring out when to switch the dialog with visual clues is also vital because providing text-only answers is not always efficient. When operating on the input query by the user, the chatbot may have to link the user or provide the user with additional visual components [33].

We crafted sample dialogues considering each prompt in the context including error flows. By scripting sample dialogs, we could explore how the actual user experience will be and what changes we have to make to provide a more natural and effective experience. By integrating the persona of a chatbot with the concept of a service, the sample dialogues were created in the context of each feature. The context of a feature was based on the results of the survey, where the environmental situations for requiring information were collated (Fig. 2).

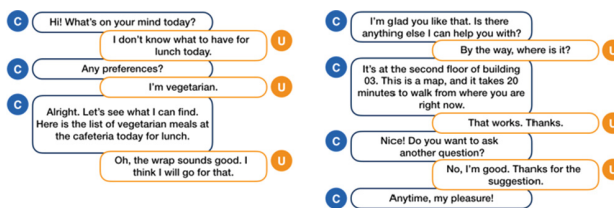


Fig. 2. Sample dialogue for choosing a lunch menu

Task Flow Chart. The task flow chart was designed according to the flow of the dialogue cases, and the fragmentation and error case were also indicated (Fig. 3).

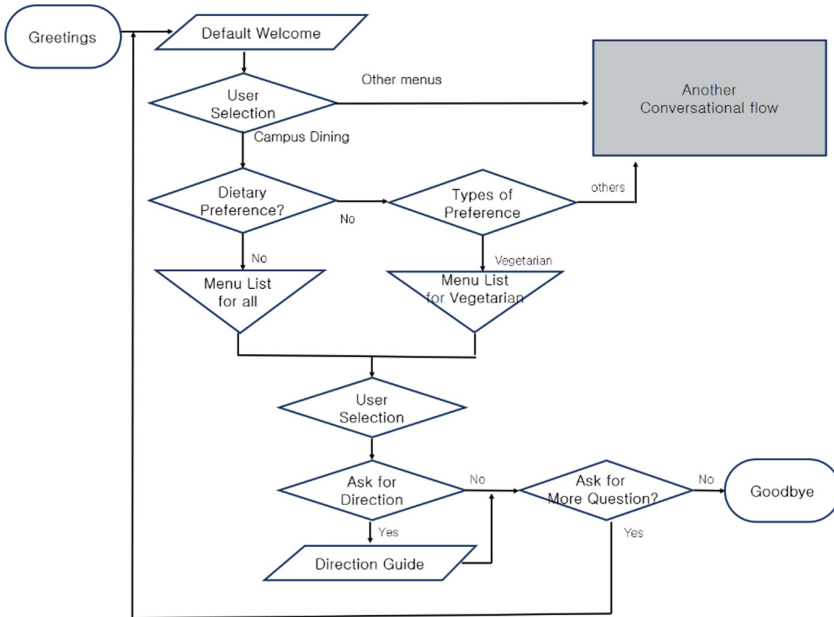


Fig. 3. Example logical task flow of the campus-bot: CiSA

There are two types of dialogues that a chatbot can present: (1) open domain and, (2) closed domain.

- Open domain: The user can input anything and the directions of dialog are unlimited. The inputs will be integrated using NLP.
- Closed domain: The flow restricts users to enter open responses. Instead, the pre-made options are provided for the user to select from. This enables the user to remain in context and reach their goal faster.

In this study, CiSA was created with a combined open and closed conversation domain to help users reach a goal without falling out of context or feeling overly controlled. By adopting predictive recommendation, we tried to improve communication efficiency [34]. Moreover, to provide rich messaging, the responses will be assisted with quick replies, buttons, and cards. It is essential to give guidance by making proper use of visual components with the text, thus lowering the user's cognitive load for processing text inputs [35].

4.3 Prototyping

CiSA was built using Dialogflow(Google) and integrated into Facebook Messenger. Dialogflow acts as an engine for the chatbot [36]. The components of conversation are divided into three groups: (1) intents, (2) entities, and (3) contexts. Intents are the purpose of the user's utterance. Leveraging a machine learning model, intents can be matched to give appropriate multi-turn responses to the user. Entities are the extracts of

specific data from user's dialogs. Contexts are the current state of a user's inquiry. Combining contexts allows the agent to carry the pieces of information through the flow of a conversation [37] (Fig. 4).

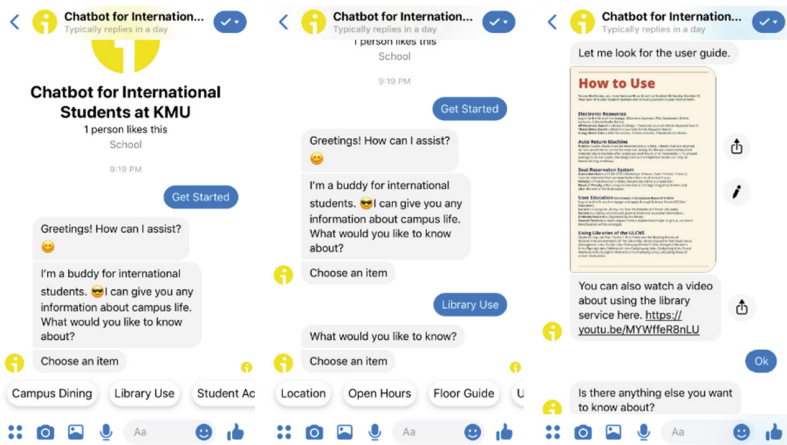


Fig. 4. CiSA running on Facebook Messenger

Facebook Messenger was used to deliver the chatbot providing a more familiar and convenient conversing experience for international students. To test the prototype in the real-world, the chatbot was integrated into a ‘Chatbot for International Students at KMU’ (Table 4).

4.4 Evaluation with Real Users

Five in-depth interviews with international students were conducted to verify the effectiveness and usability of the chatbot. The evaluation focused on how the chatbot interacts to offer context-sensitive information and how it engages in natural communication. Questions were created to determine the effectiveness, sustainability, satisfaction, and expected extension of the service.

All the participants stated that the service useful, helpful and satisfies the existing needs of information acquisition. They all found the service satisfactory as it provides essential information for everyday life on campus, thus fulfilling fundamental needs. Every participant showed high intent for using the service continuously. In particular, it is very useful for individuals who cannot speak other languages proficiently yet. Participants rated the quick reply buttons, which allowed them to view the features and contents the chatbot at a glance, highly. By using those buttons, they do not have to think about how to ask or what to type when they interacting with the chatbot. This enables the users to converse with chatbots without fail and obtain information efficiently (Fig. 5).

Table 4. Sample dialogue

Feature	Dialogue
Library Use	<p>CiSA: Good day! What can I do for you today? I'm a buddy for international students. I can give you any information about the campus life. What would you like to know? Choose an item. <i>Campus Dining/Library Use/Student Activities</i></p> <p>User: Library use</p> <p>CiSA: Let's find out about the SungKok library! Please choose an item. <i>Location/Open Hours/Floor Guide/User Guide</i></p> <p>User: User guide</p> <p>CiSA: Let me find out about User Guide. (Image of Instructions)</p> <p>You can also watch a video about using the library service here. http://youtu.be/MYWffeR8nLU</p> <p>User: Thanks!</p> <p>CiSA: Is there anything else you want to ask about? Choose an option. <i>No/Main Menu</i></p> <p>User: Main menu</p> <p>CiSA: Ask me anything! <i>Campus Dining/Library Use/Student Activities</i></p>



Fig. 5. Sketch of user interview for prototype validation

5 Conclusion and Future Work

In this study, we devised a new way of effectively delivering accurate information to students regarding campus life using intelligent technology. The chatbot service ‘CiSA’ was designed and implemented for the inclusion of distantly treated international students in the university environment. This accessible service aims to increase efficiency of information acquisition and accessibility of information by leveraging the current information systems. The effectiveness of a chatbot service was validated with the user research analysis, the result of which indicated that it greatly increases the accessibility of information required for life at a university. Upon analyzing the

evaluation, the purpose and features of the service that support the everyday life of the international students were also proven to be satisfactory and efficient. The inclusive agent ‘CiSA’ will be a powerful way to support communication for marginalized groups of people in various environments.

In future work, the service needs to be equipped with more features that cover areas other than campus life. It also needs to assist in languages other than English. Also, further investigation on the behavior of the system can be conducted including a wider range of international students to see if it can achieve the same purposes. The conclusive findings from this research can also be expanded and can contribute to the development of guide robots at universities to enhance the campus experience for individuals. Moreover, the language barrier free service can be applied to attempt different approaches on a wider scale and provide solutions to universities all over the world.

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